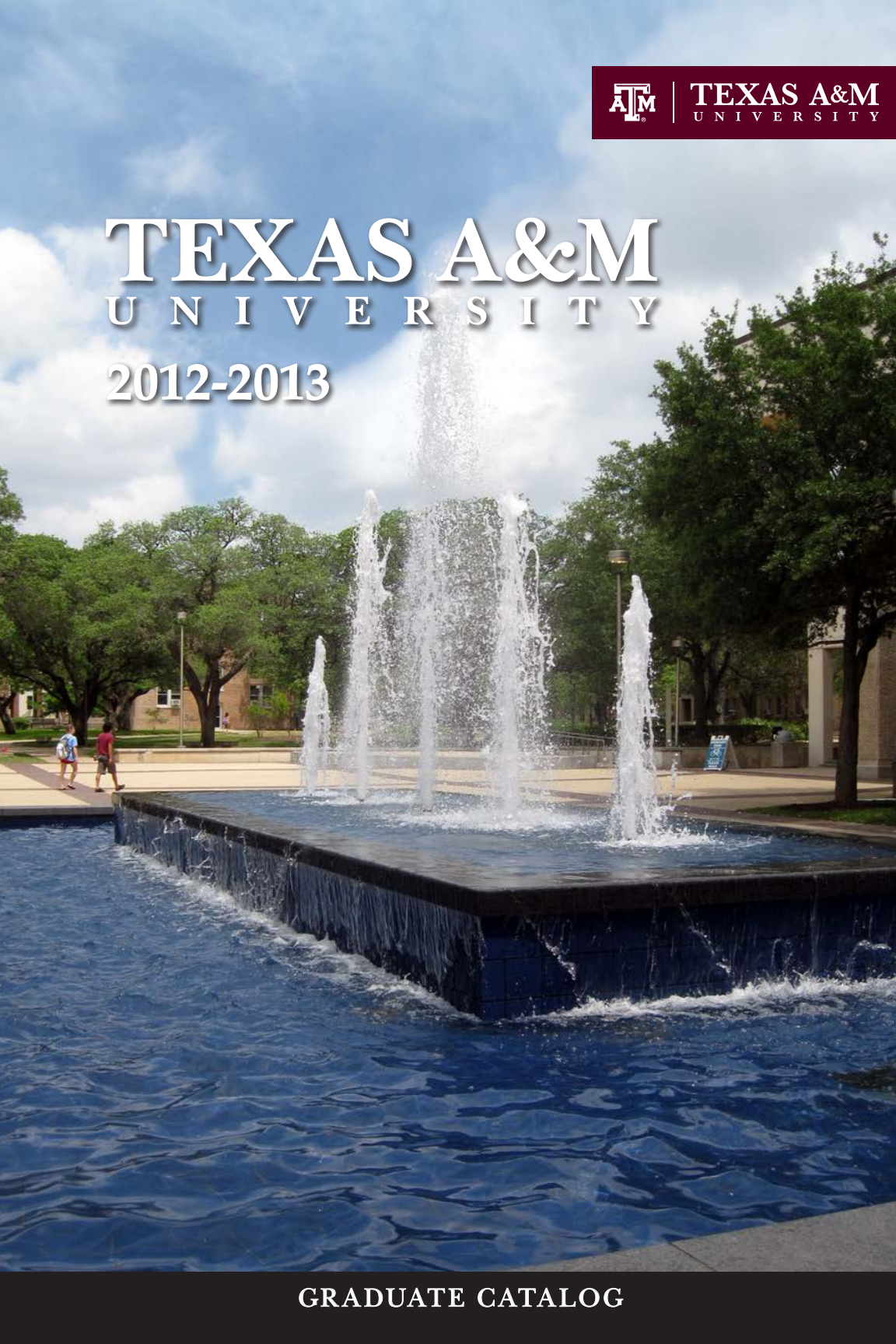




TEXAS A&M
UNIVERSITY

TEXAS A&M UNIVERSITY

2012-2013



GRADUATE CATALOG

Accreditation

Texas A&M University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (1866 Southern Lane, Decatur, Georgia 30033-4097, [404] 679-4501) to award degrees at the bachelors', masters', doctoral and professional levels. The curriculum in architecture is accredited by the National Architectural Accrediting Board; the curriculum in urban and regional planning is accredited by the Planning Accreditation Board; the curriculum in landscape architecture is accredited by the Landscape Architectural Accreditation Board and the curriculum in construction science is accredited by the American Council for Construction Education. The clinical psychology program in the Department of Psychology and the counseling psychology and school psychology program in the Department of Educational Psychology are accredited by the American Psychological Association. The veterinary medicine degree program is accredited by the American Veterinary Medical Association Council on Education. The medical education degree program is fully accredited by the Liaison Committee on Medical Education. The curriculum in forestry is accredited by the Society of American Foresters and the curriculum in rangeland ecology and management is accredited by the Society for Range Management. The dietetic track in the nutritional sciences curriculum and the dietetic internship program are accredited by the Commission on Accreditation for Dietetics Education. Within the Dwight Look College of Engineering, the undergraduate programs in aerospace, biological and agricultural engineering, biomedical, chemical, civil, computer, electrical, industrial, mechanical, nuclear, ocean, petroleum and radiological health engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). The engineering technology program is accredited by the Technology Accreditation Commission of ABET. The computer science program is accredited by the Computing Sciences Accreditation Board (CSAB). The baccalaureate and master's curricula in Mays Business School are accredited by the Association to Advance Collegiate Schools of Business (AACSB). The agricultural journalism curricula is accredited by the Accrediting Council on Education in Journalism and Mass Communication. The curriculum in recreation, park and tourism sciences is accredited by the Council on Accreditation for Recreation, Park Resources and Leisure Services. The Master of Public Service and Administration degree in the Bush School of Government and Public Service is accredited by the National Association of Schools of Public Affairs and Administration. Other accrediting agencies which have approved programs offered at the University are the American Chemical Society, and the American Society of Agricultural and Biological Engineers. The Agricultural Systems Management curriculum is recognized by the American Society for Agricultural and Biological Engineers. The Food Science and Technology curriculum is approved by the Institute of Food Technologists. Programs in professional education and degrees conferred by Texas A&M University are approved by the State Board of Educator Certification for certification and salary qualification purposes and are fully accredited by the National Council for Accreditation of Teacher Education.

Purpose of Catalog

This catalog provides information about the academic programs of Texas A&M University to students, prospective students, faculty and staff of the University. Included is information concerning admissions, academic regulations and requirements, services available to students, academic offerings and a list of the administrative officers and faculty of the University. While every effort has been made to make this catalog as complete and accurate as possible, changes may occur at any time in requirements, deadlines, fees, curricula and courses listed in this catalog.

Students should refer to the website howdy.tamu.edu for course offerings in any given semester. For administrative reasons, because of insufficient enrollment or because of limited resources, any given course might not be offered in the announced semester.

This catalog was prepared in advance of its effective date; therefore, the course descriptions may vary from actual course content. The provisions of this catalog do not constitute a contract, express or implied, between any applicant, student, faculty or staff member of Texas A&M University or The Texas A&M University System. This catalog is for informational purposes only. The university reserves the right to change or alter any statement herein without prior notice. This catalog should not be interpreted to allow a student that begins his or her education under the catalog to continue the program under the provisions in the catalog.

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Academic Calendar

2012 Summer Term I*

May 16	Graduation application opens for all students planning to graduate in August 2012.
May 25	Last day to register for first term semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
May 28	Memorial Day. Faculty and Staff holiday.
May 29	First day of first term classes.
June 1	Last day for adding/dropping courses for the first term, 5 p.m.
June 18	Last day for all students to drop courses with no penalty for the first term (Q-drop), 5 p.m. Last day to change Kinesiology 198/199 grade type for the first term, 5 p.m. Last day to officially withdraw from the University for the first term, 5 p.m.
June 29	Last day of first term classes.
July 2	First term final examinations.
July 4	Independence Day. Faculty and Staff holiday.
July 5	First term final grades due in the Office of the Registrar, noon.
July 6	Last day to apply for degrees to be awarded in August without a late fee.

2012 Summer Term II*

May 16	Graduation application opens for all students planning to graduate in August 2012.
July 2	Last day to register for the second term semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
July 3	First day of second term classes.
July 4	Independence Day. Faculty and Staff holiday.
July 6	Last day to apply for degrees to be awarded in August without a late fee.
July 9	Last day for adding/dropping courses for the second term, 5 p.m.
July 24	Last day for all students to drop courses with no penalty for the second term (Q-drop), 5 p.m. Last day to change Kinesiology 198/199 grade type for the second term, 5 p.m. Last day to officially withdraw from the University for the second term, 5 p.m.
August 6	Last day of second term classes. Last day to apply for all degrees to be awarded in August.
August 7–8	Second term final examinations for all students.
August 9	Grades for degree candidates from departments due in Office of the Registrar, noon.
August 10	Commencement and Commissioning. Last day for August undergraduate degree candidates to apply for Tuition Rebate, 5 p.m.
August 11	Texas A&M University at Galveston Commencement.
August 13	Final grades for second term due in Office of the Registrar, noon.

2012 10-Week Summer Semester*

May 16	Graduation application opens for all students planning to graduate in August 2012.
May 25	Last day to register for 10-week semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
May 28	Memorial Day. Faculty and Staff holiday.
May 29	First day of 10-week semester classes.
June 1	Last day for adding/dropping courses for the 10-week semester, 5 p.m.
July 2	No 10-week semester classes.
July 4	Independence Day. Faculty and staff holiday.
July 6	Last day to apply for degrees to be awarded in August without a late fee.
July 18	Last day for all students to drop courses with no penalty for the 10-week semester (Q-drop), 5 p.m. Last day to officially withdraw from the University for the 10-week semester, 5 p.m.
August 6	Last day of 10-week semester classes. Last day to apply for all degrees to be awarded in August.
August 7–8	10-week semester final examinations for all students.
August 9	Grades for degree candidates from departments due in Office of the Registrar, noon.
August 10	Commencement and Commissioning. Last day for August undergraduate degree candidates to apply for Tuition Rebate, 5 p.m.
August 11	Texas A&M University at Galveston Commencement.
August 13	Final grades for 10-week semester due in Office of the Registrar, noon.

*These dates are subject to change.

2012 Fall Semester*

August 15	Graduation application opens for all students planning to graduate in December 2012.
August 24	Last day to register for fall semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
August 26	Freshman Convocation.
August 27	First day of fall semester classes.
August 31	Last day for adding/dropping courses for the fall semester, 5 p.m.
September 6	Academic Convocation
September 28	Last day to apply for all degrees to be awarded in December without a late fee.
October 15	Mid-semester grades due in Office of the Registrar, noon
November 2	Last day for all students to drop courses with no penalty (Q-drop), 5 p.m. Last day to change Kinesiology 198/199 grade type, 5 p.m. Last day to officially withdraw from the University, 5 p.m.
November 15– December 4	Preregistration for 2013 spring semester.
November 18	Bonfire 1999 Remembrance Day.
November 22–23	Thanksgiving holiday.
December 3	Redefined day, students attend their Friday classes. Prep day, classes meet. No regular course exams (except for laboratory and one-hour classes) shall be given on these days.
December 4	Last day of fall semester classes. Last day to apply for all degrees to be awarded in December. Redefined day, students attend their Thursday classes. Prep day, classes meet. No regular course exams (except for laboratory and one-hour classes) shall be given on these days.
December 5–6	Reading days, no classes.
December 7, 10–12	Fall semester final examinations for all students.
December 13	Grades for degree candidates due, 6 p.m.
December 14	Last day for December undergraduate degree candidates to apply for Tuition Rebate, 5 p.m.
December 14–15	Commencement and Commissioning.
December 17	Final grades for all students due in Office of the Registrar, noon.
December 24–January 1	Faculty and Staff holiday.

2013 Spring Semester*

January 2	Graduation application opens for all students planning to graduate in May 2013.
January 11	Last day to register for the spring semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
January 14	First day of spring semester classes.
January 18	Last day for adding/dropping courses for the spring semester, 5 p.m.
January 21	Martin Luther King, Jr. Day. Faculty and Staff holiday.
February 15	Last day to apply for all degrees to be awarded in May without a late fee.
March 4	Mid-semester grades due in Office of the Registrar, noon
March 11–15	Spring break.
March 15	Faculty and Staff holiday.
March 29	Reading day, no classes.
April 2	Last day for all students to drop courses with no penalty (Q-drop), 5 p.m. Last day to change Kinesiology 198/199 grade type, 5 p.m. Last day to officially withdraw from the University, 5 p.m.
April 11–26	Preregistration for the summer and fall semesters.
April 21	Muster. Campus ceremony.
April 29	Prep day, classes meet. No regular course exams (except for laboratory and one-hour classes) shall be given on these days.
April 30	Last day of spring semester classes. Last day to apply for all degrees to be awarded in May. Redefined day, students attend their Friday classes. Prep day, classes meet. No regular course exams (except for laboratory and one-hour classes) shall be given on these days.

*These dates are subject to change.

May 1–2	Reading days, no classes.
May 3, 6–8	Spring semester final examinations for all students.
May 9	Grades for degree candidates due, 6 p.m..
May 10	Last day for May undergraduate degree candidates to apply for Tuition Rebate, 5 p.m.
May 10–11	Commencement, Commissioning.
May 13	Final grades for all students due in Office of the Registrar, noon.

2013 Summer Term I*

May 15	Graduation application opens for all students planning to graduate in August 2013.
May 27	Memorial Day. Faculty and Staff holiday.
May 31	Last day to register for first term semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
June 3	First day of first term classes.
June 6	Last day for adding/dropping courses for the first term, 5 p.m.
June 21	Last day for all students to drop courses with no penalty for the first term (Q-drop), 5 p.m. Last day to change Kinesiology 198/199 grade type for the first term, 5 p.m. Last day to officially withdraw from the University for the first term, 5 p.m.
July 4	Independence Day. Faculty and Staff holiday.
July 5	Last day of first term classes.
July 8	First term final examinations.
July 11	First term final grades due in the Office of the Registrar, noon.
July 12	Last day to apply for degrees to be awarded in August without a late fee.

2013 Summer Term II*

May 15	Graduation application opens for all students planning to graduate in August 2013.
July 8	Last day to register for the second term semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
July 9	First day of second term classes.
July 12	Last day for adding/dropping courses for the second term, 5 p.m. Last day to apply for degrees to be awarded in August without a late fee.
July 29	Last day for all students to drop courses with no penalty for the second term (Q-drop), 5 p.m. Last day to change Kinesiology 198/199 grade type for the second term, 5 p.m. Last day to officially withdraw from the University for the second term, 5 p.m.
August 12	Last day of second term classes. Last day to apply for all degrees awarded in August 2013.
August 13–14	Second term final examinations for all students.
August 15	Grades for degree candidates from departments due in Office of the Registrar, noon.
August 16	Commencement and Commissioning. Last day for August undergraduate degree candidates to apply for Tuition Rebate, 5 p.m.
August 17	Texas A&M University at Galveston Commencement.
August 19	Final grades for second term due in Office of the Registrar, noon.

*These dates are subject to change.

2013 10-Week Summer Semester*

May 15	Graduation application opens for all students planning to graduate in August 2013.
May 27	Memorial Day. Faculty and Staff holiday.
May 31	Last day to register for 10-week semester classes, 5 p.m. Refer to finance.tamu.edu/sbs/ for tuition and fee due dates.
June 3	First day of 10-week semester classes.
June 6	Last day for adding/dropping courses for the 10-week semester, 5 p.m.
July 4	Independence Day. Faculty and Staff holiday.
July 8	No 10-week semester classes.
July 12	Last day to apply for degrees to be awarded in August without a late fee.
July 23	Last day for all students to drop courses with no penalty for the 10-week semester (Q-drop), 5 p.m. Last day to officially withdraw from the University for the 10-week semester, 5 p.m.
August 12	Last day of 10-week semester classes. Last day to apply for all degrees awarded in August 2013.
August 13–14	10-week semester final examinations for all students.
August 15	Grades for degree candidates from departments due in Office of the Registrar, noon.
August 16	Commencement and Commissioning. Last day for August undergraduate degree candidates to apply for Tuition Rebate, 5 p.m.
August 17	Texas A&M University at Galveston Commencement.
August 19	Final grades for 10-week semester due in Office of the Registrar, noon.

*These dates are subject to change.

Board of Regents

Richard A. Box, Chairman.....	Austin
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* * *

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General Counsel.....	Ray Bonilla
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* * *

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* * *

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* * *

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Office of Graduate Studies Administrative Officers

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Leslie H. Feigenbaum	William A. Seitz
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Alejandro Castillo	William D. Park
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David W. Forrest	C. Wayne Smith
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Charles F. Hermann	Lori Taylor
Ren Mu	

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Michael R. Kinney	Venkatesh Shankar

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MS

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Kirsten Pullen	Ling Zhu
Sally A. Robinson	

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Paul F. Dahm	Simon W. North
Peter B. Howard	Joseph H. Ross

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John E. Bauer	Charles R. Long
Wesley T. Bissett	Loren C. Skow
Noah D. Cohen	Karen F. Snowden
Christine L. Heaps	Jörg M. Steiner

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Patrick Louchouart	Frederick C. Schlemmer
Joan Mileski	John R. Schwarz
Vijay G. Panchang	Wyndylyn M. von Zharen
Frederic B. Pearl	

Admission Statement and Policy on Individuals with Disabling Conditions

Texas A&M University has a strong institutional commitment to the principle of diversity in all areas. In that spirit, admission to Texas A&M University and any of its sponsored programs is open to all qualified individuals. Texas A&M does not discriminate on the basis of an individual's disability and complies with section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) as amended in its admissions, accessibility, treatment and employment of students in its programs and activities. The designated ADA coordinator for Texas A&M University is the Associate Vice President for University Risk and Compliance, (979) 845-0977, compliance.tamu.edu/ADAMenu.aspx. Texas A&M provides academic accommodations and auxiliary aids to students with disabling conditions, as defined under the law, who are otherwise qualified to meet the institution's academic requirements. Disability Services, (979) 845-1637, disability.tamu.edu, coordinates Texas A&M University's programs and efforts for the benefit of the students covered under the statute.

University Statement on Harassment and Discrimination

Texas A&M University is committed to providing an educational and work climate that is conducive to the personal and professional development of each individual. To fulfill its multiple missions as an institution of higher learning, Texas A&M encourages a climate that values and nurtures collegiality, diversity, pluralism and the uniqueness of the individual within our State, nation and world. The University also strives to protect the rights and privileges, and to enhance the self-esteem of all its members. Faculty, staff and students should be aware that any form of harassment and any form of illegal discrimination against any individual is inconsistent with the values and ideals of the University community.

Individuals who believe they have experienced harassment or discrimination are encouraged to contact the appropriate offices within their respective units. Students should contact the Office of the Dean of Student Life at (979) 845-3111, faculty members should contact the Office of the Dean of Faculties and Associate Provost at (979) 845-4274, and staff should contact Human Resources, Employee Relations Office at (979) 862-4027.

Graduate Appeals Process

Students who believe that course grades or evaluations of performance on examinations or documents were made on an arbitrary, capricious or prejudiced basis may appeal such decisions through the appeals process specified in the Texas A&M University Student Rules (59. Graduate Appeals Panel). In such appeals the burden of proof is upon the student to demonstrate that the evaluations in question were arbitrary, capricious or prejudiced.

University Student Rules

Each student enrolled at Texas A&M University is responsible for being fully acquainted with and complying with the Texas A&M University Student Rules. Specific rules, information and procedures may be found in publications pertaining to each particular service or department. These rules and guidelines were in effect as of the printing of this catalog. Graduate students are encouraged to check the website student-rules.tamu.edu for any changes.

Information

General Information

Office of Graduate Studies
302 Jack K. Williams
Administration Building
Texas A&M University
1113 TAMU
College Station, TX 77843-1113
(979) 845-3631
Email: ogs@tamu.edu
website: ogs.tamu.edu

Graduate Programs

(Academic Department)
Texas A&M University
College Station, TX 77843

Application Forms and Admission

Office of Admissions
Graduate Admissions
Texas A&M University
P. O. Box 30014
College Station, TX 77842-3014
(979) 845-1044
Email: graduate-admissions@tamu.edu
website: admissions.tamu.edu

Graduate Record Examination

Educational Testing Service, Box 955-R
Princeton, NJ 08541-6200
*The computerized GRE is given
on the Texas A&M University campus.
For information, please call (979) 845-0532.*

GMAT Dates and Locations

Graduate Management Admissions Test
Educational Testing Service, Box 966-R
Princeton, NJ 08541-6200

IELTS International

100 East Corson Street
Suite 200
Pasadena, CA 91103
USA

Required Tests and Locations

Measurement and Research Services
Texas A&M University
4239 TAMU
College Station, TX 77843-4239
(979) 845-0532

Thesis Office

612 Sterling Evans Library
5000 TAMU
College Station, TX 77843-5000
(979) 845-2225
Fax: (979) 862-3124
Email: thesis@tamu.edu
website: thesis.tamu.edu

TOEFL Dates and Locations

Educational Testing Service
Princeton, NJ 08541-6151

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History and Development

Mission Statement

Texas A&M University is dedicated to the discovery, development, communication and application of knowledge in a wide range of academic and professional fields. Its mission of providing the highest quality undergraduate and graduate programs is inseparable from its mission of developing new understandings through research and creativity. Students are prepared to assume roles of leadership, responsibility and service to society. Texas A&M assumes as its historic trust the maintenance of freedom of inquiry and an intellectual environment nurturing the human mind and spirit. It welcomes and seeks to serve persons of all racial, ethnic and geographic groups, women and men alike, as it addresses the needs of an increasingly diverse population and a global economy. In the twenty-first century, Texas A&M University seeks to assume a place of preeminence among public universities while respecting its history and traditions.

History and Development

Texas A&M University, the first public institution of higher education in Texas, opened for classes in 1876. It is now one of a select few institutions in the nation to hold land grant, sea grant and space grant designations. The University owes its origin to the Morrill Act approved by the Congress on July 2, 1862. This act provided for donation of public land to the states. The land was to be sold at auction, and the proceeds were set aside in a perpetual fund. The act directed that interest from this fund be used to support a college whose “leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and mechanical arts...in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.”

By resolution of the Legislature of the State of Texas in November 1866, Texas agreed to provide for a college under the terms of the Morrill Act, but no such institution was organized until the establishment of the Agricultural and Mechanical College of Texas by act of April 17, 1871. The same act appropriated \$75,000 for the erection of buildings and bound the state to defray all expenses of the college exceeding the annual interest from the endowment. Proceeds from the sale of the 180,000 acres of land scrip received under the Land Grant College Act were invested in \$174,000 of gold frontier defense bonds of Texas, forming a perpetual endowment for the institution. A commission created to locate the institution accepted the offer of 2,416 acres of land from the citizens of Brazos County in 1871, and instruction began in 1876.

In 1888, twelve years after the opening of the Agricultural and Mechanical College of Texas, the faculty initiated programs of instruction at the graduate level. In 1890, two Master of Science degrees were conferred without any indication of the specialization of the recipients. Initially, the Agricultural and Mechanical College of Texas emphasized graduate programs in agriculture and engineering which were administered by a faculty committee for graduate studies. In 1898, a single Master of Science degree in horticulture was awarded, followed by a scattering of Master of Science degrees in agriculture over the next 22 years. The acceleration in the awarding of Master of Science degrees after 1920, however, prompted the Agricultural and Mechanical College of Texas to establish the Graduate School in 1924, with the dean of the college serving as graduate dean.

In keeping with the diversified and expanded character of the institution, the 58th Legislature of Texas, on August 23, 1963, changed the name of the Agricultural and Mechanical College of Texas to Texas A&M University. With the name change to Texas A&M University, the Graduate School was designated the Graduate College. It was renamed the Office of Graduate Studies in 1987, and is administered by the Associate Provost for Graduate Studies under the Division of Research and Graduate Studies.

In 1936, the Board of Directors of the Agricultural and Mechanical College of Texas approved “certain programs of study and research leading to the doctorate.” In the same year the Academic Council of the Agricultural and Mechanical College of Texas delineated qualifications required of the faculty for participation in graduate instruction, thereby establishing the graduate faculty. The first PhD degree was awarded in 1940. In the 1960s the Board of Regents envisioned a broader role for graduate studies and implemented changes that resulted in programs of graduate instruction in all of the academic colleges throughout the University.

As the State of Texas grew, so did its land grant institution. Texas A&M now has a physical plant valued at more than \$1 billion. The campus in College Station includes 5,200 acres and is one of the largest campuses of any major institution of higher education in the nation.

On September 17, 1971, the designation “sea grant college” was assigned to Texas A&M University in recognition of its achievements in oceanographic and marine resources development. Texas A&M was one of the first four institutions nationwide to achieve this distinction. Patterned after the century-old land grant idea, sea grant colleges are federal-state partnerships for furthering marine work through practical research, education and advisory services. The designation clearly establishes the University’s leadership relative to marine affairs of the state.

Texas A&M added a third special designation to its credentials on August 31, 1989, when it was named a “space grant college.” This new designation, bestowed by the National Aeronautics and Space Administration, came to the University based on its continuing commitment to space research and its participation in the Texas Space Grant Consortium, a group of 24 higher education institutions, 22 corporations, two non-profit groups and three state agencies under the leadership of Texas A&M University and The University of Texas at Austin.

In addition to its traditional strengths in agriculture and engineering, Texas A&M has established itself as a leader in many newer technological areas such as the space, nuclear, computer, biotechnological, oceanographic and marine resources fields. It also has placed added emphasis on the arts and sciences and business, and continues to enhance its prominent role in these fields.

A mandatory military component was a part of the Land Grant designation until the 1950s, and the Corps of Cadets has played an important part in the history and development of Texas A&M. Even though membership in the Corps of Cadets became voluntary in 1965, Texas A&M historically has produced more officers than any other institution in the nation with the exception of the service academies. The University is one of only three institutions with a full-time corps of cadets including ROTC programs leading to commissions in all branches of service—Army, Air Force, Navy, Marine Corps and Coast Guard.

Texas A&M offers a variety of programs in undergraduate and graduate studies through its academic colleges and schools – Agriculture and Life Sciences, Architecture, The George Bush School of Government and Public Service, Mays Business School, Education and Human Development, Dwight Look College of Engineering, Geosciences, Liberal Arts, Science, and Veterinary Medicine and Biomedical Sciences. Texas A&M has two branch campuses. Texas A&M University at Galveston is the marine and maritime branch campus of Texas A&M University. Since 2003, Texas A&M has offered engineering degrees in the Middle Eastern country of Qatar. In addition, Texas A&M's extensive research efforts in all fields, in conjunction with agricultural and engineering experiment stations, resulted in annual expenditures of approximately \$500 million and has been consistently ranked in the top tier of research institutions by the National Science Foundation.

Classified by the Carnegie Foundation as a Research University (very high research activity), Texas A&M embraces its mission of the advancement of knowledge and human achievement in all its dimensions. The research mission is a key to advancing economic development in both public and private sectors. Integration of research with teaching prepares students to compete in a knowledge-based society and to continue developing their own creativity, learning, and skills beyond graduation.

In 2001, Texas A&M University was admitted to the Association of American Universities (AAU), the prestigious organization founded in 1900 that restricts its ranks to the nation's premier public and private institutions of higher learning. In 2004, the Kappa of Texas Chapter of Phi Beta Kappa was installed at Texas A&M University. Founded in 1776 at the College of William and Mary in Williamsburg, Virginia, Phi Beta Kappa is the nation's oldest and largest academic honor society. The mission of the society is to recognize and foster excellence in the liberal arts and sciences. While most students are nominated in their senior year, membership is also offered to a few juniors and graduate students.

Student Learning Outcomes

Student learning outcomes articulate the results we expect students to gain during their educational experiences. Sometimes these results or outcomes are identified by a particular course, sometimes by a degree program, and sometimes by the institution. A course-level learning outcome, for example, might ask that students genuinely understand a mathematical concept or a physiological process. A degree program-level outcome may be more abstract, such as having students demonstrate that they can solve real-world problems by using an approach typical of their field or discipline.

The institutional-level student learning outcomes ask students to connect their course- and degree-level learning to overall goals determined to be critically important to a university's graduates as they make their way in the world after graduation.

First and foremost, of course, we expect students to have learned the material presented in their individual courses. From entry-level general education courses required of all undergraduates to capstone courses restricted to seniors in a major to specialized graduate seminars, by the time of graduation students are expected to have learned the material assigned in all of their courses. We call this "content knowledge."

The broader institutional student learning outcomes are at a higher order of thinking that asks students to connect the pieces of their education into a whole that synthesizes what they have learned. By not only knowing facts and understanding basic concepts but demonstrating an ability to apply those facts and concepts creatively in new situations, students gain the flexible thinking and effective communication that allows them to thrive in today's complex world.

Master's

A student who graduates from Texas A&M University with a master's degree will:

- Master degree program requirements, including
 - o theories, concepts, principles, and practice, and
 - o develop a coherent understanding of the subject matter through synthesis across courses and experiences.
- Apply subject matter knowledge in a range of contexts to solve problems and make decisions.
- Use a variety of sources and evaluate multiple points of view to analyze and integrate information and to conduct critical, reasoned arguments.
- Communicate effectively.
- Use appropriate technologies to communicate, collaborate, conduct research, and solve problems.
- Develop clear research plans and conduct valid (data-supported), theoretically consistent, and institutionally appropriate research.
- Choose ethical courses of action in research and practice.

Doctoral

A student who graduates from Texas A&M University with a doctoral degree will:

- Master degree program requirements, including
 - theories, concepts, principles, and practice;
 - develop a coherent understanding of the subject matter through synthesis across courses and experiences; and
 - apply subject matter knowledge to solve problems and make decisions.
- Apply a variety of strategies and tools, use a variety of sources, and evaluate multiple points of view to analyze and integrate information and to conduct critical, reasoned arguments.
- Communicate effectively.
- Develop clear research plans, conduct valid, data-supported, theoretically consistent, and institutionally appropriate research and effectively disseminate the results of the research in appropriate venues to a range of audiences.
- Use appropriate technologies to communicate, collaborate, conduct research, and solve problems.
- Teach and explain the subject matter in their discipline.
- Choose ethical courses of action in research and practice.

Office of Graduate Studies

Objectives of Graduate Studies

The Office of Graduate Studies (OGS) maintains the official record for each graduate student, and in this role serves as the primary administrative body and overarching source of information for graduate education. Once a graduate student is accepted by an academic department, school or college, OGS assists and facilitates progression towards completion of a graduate degree through maintenance of all official documents. OGS interacts directly with the Graduate Council and Graduate Operations Committee to set minimal University guidelines, and all departments and colleges use these as a framework for operation, only setting more stringent standards when needed and appropriate. Clearance for graduation, including final review of theses and dissertations when required, is performed by OGS, but the Office of the Registrar is responsible for issuing all transcripts.

The overall objective of graduate study is to provide a student with the intellectual depth and breadth, and appropriate training necessary to pursue a productive career in a profession and/or in various fields of teaching and research and in other ways make a larger contribution to society than would be otherwise possible.

A graduate student is admitted for graduate study in a department to pursue generally only one of the programs listed on the following pages at one time. Such programs are usually accessible by admission into a single department. A select number of dual degree programs allow a student the opportunity to pursue two masters degrees simultaneously. For a listing of the approved dual degree programs, a student should consult his/her department. In some cases, an intercollegiate faculty oversees the programs allowing access through several departments. Each department has one or more graduate advisors who can provide information about specific programs within that department.

A student's program of graduate study usually consists of a combination of coursework, independent study and scholarly research resulting in a report, record of study, master's thesis or doctoral dissertation. In some programs, a student may be required to participate in an internship or other professional activity to satisfy particular degree requirements. Some departments require a student's participation in teaching as part of his/her degree programs.

Administration of Graduate Studies

The graduate faculty consists of the President, the Executive Vice President and Provost, the Associate Provosts, the Vice President for Research, the Deans of all colleges and schools, selected Directors and a properly qualified academic group appointed by the Office of Graduate Studies. Members of the graduate faculty participate in the graduate degree programs of the University by serving on student advisory committees and teaching graduate courses. Individuals who are not members of the graduate faculty of Texas A&M University may not teach graduate courses or serve on student advisory committees unless special approval is granted by the Office of Graduate Studies.

The Graduate Council serves as a reporting committee to the Faculty Senate. The Graduate Council reviews all curricular requests pertaining to the graduate academic program, is responsible for the quality and development of the graduate instruction

and programs, and advises the Associate Provost for Graduate Studies on all graduate program matters. Each college has a committee on graduate instruction with the responsibility for making recommendations concerning graduate course offerings, general policies on graduate instruction and for other matters pertaining to graduate studies in that college. The chair of each committee on graduate instruction is a member of the Graduate Council.

The **Graduate Operations Committee (GOC)** serves as an advisory body to the Associate Provost for Graduate Studies. It focuses primarily on operations and procedures regarding administration of graduate education throughout the University. The GOC works very closely with the Graduate Council to coordinate all curriculum and policy issues. It also works closely with the Academic Operations Committee and the Academic Program Council to consider recommendations concerning operations and procedures. Each academic college is represented on the GOC by the associate dean (or other named individual) responsible for graduate studies in that college.

Graduate Faculty

Guidelines for Graduate Faculty Membership

This document presents University policies and practices which Department Heads should use in nominating members to the Graduate Faculty of Texas A&M University. Departments and colleges may have additional requirements that must be satisfied by individuals wishing to be recommended for appointment to the Graduate Faculty. Additional requirements are subject to the review and approval of the Executive Vice President and Provost. The following sections discuss the various categories of Graduate Faculty. The final section discusses current policy for assigning titles to members of the Graduate Faculty in the *Graduate Catalog*.

General Description of Graduate Faculty

The Graduate Faculty at Texas A&M University consists of the President, the Executive Vice President and Provost, the Associate Provosts, the Deans of all subject-matter colleges, selected Directors, and properly qualified academic groups appointed by the Office of Graduate Studies. Appointees to the Graduate Faculty participate in the graduate degree programs of the University by serving on student advisory committees and teaching graduate courses. Individuals who have not been appointed to the Graduate Faculty may not teach graduate courses or serve on student advisory committees unless special approval is granted by the Office of Graduate Studies.

The Graduate Faculty is composed of **Members, Associate Members, Adjunct Members, and Special Appointments. Members and Associate Members** are selected from qualified individuals of the academic staff of Texas A&M University, from the staff of other parts of the University, from The Texas A&M University System, and from affiliated research organizations (such as USDA) located in College Station, TX.

Nomination for membership on the Graduate Faculty is always initiated by the head of the appropriate academic department of Texas A&M University in College Station and is processed as discussed in the following sections.

Appointment to membership on the Graduate Faculty, although considered an honor, serves functional purposes and must be earned. Appointment to membership is not for the purpose of conferring recognition upon an individual, but is designed to assure

competence in the directing and counseling of graduate students and in the teaching of graduate courses. Such competence is, in part, a function of experience and knowledge of operational procedure; it is also characterized by ability and motivation.

Membership on the Graduate Faculty is maintained only by participating in the graduate program by teaching, by directing or administering graduate work, by doing research and publication, or by other direct and substantial contributions to the graduate programs of the University, such as by service on a Graduate Instruction Committee or by administrative assignments in graduate education. The Graduate Council expects that all Deans and Department Heads will regularly review the Graduate Faculty under their direction and will recommend withdrawal of the appointments of any members who no longer merit membership on the Graduate Faculty on the basis of their lack of contribution to graduate education. The Department Head shall notify any faculty member who is non-voluntarily removed from the roles of the Graduate Faculty, and the faculty member has the right to appeal his/her removal through the PPM 2.3.2.6 (Faculty Grievance Procedures).

A graduate student at Texas A&M University may not be a member of the Graduate Faculty. Membership on the Graduate Faculty of any faculty or staff member of Texas A&M University or The Texas A&M University System and affiliated research organizations is forfeited upon a faculty or staff member's admission to a graduate program at Texas A&M University. The four categories of membership are: **1) Member, 2) Associate Member, 3) Adjunct Member, and 4) Special Appointment.**

Members

Eligibility. Tenure track and tenured faculty members of Texas A&M University are eligible to participate as **Members** of the Graduate Faculty under criteria and guidelines as established by each college or department on the College Station campus. Appointment of an individual as a **Member** is accomplished by a letter of nomination from the head of a department on the College Station campus to the Associate Provost for Graduate Studies. In some cases, additional approval is required by the Dean or the Graduate Instruction Committee of the individual's college.

A non-tenure-track individual employed by Texas A&M University, TAES, TAEX, TEES, TEEX, or TTI with professorial rank is eligible to participate as a **Member** of the Graduate Faculty. A person holding the title of Lecturer or Senior Lecturer may not normally be considered for Member status on the Graduate Faculty. Exceptions to this will be acceptable only if the person concerned has an unusual or unique contribution to make to the graduate program of Texas A&M University and approval is granted by the department, college, and Office of Graduate Studies. A non-tenure-track individual is nominated by the head of the appropriate academic department in College Station who must present evidence that (a) the nominee (1) has taught a graduate class, or (2) has actively served on a graduate student's advisory committee, or (3) has held a definite administrative assignment in the graduate program of a university; and that (b) the nominee has published a scholarly work as primary author (or, in the case of a professional discipline, has exhibited appropriate evidence of professional accomplishment). Recognized scholars and authorities whose merits are clearly established need not be measured by standard criteria. Appointment of these individuals is accomplished by use of the Personal Record Form, initiated by the head of the academic department in

College Station, through the College Graduate Instruction Committee and the College Dean to the Associate Provost for Graduate Studies.

Privileges. A **Member** of the Graduate Faculty, located at College Station, may teach graduate courses and serve as member, co-chair or chair of a graduate student's Advisory Committee. In addition, a **Member** may be chosen from time to time to serve as Graduate Council Representative on doctoral Advisory Committees. **Members** located at the Texas A&M University Galveston Campus, the Texas A&M Temple Campus, or Texas A&M's Institute of Biosciences and Technology-Houston may teach graduate courses and serve as a member, co-chair or chair of a graduate student's Advisory Committee. Other **Members** of the Graduate Faculty located off-campus may teach graduate courses and serve as a member or co-chair (but not chair), with a **Member** as the other co-chair, of a graduate student's Advisory Committee.

Associate Members

Eligibility. Any faculty member (including Instructors and Lecturers, if permitted by the department or college's policy) or professional staff employed by Texas A&M University, TAES, TAEX, TEES, TEEX, or TTI who holds the highest earned degree common to that person's discipline may be granted **Associate Member** status on the Graduate Faculty of Texas A&M University provided that the individual's appointment as an **Associate Member** of the Graduate Faculty will be beneficial to the department's graduate program. In addition, employees of federal and state agencies located in the College Station area are eligible for **Associate Member** status. It is expected that a nominee for **Associate Member** status has published a scholarly work as primary author (or, in the case of a professional discipline, has exhibited appropriate evidence of professional accomplishment). Recognized scholars and authorities whose merits are clearly established need not be measured by standard criteria.

Appointment to **Associate Member** status is accomplished by use of the Personal Record Form, initiated by the head of the academic department at College Station through the College Graduate Instruction Committee and the College Dean to the Associate Provost for Graduate Studies. A non-tenure-track individual is nominated by the head of the appropriate academic department at College Station who must present evidence that (a) the nominee (1) has taught a graduate class, or (2) has actively served on a graduate student's advisory committee, or (3) has held a definite administrative assignment in the graduate program of a university; and that (b) the nominee has published a scholarly work as primary author (or, in the case of a professional discipline, has exhibited appropriate evidence of professional accomplishment). Recognized scholars and authorities whose merits are clearly established need not be measured by standard criteria. Appointment of these individuals is accomplished by use of the Personal Record Form, initiated by the head of the academic department at College Station through the College Graduate Instruction Committee and the College Dean to the Associate Provost for Graduate Studies.

Privileges. An **Associate Member** of the Graduate Faculty of Texas A&M University may teach graduate courses and serve as member or co-chair (but not as chair) with a **Member** as the other co-chair of a graduate student's Advisory Committee.

Adjunct Members

Eligibility. Recognized scholars who do not hold a permanent appointment to the faculty (including visiting and adjunct academic appointments) of this University, but who otherwise meet the basic requirements for the status of **Member** of the Graduate Faculty, as described previously, may be eligible for appointment to **Adjunct Member** status. In addition, individuals not located in College Station and not employed by Texas A&M University may be considered for **Adjunct Member** status on the Graduate Faculty provided they are employed by another agency of the Texas A&M University System or are qualified staff of federal or state agencies. Such nominations should be made in those cases in which there is an apparent need, and justification can be presented by the head of an academic department in College Station.

Appointment of an **Adjunct Member** is accomplished by use of the Personal Record Form, initiated by the head of the academic department at College Station through the College Graduate Instruction Committee and the College Dean to the Associate Provost for Graduate Studies. A non-tenure-track individual is nominated by the head of the appropriate academic department in College Station who must present evidence that (a) the nominee (1) has taught a graduate class, or (2) has actively served on a graduate student's advisory committee, or (3) has held a definite administrative assignment in the graduate program of a university; and that (b) the nominee has published a scholarly work as primary author (or, in the case of a professional discipline, has exhibited appropriate evidence of professional accomplishment). Recognized scholars and authorities whose merits are clearly established need not be measured by standard criteria. Appointment of these individuals is accomplished by use of the Personal Record Form, initiated by the head of the academic department at College Station through the College Graduate Instruction Committee and the College Dean to the Associate Provost for Graduate Studies.

Privileges. An **Adjunct Member** of the Graduate Faculty may teach graduate courses and serve as a member or co-chair (but not chair) with a **Member** as the other co-chair of a graduate student's Advisory Committee.

Special Appointment

There may be times when the head of an academic department in College Station wishes to have qualified individuals teach a graduate course or serve on a student's Advisory Committee without being permanently on the Graduate Faculty as either a **Member, Associate Member, or Adjunct Member**. In addition, qualified individuals from other universities, government or industry may be appointed in special cases to teach a graduate course or to serve on a student's Advisory Committee.

These appointments are accomplished by a letter of request from the head of an academic department in College Station to the Associate Provost for Graduate Studies with the individual's resume attached. In the letter of request, the department head should indicate if the **Special Appointment** status is to be limited to the one specified committee, to one specified teaching assignment, or to a fixed length of time (e.g., for one or two years).

A qualified individual from another university, government or industry who holds **Special Appointment** status to the graduate faculty and who serves on a Graduate Advisory Committee is not counted toward the minimum number of graduate faculty necessary to form the committee.

Procedural Guidelines

1. Research staff who are on the Graduate Faculty of Texas A&M University and who hold payroll titles equivalent to the “Scientist” titles will be assigned by the Associate Provost for Graduate Studies, for the purpose of listing in the Graduate Catalog, the equivalent “Scientist” title. (Example: A person holding the payroll title of “Associate Research Engineer” will be assigned the title of “Associate Research Scientist.”)
2. Extension Service personnel on the Graduate Faculty of Texas A&M University will be identified in the Graduate Catalog by the title “Extension Specialist.”
3. USDA personnel on the Graduate Faculty of Texas A&M University will be identified in the *Graduate Catalog* by the title “USDA Scientist.”
4. Individuals in the **Member, Associate Member, and Adjunct Member** categories will be listed in the Graduate Faculty section of the *Graduate Catalog*.
5. Only names of individuals in the **Member** category of the Graduate Faculty will be listed under the respective departmental headings in the *Graduate Catalog*.

Intercollegiate Faculty

Texas A&M University has established the concept of an intercollegiate faculty with expressed goals of (a) fostering development and communication in disciplinary fields represented by faculty members in different departments and colleges, (b) utilizing faculty expertise in specific areas to strengthen emerging disciplinary programs and (c) overseeing the academic administration of graduate degree programs in a particular discipline.

To have access to an intercollegiate faculty’s degree programs, a graduate student must be admitted to that program and a member of that faculty must serve as chair or co-chair of the student’s advisory committee.

Intercollegiate faculties have been formed in agribusiness, biotechnology, engineering systems management, food science and technology, genetics, nutrition, materials science and engineering, molecular and environmental plant sciences, toxicology, reproductive biology, and water management and hydrological science.

Texas A&M University System Graduate Faculty

The Texas A&M University System has established a System Graduate Faculty which enables and facilitates the collaborative research and teaching among faculty members of the nine universities and the Health Science Center within the System. By acquiring status through the System Graduate Faculty, a member of the Texas A&M University System Graduate Faculty may teach graduate courses and serve as member or co-chair (but not as chair) with a member of the Texas A&M University Graduate Faculty. These individuals will be automatically granted Associate Member status on the Texas A&M University Graduate Faculty.

System Graduate Faculty Guidelines

- I. Purpose. The Texas A&M University System Graduate Faculty has been developed for the following purposes:
 - A. To facilitate participation in graduate education for a student in the A&M System.
 - B. To provide a graduate student access to the expertise of faculty members throughout the System.
 - C. To increase inter-institutional faculty collaboration throughout the A&M System.
 - D. To promote the development of multi-disciplinary educational and research programs and the capacity to study complex scientific and social issues.
- II. Membership Background
 - A. Membership on the A&M System Graduate Faculty provides the opportunity to participate in graduate education at the A&M System universities through serving on graduate committees, advising a graduate student, and teaching graduate courses.
 - B. Appointment to membership on the A&M System Graduate Faculty is designed to assure rigor in the directing, counseling, and teaching of a graduate student.
 - C. All of the A&M System Graduate Faculty members can serve as members of any graduate committee.
 - D. The chair, or co-chair, of a graduate committee must be from the institution that is conferring the graduate degree.
- III. Membership Qualifications. Consideration for membership on the A&M System Graduate Faculty requires meeting the following qualifications.
 - A. The individual must hold the terminal degree, usually an earned doctorate. Exceptions will be considered only if justified in accordance with the Commission on Colleges of the Southern Association of Colleges and Schools.
 - B. The individual must be a tenured or a tenure-track faculty member of a Texas A&M University System university and hold a professorial rank.
 - C. A person holding the title of instructor or lecturer may not be considered for membership on the A&M System Graduate Faculty.
 - D. Individuals holding professorial rank at an agency of the A&M System are eligible for membership.
 - E. The individual must be a member of the graduate faculty at his/her home institution.
 - F. The individual must be an active participant in his/her graduate program through teaching, directing or administering graduate work.
 - G. The individual must show evidence of active research and scholarly work within the past five years. This should include publication as primary author of scholarly works in peer-reviewed journals, publication of scholarly books, presentations at professional meetings, or creative works, such as performances, work in juried exhibitions, or other creative works appropriate to the individual's discipline.
 - H. A graduate student at any A&M System institution may not be a member of the A&M System Graduate Faculty. Membership on the A&M System Graduate Faculty is forfeited upon a faculty or staff member's admission to a graduate program at any institution in the A&M System.

IV. Nomination, Appointment and Review Process

- A. Nomination for membership to the A&M System Graduate Faculty is made by submission of an official application by a faculty member and an accompanying letter of endorsement from the individual's department head or chair and college dean. The application and letter of endorsement are sent to the graduate dean, who certifies institutional graduate faculty appointment status, and forwards the nomination to the A&M System Council of Graduate Deans for consideration and action.
- B. The application from the faculty member must identify the institutional graduate faculty of which he or she is a member, specify the graduate degree(s) that he or she is qualified to supervise under the conditions of the institutional appointment, and specify the graduate program(s) in which he or she wishes to participate as a System graduate faculty member. The application should be accompanied by a current curriculum vitae.
- C. The Council of Graduate Deans will appoint faculty from member institutions as needed to a Graduate Faculty Review Advisory Committee to consider applications and reappointments and to make recommendations to the Council of Graduate Deans.
- D. A Graduate Faculty member of the A&M System is appointed for a five-year term. At the end of the five-year term, the member will be re-evaluated for reappointment by the Council of Graduate Deans. Failure to maintain membership criteria will result in removal from the A&M System Graduate Faculty. The Council of Graduate Deans will notify by letter a faculty member who is non-voluntarily removed from membership on the A&M System Graduate Faculty. The faculty member's department head, dean, provost and graduate dean will also receive notification.

- V. Graduate Faculty Membership. Information about Graduate Faculty Membership will be maintained in the Office of the Vice Chancellor for Academic and Student Affairs, the graduate office at each System university and on the website ogs.tamu.edu/wp-content/uploads/2011/05/Graduate_Faculty_Membership.pdf.

Graduate Advisors

A graduate student entering the University for the first time is required to consult with a graduate advisor in his or her department. Departmental Graduate Advisors are available for consultation several days prior to registration. Graduate Advisors are designated by an asterisk in the Course Description section of this catalog.

Ombudsperson for Graduate Education

The Ombudsperson for Graduate Education assists graduate students, faculty, staff and administrators in solving conflicts informally. This is accomplished by serving as a neutral listener, information resource, advisor, intermediary and mediator.

A graduate student may serve in many roles during his/her academic career such as student, teacher, co-worker, colleague, employee or technician. Varying rules/policies are in place to guide and protect each of these roles. When expectations for each of these roles are understood and accepted by all parties, problems rarely occur. Challenges can

arise, however, when differing expectations of conflicting policies occur, or when one group is accused of violating the rules. The Ombudsperson supports the processes of graduate education by being equally open and accessible to all parties—students, faculty, staff and administrators.

The Ombudsperson for Graduate Education can assist if a graduate student:

- has an issue or a concern that others cannot resolve, or the student would prefer not to address through formal channels.
- has a matter to explore “off the record,” or those for which the student needs informal consultation.
- has a problem, and is unsure with whom to speak or what options are available to address it.
- believes that a University policy, procedure or regulation has been applied unfairly, or is itself unfair or ambiguous.
- has a problem that requires an outside party to negotiate a solution, or facilitate the student’s communication with others.

Ombudsperson contact information:

Ombudsperson for Graduate Education
1113 TAMU
College Station, TX 77843-1113
(979) 845-3631
ombuds@tamu.edu

New Graduate Student Orientation

A University-wide New Graduate Student Orientation takes place at the start of the fall and spring semesters of each academic year. This orientation acquaints new graduate students with Texas A&M University’s personnel, services, resources, policies and procedures. Graduate students admitted for the summer semester are expected to attend the fall orientation.

New Graduate Student Orientation consists of presentations given and organized by the Office of Graduate Studies highlighting an overview of graduate education and other areas pertinent to new graduate students. Policies, procedures and timelines are discussed, and information on financial aid, campus police, writing services and additional campus services is provided. To close the morning session, a panel of current graduate students discuss their experiences at Texas A&M and answer questions presented to them from the audience of new graduate students. After these presentations, new graduate students are given the opportunity to walk through resources tables from other offices around the Texas A&M campus who serve graduate students. Lunch is provided as a time for students to meet one another and network with staff.

Orientation covers the what, why and how of graduate degree requirements for new graduate students. Distance Education graduate students should complete the online orientation on the ogs.tamu.edu website.

For additional information about New Graduate Student Orientation, please contact The Office of Graduate Studies at 302 Jack K. Williams Administration Building, Texas A&M University, 1113 TAMU, College Station, TX 77843-1113, (979) 845-3631 or email us at ogs@tamu.edu.

Workshop Series

The Office of Graduate Studies provides workshops each fall and spring semester to assist graduate students in gaining a greater understanding of the resources available to them as they move through their program to graduation. The workshops are offered to all graduate students, Masters and Doctoral, and are intended to provide useful information to increase each student's knowledge in various areas of graduate education. Workshops provided include an Office of Graduate Studies Overview, Writing an Abstract, Writing and Plagiarism, Health Insurance, Career Planning, Thesis Office Services, Library Services, Writing Grants and Fellowships, Suicide Prevention, etc. Workshops are added as students request new information, and are offered to individual student organizations as requested.

Graduate Student Council

The **Graduate Student Council (GSC)** exists to share and discuss information important to a Texas A&M University graduate and professional student and to serve as an advocate for his/her interests within the University community. Specific goals of the GSC include: to represent all graduate and professional students by identifying and advocating his/her interests on graduate issues; to be recognized as representing a unique population within the University system; to facilitate communication on graduate issues within the University community; and to enhance the graduate experience through social and service opportunities. Each academic graduate department elects one representative each fall. Officer elections are held in the spring. GSC also works closely with Student Government to assure graduate student issues are represented and addressed through student legislation and on University committees. Additional information can be obtained by visiting us on the website at gsc.tamu.edu.

Letter of Completion

As a courtesy, the Office of Graduate Studies may issue a letter of completion for an individual student upon written request from the student. The letter of completion certifies that the student has completed all academic requirements for the degree and states the date the degree will be awarded. International students should contact International Student Services prior to requesting a letter of completion to determine how receiving it could affect the student's visa status.

This letter may be requested anytime from the point the student has completed all requirements for the award of the degree and until five days prior to commencement. A student in master's thesis option or doctoral program must have completed all degree requirements, including final clearance from the Thesis Office, to be eligible to request this letter. For a student in master's non-thesis option programs, requests for a letter will be accepted only if the student has completed all degree plan coursework and the final examination results, if applicable, have been approved by the Office of Graduate Studies.

In addition to making a request for a letter with the Office of Graduate Studies, the student must also obtain clearance from the Student Debt Management Office. The Student Debt Management Office will verify to the Office of Graduate Studies whether all financial obligations to the University have been satisfied.

Degree Information

Expectations for Graduate Study

The major goals of graduate education at Texas A&M University are to instill in each student an understanding of and a capacity for scholarship, independent judgment, academic rigor and intellectual honesty. Faculty and graduate students have a shared obligation to work together to foster these goals through relationships that advance freedom of inquiry, demonstrate individual and professional integrity, and encourage common respect.

Graduate student progress is guided and evaluated by an advisor and a graduate committee. These individuals give direction and support for the appropriate developmental and learning goals of a graduate student. The advisor and the graduate committee also have the obligation of evaluating a graduate student's academic performance. The graduate student, the advisor and the graduate committee constitute the basic core of graduate education. The quality, scope and extent of interaction in this group determines the significance of the graduate experience.

High quality graduate education requires professional and ethical conduct of the participants. Faculty and graduate students have mutual responsibilities in ensuring academic standards and quality graduate programs. Excellence in graduate education is achieved when faculty and students are inspired, have the academic and professional backgrounds essential to function at the highest level, and are genuine in their mutual desire to see one another succeed. Any action that negatively affects this interaction—from either faculty member or student—destroys the whole relationship. Mutual respect is critical to the successful process.

The requirements set forth in this catalog are defined as minimum University requirements. Departments and Colleges may opt to establish higher standards and/or additional requirements.

Student Responsibility

Each student has a responsibility to:

1. Know specific degree requirements as established by the University or the student's department, college or school.
2. Enroll in the appropriate coursework to complete the degree plan.
3. Maintain the appropriate standards to continue in graduate studies.
4. Know steps and deadlines related to graduation.
5. Be acquainted with the Texas A&M University Student Rules (refer to the website student-rules.tamu.edu).

Information about general degree requirements is available in this catalog. Specific degree requirements and procedural guidelines are available from the departmental graduate advisor(s).

Scholastic Requirements

A graduate student must maintain a grade point average (GPA) of 3.000 (B average based on a 4.000 scale) for all courses which are listed on the degree plan and for all graded graduate and advanced undergraduate coursework (300- and 400-level) completed at Texas A&M and eligible to be applied toward a graduate degree. A graduate student will not receive graduate degree credit for undergraduate courses taken on a satisfactory/unsatisfactory (S/U) basis. A graduate student may not receive grades other than satisfactory (S) or unsatisfactory (U) in graduate courses bearing the numbers 681, 684, 690, 691, 692, 693 and 695 (except for ALEC 695, BUAD 693, AGECE 695, GEOG 695 and IBUS 692). Any other graduate course taken on an S/U basis may not be used on a graduate degree plan (except CHEM 686 and CHEM 697). Graduate courses not on the degree plan may be taken on an S/U basis.

Only grades of A, B, C and S are acceptable for graduate credit. Grades of D, F or Unsatisfactory (U) for courses on the degree plan must be absolved by repeating the courses at Texas A&M University and achieving grades of C or above or Satisfactory (S). A course in which the final grade is C or lower may be repeated once for a higher grade. If the second grade is higher, the original grade will remain on the student's permanent record, and the most recent grade will be used in computing the cumulative and degree plan GPAs.

The cumulative GPA for a graduate student is computed by using all graded graduate (600- and 700-level) and advanced undergraduate (300- and 400-level) coursework completed at Texas A&M University and eligible to be applied toward a graduate degree.

If either of a student's cumulative GPA or the GPA for courses listed on the degree plan falls below the minimum of 3.000, he or she will be considered to be scholastically deficient. If the minimum GPA is not attained in a reasonable length of time, the student may be dropped from graduate studies. The procedures for dismissal are explained in the Texas A&M University Student Rules (refer to the website student-rules.tamu.edu).

For a scholastically deficient post-baccalaureate non-degree student (G6 classification), the student's home department shall determine eligibility, and the department is responsible for notifying the Office of Graduate Studies if a registration block is to be placed on the student.

Departments or colleges may adopt specific guidelines pertaining to scholastic deficiency or dismissal.

Any eligible coursework not applied towards a prior graduate degree, and not exceeding time limits, will be included in the student's GPR for the subsequent degree program.

Residence Requirements

A major purpose of the residence requirements for graduate degrees is to ensure that the student has an opportunity to benefit from the advantages of a university environment. These advantages include accessibility of library, laboratory and other physical facilities, and also the opportunity to participate in seminars and a variety of cultural activities. Equally important to the graduate student are the advantages of becoming acquainted with the faculty and other students on a personal and a professional basis.

A student "in residence" is expected to devote most of his or her time and energy to graduate studies **under the direction of the student's major professor and the advisory committee.**

Another major purpose of the residence requirements for graduate degrees is to ensure that the faculty have the opportunity to properly evaluate the student and his or her development to guide and direct his or her studies and to determine competency.

The minimum time required to qualify for an advanced degree varies with the ability and preparation of the student. A student may find it necessary to extend his/her studies beyond the minimum requirements. **For specific minimum residence requirements, a student should check the description of the degree program for the degree which he/she is pursuing.**

Degree Plan

A graduate student must file a degree plan which includes those courses to be applied toward a particular degree. Courses previously used for another degree are not acceptable for degree plan credit. Changes in the approved degree plan may be made by petition to the Office of Graduate Studies. A student should submit the degree plan using the online Automated Degree Plan Submission System located on the website at ogsdpss.tamu.edu.

Lower division undergraduate coursework (100- and 200-level) may not be used for credit toward a graduate degree. **Coursework may not be used to satisfy requirements for more than one degree.** Additional coursework may be added to the approved degree plan by the student's advisory committee if such additional coursework is needed to correct deficiencies in the student's academic preparation. Specific details and requirements for each degree program may be obtained from the student's academic department.

Courses listed on the degree plan are subject to degree time limits. Please refer to the Time Limits section in each degree section in which the student is presently enrolled.

Petitions

Exceptions to published rules may be requested by proper petition to the Office of Graduate Studies. Each petition will be considered on its own merit by the Associate Provost for Graduate Studies. The signature of the student and the signatures of all members of the graduate student's advisory committee, if appointed, are required on a petition. Furthermore, the signature of the department head, or his or her designee, (or chair of the intercollegiate faculty, if appropriate) is required on all petitions.

Specific forms for these types of petitions are found on the Office of Graduate Studies website address at ogs.tamu.edu/incoming-students/student-forms-and-information/ and must be used.

Pre-Defense Publication of Thesis or Dissertation Material

A graduate student may publish material that subsequently will be used as part of the thesis, dissertation or record of study.

A student should be aware of the copyright agreement that is signed when a journal (hard copy or electronic) accepts an article for publication. At that time, the student generally assigns rights to the journal as publisher. If the student has not retained the right to use the material in the thesis, dissertation, or record of study, he/she must then obtain written permission from the copyright holder to include the material in the manuscript. If such permission is not obtained, or rights have not been retained, the copyrighted material cannot be included in the thesis, dissertation, or record of study.

Classified and Proprietary Information

Committee chairs should be cautioned about allowing a student to use classified or proprietary information in theses or dissertations because these documents become available to the public upon submission to the Office of Graduate Studies. The research conducted at Texas A&M University, as a Texas public institution, is ultimately for the benefit of the public. All theses, dissertations, and records of study are available on the Internet via the Texas A&M University Libraries. In addition, dissertations are published electronically by ProQuest (UMI) and are available from that source. Availability may be delayed temporarily only for patent/proprietary or publication issues.

Intellectual Property

Intellectual Property will mean individually and collectively, all forms of intellectual property including, but not limited to inventions, copyrightable works, trademarks, plant varieties, tangible research products, and know-how. In keeping with academic tradition, works created by a student in the course of his/her education, such as dissertations, papers and journal articles are owned by the student. Intellectual property created from activities related to an individual's employment responsibilities and/or with support from University-administered funds, facilities or personnel will be owned by the University. Ownership of intellectual property developed in the course of or resulting from research supported by a grant or contract with the federal government or state government or a nonprofit or for-profit nongovernmental entity shall be determined in accordance with the terms of the sponsored grant or contract, or in the absence of such terms, shall be owned by the University.

Thesis, Dissertation and Record of Study–Thesis Office

The Thesis Office is responsible for reviewing each thesis, dissertation and record of study to ensure that the format requirements of the University are met. Guidelines and electronic templates for the preparation of the manuscript are available in the *Thesis Manual*, which is available online at thesis.tamu.edu. All manuscripts must be submitted electronically. The Thesis Office is located on the sixth floor of Sterling C. Evans Library, (979) 845-2225.

Graduation

Graduate degrees are conferred at the close of each regular semester and the 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of a fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. The Registrar attempts each semester to balance the size of each ceremony. A student should check the website of the Office of the Registrar at graduation.tamu.edu/ceremon.html to determine the date and time of his/her graduation

ceremony. **The electronic application for graduation can be accessed through the student's account via the Howdy portal.**

Letter of Intent

Every student completing a graduate degree who wishes to continue to enroll in pursuit of another graduate degree should do so by filing an approved letter of intent with the Office of Graduate Studies. A letter of intent which has been approved by the head of the department (or chair of the intercollegiate faculty) in which the student intends to study will be viewed by the Office of Graduate Studies as an admission to the program specified in the letter. A student must use the letter of intent form which is available on the website at ogs.tamu.edu.

If a break in enrollment occurs for one academic year or longer following graduation, then a student must apply for admission to another degree program through Graduate Admissions.

Graduate Degree Programs Offered by Distance Education

Texas A&M University currently offers the following programs by distance education:

- Doctor of Education (EdD) in Agricultural Education
- Doctor of Education (EdD) in Curriculum and Instruction
- Master of Agriculture (MAgr) two majors:
 - Agricultural Development
 - Poultry Science
- Master of Education (MEd) in Bilingual Education
- Master of Education (MEd) in Curriculum and Instruction
- Master of Education (MEd) in Educational Administration
- Master of Education (MEd) in Educational Psychology
- Master of Education (MEd) in Educational Technology
- Master of Education (MEd) in Special Education
- Master of Engineering (MEng) in Biological and Agricultural Engineering (Food Engineering Emphasis)
- Master of Engineering (MEng) in Industrial Engineering
- Master of Engineering (MEng) in Petroleum Engineering
- Master of Industrial Distribution (MID)
- Master of Natural Resource Development (MNRD)
- Master of Recreation and Resources Development (MRRD)
- Master of Science (MS) in Agricultural Systems Management
- Master of Science (MS) in Bilingual Education
- Master of Science (MS) in Educational Administration
- Master of Science (MS) in Educational Human Resource Development
- Master of Science (MS) in Educational Psychology
- Master of Science (MS) in Engineering Systems Management
- Master of Science (MS) in Health Education
- Master of Science (MS) in Mathematics
- Master of Science (MS) in Plant Breeding
- Master of Science (MS) in Safety Engineering
- Master of Science (MS) in Special Education

Master of Science (MS) in Sport Management
Master of Science (MS) in Statistics
Master of Wildlife Science (MWSC)

A limited number of graduate certificate programs are available by distance education. Please review Transcribed Graduate Certificate Programs on [page 39](#).

The delivery platform differs among these programs. Most are available 100% online, some are web-supported with interactive video and others require periodic campus visits. The delivery platform in most programs changes depending on the course/program content, needs of the students and their geographic locations. Students should carefully consider distance education and address any specific questions to the department offering the program of interest.

Only a student who is admitted to Texas A&M University may enroll in these distance education programs and the associated courses. A student wishing to enroll in any of the distance education programs must be admitted as a degree-seeking graduate student or as a post-baccalaureate non-degree seeking student. Please see admissions.tamu.edu for graduate admissions information.

A student may take up to 12 hours in non-degree-seeking post-baccalaureate status and apply these hours to a master's program with the approval of the student's advisory committee, the head of the department (or Chair of the Intercollegiate Faculty, if appropriate), and the Office of Graduate Studies if all admission requirements to the selected master's program are fulfilled. Courses offered for extension credit may not be used on the student's degree plan. Post-baccalaureate non-degree status does not establish eligibility for admission to degree-seeking status.

Texas A&M University provides students pursuing a graduate degree by distance a wide variety of student support services, including access to library resources, advising, technology support and course materials acquisition through the online bookstore. A complete listing of services, degree program descriptions, appropriate points of contact within each program, and costs are available through the distance education website at distance.tamu.edu. Additional distance education programs are in development. Interested students should check the website periodically for updates. Students should contact the department offering the program for any questions.

Detailed expectations for good practice in graduate education for graduate students and faculty members are discussed in a separate brochure entitled *Expectations for Graduate Students at Texas A&M University*. Copies of this brochure can be obtained in the student's department or the Office of Graduate Studies.

Teacher Certification

Programs leading to teacher certification are available through the College of Education and Human Development. Initial teaching certificates, enabling candidates to teach in the public schools of Texas, can be earned through extended programs which commence with undergraduate studies leading to the baccalaureate degree and which culminate with the completion of selected graduate courses. Graduate courses used to satisfy certification requirements in these extended programs may be used toward satisfying the requirements for the master's degree. A candidate seeking teacher certification through extended programs must be fully admitted to graduate study as a

degree seeking candidate. For more information on these programs, please review the appropriate material in the *Texas A&M University Undergraduate Catalog* or consult with advisors in the College of Education and Human Development. An individual who already holds a baccalaureate degree in a field other than education and who wishes to acquire an initial teaching certificate should contact the Teacher Certification Office in the College of Education and Human Development. Please see the program descriptions of these departments in this catalog.

Cooperative Graduate Programs

Texas A&M University has executed Memoranda of Agreement establishing cooperative graduate programs with the following universities: Baylor College of Medicine, Sam Houston State University, Stephen F. Austin State University, Tarleton State University, Texas A&M University-Kingsville, Texas State University, Texas Tech University and The University of Texas at Tyler. Details concerning the cooperative graduate programs are available from the graduate offices of the institutions involved.

Texas A&M University and The University of Texas System also have entered into an agreement relating to cooperative use of courses and facilities in graduate education. See section on “Texas A&M University, Baylor College of Medicine, The University of Texas System, Study Abroad” on [page 557](#) in the Course Description section of this catalog.

Pathways to the Doctorate

The Pathways to the Doctorate is a program dedicated to increasing the number, quality, and diversity of Master’s and doctoral graduates across all disciplines within The Texas A&M University System. Consisting of nine universities and the Health Science Center, the System spans the State of Texas. This enables the System to recruit top students from a variety of geographical, socio-economic, racial, ethnic, and cultural environments. The Pathways to the Doctorate is one approach to Closing the Gaps Program in Texas. The goal of the Pathways to the Doctorate Program is to attract high achieving students within The Texas A&M University System to pursue careers in higher education. This program will help produce some of the next generation of faculty.

Through a variety of activities such as seminars and workshops, inter-institutional exchange programs, a mentoring program and an annual research symposium with System-wide participation, the Pathways program aims to:

- create a pathway for talented students to pursue graduate education;
- foster opportunities for faculty, graduate students, and undergraduate students to collaborate and to foster innovative research and interpersonal communication skills;
- enlighten and encourage students and teachers (K-12 through college) to see that science and technology are essential to lead a life of discovery and fun;
- help meet faculty needs as postsecondary enrollment grows and current faculty retire.

Academic Common Market

The purpose of the **Academic Common Market (ACM)** is to share specified academic degree programs between states located at southern public colleges and universities. This is accomplished through an exchange of students across borders at in-state rates. The motivation for this cooperation continues to be: 1) eliminating unnecessary duplication among the states, in that it is impractical for any institution or single state to develop or maintain degree programs in every field of knowledge, 2) to support existing degree programs that have the capacity to serve additional students, and 3) to provide access and encourage movement across state lines for programs not available in a student's home state.

Texas A&M University is a member of the Academic Common Market/Electronic Campus (ACM/EC). The ACM/EC enables students to pursue eligible degree programs via distance or e-learning without leaving their home state, work and other commitments.

For more information on the Academic Common Market, contact the Office of Graduate Studies at 302 Jack K. Williams Administration Building or call (979) 845-3631.

Transcripted Graduate Certificate Programs

Graduate Certificate in Advanced International Affairs (Bush School of Government and Public Service)
 Certificate in Advertising
 Certificate in Africana Studies
 Certificate in Agriculture eLearning Development
 Applied Statistics Certificate Program
 Graduate Certificate in Business Management
 Certificate in Community Development
 Graduate Certificate in China Studies (Bush School of Government and Public Service)
 Computational Sciences Certificate Program
 Conservation Training Certificate
 Dietetic Internship Certificate
 Certificate in Digital Humanities
 Graduate Certificate in Education and Social Sciences Advanced Research Methods (ARM)
 Energy Sustainability Engineering Certificate Program
 Certificate in Entrepreneurship
 Certificate in Environmental Hazard Management
 Certificate in Facility Management
 Graduate Certificate in Film and Media Studies
 Graduate Certificate in Food Safety
 Graduate Certificate in Geographic Information Systems (GIS)
 Certificate in Health Systems and Design
 Certificate in Hispanic Bilingual Education
 Certificate in Historic Preservation
 Graduate Certificate in Homeland Security (Bush School of Government and Public Service)
 The Professional Certificate in Human Resource Management

The Graduate Certificate in International Agriculture and Resource Management (IARM)
International Graduate Certificate Program (College of Education and Human Development)
Certificate in International Business (Mays MBA Students Only)
Graduate Certificate in International Business (Mays MS Students Only)
Certificate in International Petroleum Management
Certificate in Leadership Education, Theory, and Practice
Graduate Certificate in Meat Science
Certificate in Military Land Sustainability
Graduate Certificate in National Security Affairs (Bush School of Government and Public Service)
Graduate Certificate in Nonprofit Management (Bush School of Government and Public Service)
Ocean Observing Systems Certificate Program
Certificate in Petroleum Geoscience
Certificate in Prevention Science
Graduate Certificate in Remote Sensing (RS)
Certificate in Retailing
The Safety Engineering Certificate – Graduate Program
Certificate in Sales
Certificate in Space Life Sciences
Certificate in Supply Chain Management (Mays MBA and MS Students Only)
Certificate in Sustainable Urbanism
Certificate in Transportation Planning
Certificate Program in Tree Improvement
Certificate in Women's and Gender Studies

A graduate certification program represents an emphasis area within a particular field or it could be interdisciplinary and involve several fields. Other certificate programs may exist in the various colleges or schools. Inquiries should be addressed to these colleges.

Certificate in Advanced International Affairs packages critical graduate education experiences in a novel way. It involves a multidisciplinary series of graduate courses for people whose careers or personal interest cause them to seek a more complete understanding of world affairs, but who may not have the time or disposition for a longer, residential graduate degree. A student admitted to the certificate program completes 12 credit hours of study typically involving four graduate-level courses available in residence and/or online. Some residential courses may not be available because of enrollment ceilings. The set of courses from which a student selects include intelligence, national security, diplomatic history, international business and government, geography and world systems, international law, and certain skill courses.

An applicant, once admitted, can enter the certificate program at any time and must have a bachelor's degree and meet certain other qualifications. Inquiries may be addressed to the Bush School.

An individual who successfully completes the certificate program will be awarded a certificate by the Bush School. Grades for courses taken as part of this program will

appear on the official transcript, together with notation that the certificate has been achieved.

For more information, visit bush.tamu.edu or call (979) 862-7810.

Certificate in Advertising. The Certificate in Advertising is designed to complement a student's degree and to provide tangible evidence of rigorous academic and experiential preparation for a career in advertising, media, public relations, or a related field. It is open to MS-Marketing graduate students and requires 12 hours of coursework and an internship. For more information, please visit mays.tamu.edu/mktg/advising/careers/tracks/.

Certificate in Africana Studies. This interdisciplinary certificate is offered by the Program in Africana Studies in the College of Liberal Arts. It offers interested masters or doctoral students an opportunity to develop an interdisciplinary graduate concentration in Africana Studies, while at the same time earning a degree in a disciplinary major field. In addition to gaining knowledge of peoples and of issues with particular significance to the Africana world, students pursuing this certificate will also benefit from the interdisciplinary training that is the hallmark of Africana Studies. They will be exposed to the scholarship, methods, and theories of the multiple disciplines that contribute to the critical analysis and understanding of the Africana world. Awarding of the Africana Studies Certificate requires that the certificate candidate complete 12 hours of Africana Studies approved coursework and receive a grade of at least a B in each course completed. Those 12 hours should include: 3 hours of humanities credits, 3 hours of social science credits, 3 hours of approved free elective credits, and AFST 601, which is required for all students pursuing the graduate certificate. More detailed information on the Africana Studies program is available at africana.tamu.edu.

Certificate in Agriculture eLearning Development. The Agriculture eLearning Development Certificate is an innovative program offered by the Department of Agricultural Leadership, Education, and Communications. This program prepares students across the College of Agriculture and Life Sciences with the unique knowledge and skills required to develop sophisticated eLearning courses and training programs for their Ag disciplines. Students will gain a substantive foundation of learning theory, adult education, instructional design, and computer programming from an eLearning perspective. This emphasis area consists of 14 semester hours. Inquiries should be addressed to the Department of Agricultural Leadership, Education, and Communications. The URL about this program can be found at cbi.tamu.edu/el.

Applied Statistics Certificate Program is offered through the Department of Statistics. This certificate is designed to meet the needs of students and the workforce. The student can choose from various areas of emphasis including, but not limited to, biostatistics, business analytics, statistical computations, and AP teacher training. To complete the certificate program the student must 1) be admitted to the university and 2) successfully complete at least 12 semester credit hours from the list of graduate courses. The specific courses will be chosen by the student, in consultation with the associate department head or the director of Online Learning, so as to best meet the student's career goals.

Graduate Certificate in Business Management prerequisites include successful completion of terms 1, 2, 3 and 4 of the Mays MBA Program. Requirements include completion of at least 4 graduate level courses (12 credit hours) offered by Mays Business School. These courses may NOT include ACCT 640, FINC 635, MKTG 621 and MKTG 675 or MGMT 655 and MGMT 680 as these are duplications of the core MBA courses. All courses taken towards the certificate must be taken for a grade. Courses taken S/U will not count toward the certificate. The student must maintain a minimum GPA of 3.0 in the courses for the certificate.

Prior to registering for the certificate courses the MBA student must inform the Mays MBA program office of their intentions to take the certificate and present the proposed courses for approval by the office.

Certificate in Community Development. The Department of Recreation, Park and Tourism Sciences offers this transcribed certificate through its Program in Rural Sociology and Community Studies. This twelve-hour certificate program provides a student with an understanding of the principles and processes of community development. It addresses issues of decision making and leadership, human organization and communication, institutional capacity and enhancement, and resource mobilization and management. It also gives attention to special populations in development processes and outcomes. The program is available to students pursuing any graduate degree at Texas A&M University and who meet enrollment criteria. For more information contact the Graduate Coordinator in the Department of Recreation, Park and Tourism Sciences or the Leader of the Program in Rural Sociology and Community Studies.

Graduate Certificate in China Studies. The Certificate in China Studies is a collaborative effort of the George Bush School of Government and Public Service, the College of Liberal Arts, and the Institute for Pacific Asia (Confucius Institute). The certificate program is open to students from any graduate degree program at Texas A&M University. It provides students a menu of courses offered by various departments and colleges that in aggregate create a more robust curriculum of courses on China than is currently available in any single department. A student admitted to the certificate program completes 12 credit hours of study typically involving four graduate level courses available in residence. The set of courses from which a student selects includes economic development, foreign policy, history, population and society, strategic thought, and geography. Designed as an interdisciplinary learning experience, no more than two courses from any one department will count toward the certificate. Inquiries may be addressed to the Bush School. The certificate program is supervised by the Bush School and College of Liberal Arts. Grades for courses taken as part of this program will appear on the official transcript, together with notation that the certificate has been achieved.

For more information, visit bush.tamu.edu or call (979) 458-2276.

Computational Sciences Certificate Program was developed to meet the increased need for computational techniques to help solve complex science and engineering programs. This program is targeted to science and engineering students enrolled in graduate studies. The goal of this certificate program is to provide formal documentation upon a student's transcript that they have taken additional courses focused on the computational aspects that supplement a given degree in science and engineering. To

fulfill the certification requirements, a student must complete four courses, as described by the program outline, and a capstone project in their home department.

This certification will provide a graduate student with a broad-based multidisciplinary enhancement to his/her degree program as well as prepare him/her with the intellectual infrastructure to be a new leader in computational science, engineering, and technology. By joining this certification program, a graduate will receive an official certified transcript that will add value and marketability to his/her advanced degree. For more information, visit isc.tamu.edu/research-education/CSCP/ or send an email message to cspc@isc.tamu.edu.

Conservation Training Certificate Program provides a student with a thorough knowledge of the latest artifact conservation methods and their application. Artifacts recovered from underwater sites are unstable when recovered and immediate conservation is necessary to ensure that the artifact does not deteriorate once out of the water. The certificate consists of formal courses in artifact conservation and practical application of that knowledge. Traditional approaches to artifact conservation are covered in detail as well as methods recently developed. The certificate requires students to take three courses (ANTH 605, ANTH 606 and ANTH 617) and a one credit hour Directed Studies course (ANTH 685) which involves the application of conservation methods under the supervision of trained conservators at the Conservation Research Laboratory. The certificate is available to degree seeking and non-degree seeking graduate students.

Dietetic Internship Certificate. The combined graduate degree – Dietetic Internship is accredited with the Commission on Accreditation for Dietetics Education (CADE). The program integrates knowledge gained in coursework and laboratories with intensive training in professional settings. A student gains experience in community nutrition/outpatient, business/foodservice management, and clinical dietetics. Major affiliating institutions include Scott and White Memorial Hospital and Clinic and The Central Texas Veterans Health Care System. Upon completion of the program, a student is eligible to take the registration examination to become a Registered Dietitian.

Certificate in Digital Humanities. This transcribed certificate offers masters or doctoral students that intend to practice in an academic environment, museum, or other cultural institution the opportunity to acquire practical knowledge of digital tools and methodologies and to become competent in conducting digital practice activities. The Digital Humanities Certificate provides a basic introduction to the development and application of information technology in the context of research and practice in the humanities. The certificate provides students with the skills, applied and theoretical, that are necessary to apply computational techniques to complex research problems as well as practical tasks in the humanities. The certificate program is open to students from any graduate degree program at Texas A&M University and the plan of study comprises 12 hours of coursework, including 3 hours of independent study. At least one course must be outside the student's home department. For more information, see dh.tamu.edu/certificate.

Graduate Certificate in Education and Social Sciences Advanced Research Methods (ARM). Offered by the College of Education and Human Development (CEHD), a Graduate Certificate in Education and Social Sciences Advanced Research

Methods allows students in the College of Education and Human Development to add to their degree's minimum requirements for training in research methodology. The Certificate testifies to a student's successful mastery of advanced competencies in education and social sciences research methods, with emphasis on quantitative or qualitative approaches. The Certificate requires 12 hours of advanced research methods courses, identified as such by the CEHD's Research Certificate Committee. Enrollment in these advanced courses will require the completion of established prerequisites (designated in the Graduate Catalog) and/or the approval of the course instructor and the student's dissertation committee chair/faculty advisory. As part of the certificate completion requirements, students will provide evidence of submission of a manuscript for publication as the main author, or as a co-author. As a first step in applying for the Certificate, graduate students should contact their dissertation or program Chair(s).

Energy Sustainability Engineering Certificate. The graduate level Energy Sustainability Engineering Certificate is offered through the Department of Petroleum Engineering. It is designed to provide an education for college graduates in how to apply three essential criteria—environmentally benign, economically competitive, and socially acceptable—to engineer the sustainability of energy resources and their use. The certificate requires taking 3 courses to be selected from the prescribed electives list, plus one other course addressing a specific energy topic to be approved on a case-by-case basis. The 5 prescribed elective courses provide an overview of energy and sustainability, sustainability metrics, sustainability engineering design, energy economics and policy, and innovation. The certificate is intended for graduate students and working professionals with a wide range of career interests and is not limited to engineering graduates. Courses emphasize team project experiences and are available to distance learning students.

Certificate in Entrepreneurship. A certificate in entrepreneurship and technology commercialization provides a base understanding of new business planning; key issues encountered when developing commercial applications for new technical discoveries; the general legal aspects of intellectual property protection; fundamental business start-up and securities laws; and the management of creativity and innovation in organizational settings. To complete the certificate program, you need to complete 12 hours of coursework chosen from the following: MGMT 632, MGMT 637, MGMT 638, MGMT 640, MGMT 675 and FINC 644. This certificate is open to any graduate student at Texas A&M University.

Certificate in Environmental Hazard Management. This cross-disciplinary program is housed in the College of Architecture and is designed to provide a student with an understanding of the interrelationship between the built environment and extreme events in the natural environment. The program consists of a series of courses that are open to students from any graduate degree program at Texas A&M University.

Certificate in Facility Management. This certificate program, while housed in the College of Architecture, provides a student in any graduate degree program at Texas A&M University an opportunity to develop a body of knowledge in facility management that will further his/her career goals. The certificate assumes that facility management is a cross-disciplinary field. The program is designed to ensure that a student gains a sense

of mutual respect for others in the field, and appropriate awareness, understanding, and ability within a specific body of knowledge.

Graduate Certificate in Film and Media Studies. Administered by the Film Studies Program, the Graduate Certificate in Film and Media Studies offers masters and doctoral students an interdisciplinary concentration in the study of film and other visual- and sound-based media that will enhance students' major field of study. By combining Film courses in such diverse areas as Communication, English, History, European and Classical Languages, Hispanic Studies, Performance Studies, Philosophy and Visualization, students can create a program of study that will enrich their understandings of the global and interdisciplinary dimensions of the media culture environment. The graduate certificate is open to any Texas A&M University student seeking a masters or doctoral degree; it consists of 12 hours of coursework (approved by the director of the Film Studies Program), including 3 required hours of COMM 662 or its equivalent. For more information about the Graduate Certificate in Film and Media Studies, please visit the Film Studies Program webpage, film.tamu.edu.

Graduate Certificate in Food Safety. The Department of Animal Science at Texas A&M University offers a Graduate Certificate in Food Safety. The certificate is designed for graduate students interested in food microbiology, HACCP, sanitation, regulatory affairs, and quality control or assurance. The Graduate Certificate in Food Safety requires 12-credit hours from any of the following courses:

- ANSC 657/FSTC 657, Hazard Analysis and Critical Control Point (HACCP) System
- DASC 606 /FSTC 606, Microbiology of Foods
- ANSC 637, Food Safety: Policy, Regulations, and Issues
- ANSC 697/FSTC 697, Applied Microbiology for Foods of Animal Origin: Processing, Sanitation, and Sanitary Design
- VIBS 615, Food Hygiene
- VIBS 618, Food Toxicology

This program is available to graduate students pursuing any graduate degree at Texas A&M University. Upon completion, students will be prepared to meet the demands of careers in the area of food safety, and formal documentation of completing this program will be placed on the student's transcript. Please contact Kerri B. Harris at kharris@tamu.edu or (979) 862-3643 for more information.

Graduate Certificate in Geographic Information Systems (GIS) is a joint program administered by the Departments of Ecosystem Science and Management and Geography. GIS technologies are applied to wide-ranging fields with interests in spatially distributed information such as transportation, environmental/resource management, marketing, facility management, healthcare delivery, homeland security, agriculture, and urban planning, among others.

This certificate program has been designed to meet the growing demand for qualified individuals in the field. The certificate requires four courses (12 hours), including an introductory, two advanced, and one elective course. For more detailed information please contact a graduate advisor in the Department of Ecosystem Science and Management or Geography, or visit the program website at ssl.tamu.edu/education/graduate-certificate-program/.

Certificate in Health Systems and Design. This interdisciplinary certification program was created by the colleges of Architecture and Medicine to promote research, innovation, and communication focusing on health facility planning and design. The program is available to students pursuing any graduate degree at Texas A&M University. Though the program emphasizes a cross-disciplinary perspective, it also ensures that a student develops in-depth understanding and ability within the field of health systems design.

Certification in Hispanic Bilingual Education. The Department of Educational Psychology at Texas A&M University offers a Certification Program in Hispanic Bilingual Certification. This certification can be transcribed and meets the requirements of the Texas State Board of Educator Certification (SBEC). This certification is appropriate for Hispanic Bilingual classroom teachers. It requires the following coursework: Hispanic Bilingual Assessment and Monitoring; Dual Language Programs Methodologies; Content Area Instruction for Hispanic Bilingual Programs; Biliteracy for Hispanic Bilingual Students; and Bilingual and Dual Language Classroom for Hispanic Students.

Certificate in Historic Preservation. Based in the College of Architecture, the Certificate in Historic Preservation is open to students in a graduate degree program at Texas A&M University. This cross-disciplinary program draws on strong discipline-based academic programs that prepare graduates to further their career goals. The certificate assumes that historic preservation is a cross-disciplinary field, and the program is designed to ensure that students gain a sense of mutual respect for others in the field, and appropriate awareness, understanding, and ability within a specific body of knowledge.

Graduate Certificate in Homeland Security consists of 15 credit hours of web-based, distance education instruction surveying the dimensions of homeland security and defense, from the traditional concepts of public safety to the emerging concepts of public security. The program is designed for individuals seeking careers with management or policy responsibilities at various levels of government, business or the military. After a required gateway seminar, students select from a menu of electives dealing with such topics as protection of critical infrastructure, recovering from WMD, terrorism, inter-government coordination, and business strategies for protection and recovery. The certificate is available only online—it is not offered in residence. Applicants must have an accredited bachelor's degree and meet other entry qualifications to be admitted to graduate study at Texas A&M University specifically for this certificate. Students who are currently enrolled in a graduate degree program at Texas A&M University may take individual courses. However, they must formally enroll in the certificate program, and meet certificate completion requirements to gain the certificate. Grades for courses taken as part of this program will appear on the student's official Texas A&M University transcript. For more information, visit bush.tamu.edu or call (979) 862-7810.

The **Professional Certificate in Human Resource Management** is an innovative program offered by the Department of Management. The program prepares students with the unique knowledge and skills required to apply human resource management theories at any level in businesses or not-for-profit organizations. The certificate program consists of 14 semester hours of coursework. Grades for courses taken as part of this program

will appear on the official transcript, together with a notation that the certificate has been achieved. Admission to the program is by permission of the Department of Management only. Inquiries should be addressed to the Department of Management, (979) 845-4861.

The **Graduate Certificate in International Agriculture and Resource Management (IARM)** is available to persons majoring in one of the 17 graduate programs in the College of Agriculture and Life Sciences. This emphasis area consists of 13 semester hours. For more information and to coordinate content of and participation in the certificate program with the content of their own degree programs, graduate students in the College of Agriculture and Life Sciences should contact the departmental advisor or the IARM certificate coordinator in their department. Additionally, students should register their intent to complete the requirements for the IARM graduate certificate with The Borlaug Institute for International Agriculture.

International Graduate Certificate Program (College of Education and Human Development). The College of Education and Human Development International Education and Graduate Certificate Program consist of coursework and field experiences that will give graduate students an international perspective on educational issues. The certificate program will give students an interdisciplinary basis from which to interpret and analyze global socioeconomic and cultural influences that shape educational systems. To meet the needs of an increasingly demographically-diverse society, U.S. educators and administrators must increase their knowledge about the various cultures that are part of our country. In addition, educators and administrators who work and live abroad need exposure to international theories and experiences in order to prepare them for leadership positions abroad.

Certificate in International Business (Mays MBA Students Only). The increasing globalization of contemporary business environment finds companies under pressure to change and adapt to new technologies and markets. Companies need MBA students that are sensitive to diverse cultures and understand global developments and ethics.

The Graduate Certificate in International Business provides you with the knowledge base and international exposure needed to meet the global business challenges faced by organizations today.

The Certificate in International Business will be awarded to Mays MBA students that meet the following academic requirements:

1. Successfully complete the “International Business” course offered in Term 4 of your MBA program.
2. Participate in a semester-long (summer, fall or spring) overseas study program identified by Mays Business School and take at least four courses (12 credit hours) of international business courses.

Mays MBA students have several options available to fulfill requirements for the overseas study and international business course requirements.

Graduate Certificate in International Business (Mays MS Students Only) is an innovative program, interdisciplinary and international in its orientation, offered by the Mays Business School. All graduate business students seeking a Master of Science degree

are eligible to pursue the Certificate program, which requires a minimum of 12 semester credit hours of international business coursework abroad during a semester of overseas study (for U.S. students) that can be accommodated within the regular graduate business program. As a prerequisite, MS students must take IBUS 678 or IBUS 679 prior to their study abroad. For more information and to coordinate content of and participation in the certificate program, graduate business students should contact the departmental advisor of the MS program.

Certificate in International Petroleum Management. As part of this graduate program in the Department of Petroleum Engineering, the Mays Business School will award the degree candidate a Certificate in International Petroleum Management. To qualify for this certificate the student must complete at least 18 semester hours of coursework in the Mays Business School. A required course sequence list can be found at www.pe.tamu.edu/academics/IPM_req.doc. Any variation in the course sequence must be approved by the IPM Program Coordinator in the Mays Business School and the Graduate Advisor in the Petroleum Engineering Department.

Certificate in Leadership Education, Theory, and Practice is an innovative program offered by the Department of Agricultural Leadership, Education, and Communications. This program prepares students with the unique knowledge and skills required to apply leadership theory and put into practice these theories at any level in an organization. Students will gain a substantive foundation of leadership theory, with the instructional focus on leadership situations and how to apply leadership theories to all professional organizations, including professional and civic. This emphasis area consists of 14 semester hours. Inquiries should be addressed to the Department of Agricultural Leadership, Education and Communications.

Graduate Certificate in Meat Science. The Department of Animal Science at Texas A&M University offers a Graduate Certificate in Meat Science for students who complete this four-course, 12-hour program:

ANSC 607, Physiology and Biochemistry of Muscle as a Food

ANSC 627, Carcass Composition and Quality

ANSC 647, Technology of Meat Processing and Distribution

ANSC 667, Industrial Processed Meat Operations

This program is available to graduate students pursuing any graduate degree at Texas A&M University. Upon completion, students will have a broad-based and in-depth overview of meat science and technology, and formal documentation of completing this program will be placed on the student's transcript.

Please contact Jeff Savell at j-savell@tamu.edu or (979) 845-3992 for more information.

The **Certificate in Military Land Sustainability** is a web-based program that provides students with an understanding of factors that influence natural resource conservation and management of military lands. The program is comprised of coursework in three integrated, multidisciplinary thematic areas of emphasis: land management, policy analysis and development, and cultural competencies and conflict management. The Certificate in Military Land Sustainability can complement existing professional

graduate degrees offered in the Departments of Ecosystem Sciences and Management (ESSM) and Wildlife and Fisheries Sciences (WFSC).

Certificate in National Security Affairs is a 12 credit hour graduate certificate offered by the Bush School of Government and Public Service. It is intended to provide a comprehensive overview of the formation and operation of the United States national security policy for individuals with specific background and experience. Individuals may apply who hold a terminal or graduate degree from an accredited university and three years employment (or a bachelor's degree and five years employment) in a firm, laboratory, agency or non-governmental organization in which the individual's responsibilities involve the development or provision of systems, services or products for use in national or international security. Applicants must meet these requirements and those for admission for graduate study at Texas A&M University as a non-degree seeking students (G-6). Proficiency in reading, writing and comprehending spoken English at a level necessary for graduate instruction is required.

Graduate-level courses for the certificate include a mix of required courses and electives selected from a structured menu. Among those courses included are those dealing with deterrence, intelligence, terrorism, and national security policy. Typically, this certificate requires residency in the first term of the summer semester followed by courses taken via distance education to complete the program. An individual who successfully completes the program will be awarded the certificate by the Bush School. Grades for courses taken as part of this program will appear on the official university transcript, together with notation that the certificate has been achieved. Inquiries may be addressed to the Bush School. For more information, visit bush.tamu.edu or call (979) 458-2276.

Graduate Certificate in Nonprofit Management (Bush School of Government and Public Service). Students who complete the certificate will gain an understanding of the nonprofit sector, nonprofit organizational structures (i.e., legal frameworks and governance issues) and management practices appropriate to the sector (i.e., strategy, volunteer behavior, and fund raising). With this preparation, students will be able to offer effective leadership in the management of nonprofit organizations. The certificate requires students to complete 12 credit hours of graduate level coursework. This includes two required courses: Foundations of the Nonprofit Sector and Management and Leadership of Nonprofit Organizations. Students can select from a variety of electives, such as fund raising and program evaluation, to satisfy the remaining six hours of required coursework. An applicant, once admitted, can enter the certificate program at any time and must have a bachelor's degree and meet certain other qualifications. Inquiries may be addressed to the Bush School. Individuals who successfully complete the program will be awarded a certificate and it will appear on their university transcript. For more information, visit bush.tamu.edu or call (979) 862-7810.

Ocean Observing Systems Certificate Program is offered through the Department of Oceanography. Ocean Observing is an important new direction in oceanographic research that requires specially trained individuals in ocean data collection, data management, and production and distribution of needed products and services. The program provides training for *in situ* ocean observations, remote sensing technologies, data analysis and display, including geographic information systems (GIS), analytical

techniques and modeling. The certificate targets non-thesis graduate students who would like to add an Ocean Observing credential to their portfolio as a means of enhancing their professional prospects.

The certificate program requires a minimum of 24 hours of study from a selected curriculum and enrollment in a graduate program. For detailed information, please contact a graduate advisor in the Department of Oceanography.

Certificate in Petroleum Geoscience. The Graduate Certificate in Petroleum Geoscience is an interdisciplinary program in the Department of Geology and Geophysics designed to enhance both critical thinking and the technical skills that serve as the scientific foundation for practicing petroleum geoscience. The program requires a minimum of 18 semester credit hours from Geology and Geophysics and optionally Petroleum Engineering as part of a regular graduate program. In addition, workshops, lectures and field trips enable students to learn about pressing scientific problems in petroleum exploration and production. Students are required to take a core of courses including reflection seismology and seismic interpretation, sequence stratigraphy and basin analysis, 3-D structure, rock properties and one seminar per year are required. In addition, students must choose at least one course from an approved list of supporting courses in both the Department of Geology and Geophysics and Petroleum Engineering. The Certificate is conferred upon successful completion of a MS or PhD degree program in Geology or Geophysics including the required courses. For detailed information please contact the graduate advisor, Department of Geology and Geophysics or send an e-mail to petroboss@geoweb.tamu.edu.

Certificate in Prevention Science. The certificate is to provide students from a variety of majors an interdisciplinary perspective on the science and practice related to the prevention of mental, emotional, and physical health problems and the promotion of well-being in these same domains.

Graduate Certificate in Remote Sensing (RS) is a joint program administered by the Departments of Ecosystem Science and Management and Geography. Remote Sensing (RS) technologies are applied to wide-ranging fields such as environmental/resource management, marketing, facility management, agriculture, urban planning, homeland security and intelligence, among others. In addition, the synergistic linkages between RS technologies and Geographic Information Systems (GIS) are rapidly increasing.

This certificate program has been designed to meet the growing demand for qualified individuals in this field. The certificate requires four courses (12 hours), including an introductory, two advanced, and one elective course. For more detailed information please contact a graduate advisor in the Department of Ecosystem Science and Management or Geography, or visit the program website at ssl.tamu.edu/education/graduate-certificate-program/.

Certificate in Retailing. The Certificate in Retailing is designed to complement a student's degree and to provide tangible evidence of rigorous academic and experiential preparation for a career in retailing. It is open to MS-Marketing graduate students and requires 12 hours of coursework and an internship. For more information, please visit mays.tamu.edu/mktg/advising/careers/tracks/.

The **Safety Engineering Certificate – Graduate Program** requirements are achievable and relevant to all engineering disciplines. Graduate students in any engineering discipline can choose this option as part of their curriculum. Through this option, students are exposed to principles and case histories from a wide variety of engineering disciplines. The curriculum emphasizes the interdisciplinary nature of safety, health, and environmental engineering. It also emphasizes the knowledge and skills most likely to be needed by any engineer, as well as those who specialize in Safety Engineering.

The proposed Safety Engineering Certificate – Graduate Program, which will be administered by the Mary Kay O'Connor Process Safety Center, seeks to serve all engineering disciplines equally well. The certificate requires 12 hours of coursework. It is the intent that these hours are applicable to the hours necessary for graduation and not an additional load, but this will depend on the disciplines' specific course requirements. Receiving the certificate is not dependent on conferral of a degree. Of the total hours required for the Certificate, six hours are dedicated to Basic Topics and are required for everyone in the program. An additional six hours address more specific or advanced topics. The advanced topics are cross-listed with numerous departments.

Certificate in Sales. The Certificate in Sales is designed to complement a student's degree and to provide tangible evidence of rigorous academic and experiential preparation for a career in sales. It is open to MS-Marketing graduate students and requires 12 hours of coursework and an internship. For more information, please visit mays.tamu.edu/mktg/advising/careers/tracks/.

Certificate in Space Life Sciences. This cross-disciplinary certificate program is housed in the College of Agriculture and Life Sciences. It is designed to provide students pursuing a Ph.D. in Genetics, Kinesiology, Nuclear Engineering or Nutrition and those pursuing a Ph.D. or Ph.D./M.D. in Medical Sciences an understanding of critical areas of space life sciences and the countermeasures to these problems. Students gain a respect for the interdisciplinary nature of space life sciences research through participation in GENE, KINE, NUEN and NUTR courses, a space life sciences seminar course, a research program focusing on issues of space life sciences, and experiences at NASA/JSC, Brookhaven National Laboratory and the NASA bed-rest facility.

Certificate in Supply Chain Management (Mays MBA and MS Students Only). Supply Chain Management (SCM) is, by its very nature, multidisciplinary. It draws heavily upon an expertise in operations management, business logistics, physical distribution, purchasing, channel management, information technology, and decision sciences. The Certificate in SCM leverages Mays faculty expertise in these areas to create an innovative and state-of-the-art program.

Such a focus parallels recent trends in industry, and provides significant differentiation and competitive advantages for Mays MBA and MS students. The certificate requirement is completion of four graduate level courses (12 hours) in supply chain management, including the introductory supply chain management course.

Certificate in Sustainable Urbanism. Sustainable Urbanism is an interdisciplinary program based in the Center for Housing and Urban Development (CHUD) in the

College of Architecture. The certificate has been designed to provide students with an understanding of the interrelationship between the sustainability, cities, and the environmental design professions. The Sustainable Urbanism Program consists of a series of courses that are open to students from any graduate degree program at Texas A&M University.

Certificate in Transportation Planning. The certificate in Transportation Planning program provides students with a substantive base of knowledge needed to be broadly successful in the transportation profession, as well as with specialized instruction tailored to building student skills and capabilities in three critical areas: Transportation Systems Planning, Transportation and Urban Design, and Transportation Policy. Students enrolled in the certificate program will further take a comprehensive capstone course. The Certificate is one of the few educational programs that address the field of transportation in a truly comprehensive, interdisciplinary manner. It is a partnership among the Department of Landscape Architecture and Urban Planning (LAUP) in the College of Architecture, the Texas Transportation Institute (TTI), the Department of Civil Engineering, and the Bush School of Government and Public Service. The Certificate is housed in the Hazard Reduction and Recovery Center in the College of Architecture. This program will be open to any graduate student at Texas A&M University with an interest in transportation. Certificate Coordinator: Dr. Eric Dumbaugh.

Certificate Program in Tree Improvement is offered through the Department of Ecosystem Science and Management and targets practicing tree improvement professionals who want to make a more significant contribution to the scientific management of tree breeding programs. It is also available to graduate students enrolled in a degree program. The certificate is structured around four courses and a field practicum and consists of 13 semester hours. The courses will emphasize applied tree improvement techniques, the principles of forest genetics, tree structure and physiology, and developments in biotechnology applied to tree improvement. These four courses are offered with a web-based distance-learning format and have a short field practicum as a capstone. The certificate is designed to be completed in two years. For detailed information please contact a graduate advisor in the Department of Ecosystem Science and Management.

Certificate in Women's and Gender Studies. This transcribed certificate offers the master's or doctoral student the benefits of gaining an interdisciplinary concentration in gender, while at the same time earning a degree in a disciplinary major field. The Women's and Gender Studies Certificate aims to enhance critical thinking and methodological skills while facilitating analysis of gender's role in culture, society and the arts and encouraging the development of innovative research that combines recent scholarship in gender studies with the student's major area of study. The certificate program is open to students from any graduate degree program at Texas A&M University and consists of 12 hours of coursework approved for this purpose by the Director of Women's and Gender Studies, including at least 3 hours of humanities and 3 hours of social science credits. For more detailed information, please consult wgst.tamu.edu.

Professional Internships

In those programs in which a professional internship is used (see individual programs), a student will spend an appropriate period of time under the supervision of a practicing professional in industry, business, an educational institution or a government agency. The objectives of the internship are two-fold: (1) to enable the student to demonstrate the ability to apply technical training and knowledge by making an identifiable contribution in an area of practical concern to the industry or organization in which the internship is served, and (2) to enable the student to function in a non-academic environment in a position in which he or she will become aware of the organizational approach to problems in addition to those traditional approaches with which the student is familiar. These may include, but are in no way limited to, problems of management, labor relations, public relations, environmental protection, economics, etc.

Internship agreements should be negotiated between the appropriate organization or industry and the appropriate academic department. The organization of the internship, the internship supervisor and the nature of the internship will be determined by mutual consent of the student, the head of the student's major department, the student's advisory committee and the supervising organization prior to the commencement of the internship period. The internship experience should be at a level commensurate with the particular degree objective.

An internship report should be prepared by the student in accordance with guidelines established by the student's major department, the student's advisory committee or other appropriate body. The report should be submitted to the advisory committee and to any other organization which may be specified for specific programs. The internship report must be the original work of the student.

An internship, if utilized as part of a student's degree requirements, should be undertaken near the end of the student's educational program, after the student has had the opportunity to establish a solid theoretical base for the internship experience.

The Graduate Teaching Academy

The Graduate Teaching Academy (GTA) provides professional development of graduate students in preparation for a career in higher education. We offer a two-semester program anchored by faculty mentorship and featuring weekly seminars and workshops. GTA events are free and open to everyone in the Texas A&M University academic community. Participants may choose to attend a few events or to complete requirements for the Graduate Teaching Academy Fellow certificate. New fellows are recognized at our awards ceremony in April.

While the GTA serves as a supplement to research-oriented programs by assisting graduate students with the teaching component of their career preparation, it is not teaching assistant training per se. Instead, the GTA provides broader benefits applicable to all graduate students, whether currently teaching or preparing for teaching in the future. These benefits include:

- Opportunity to learn from a diverse pool of professors known for excellence in teaching.
- Mentorship in the area of teaching in higher education environments.
- Exploration of career paths.
- Development of teaching portfolio materials for use in academic job searches.

- Opportunity to earn a certificate of completion with designation as a GTA Fellow
- Advanced professional development opportunities for GTA Fellows, including: opportunity to earn the Senior Fellow Certificate, leadership opportunities, reserach projects, and participate in forums or learning communities on college teaching.

Interested graduate students are encouraged to begin their GTA experience in the fall semester. The Graduate Teaching Academy is sponsored by the Office of Graduate Studies and the Center for Teaching Excellence. For more information, please visit our website gta.tamu.edu, or find us on Facebook.

Undergraduate and Graduate Degree Programs

Approved by the Texas Higher Education Coordinating Board

Interdisciplinary Degree Programs	Baccalaureate	Masters	Doctorate
Agribusiness	BS	MAB	
Biotechnology		MBIOT	
Engineering Systems Management ¹		MS	
Environmental Studies	BS		
Genetics ²		MS	PhD
Marine Biology ³		MS	PhD
Materials Science and Engineering		MS, MEng	PhD
Molecular and Environmental Plant Sciences		MS	PhD
Neuroscience ⁴		MS	PhD
Spatial Sciences	BS		
Toxicology		MS	PhD
University Studies	BA, BS		
Water Management and Hydrological Science		MS, MWM	PhD
College of Agriculture and Life Sciences			
Interdepartmental Degree Programs			
Renewable Natural Resources	BS		
Department of Agricultural Economics			
Agribusiness and Managerial Economics			PhD
Agricultural Economics	BS	MS, MAgr	PhD
Department of Agricultural Leadership, Education, and Communications			
Agricultural Communications and Journalism	BS		
Agricultural Development		MAgr	
Agricultural Education			EdD ⁵
Agricultural Leadership and Development ⁶	BS		
Agricultural Leadership, Education and Communication ⁶		MS, MEd	PhD
Agricultural Science ⁶	BS		
Department of Animal Science			
Animal Breeding		MS	PhD
Animal Science	BS	MS, MAgr	PhD
Production/Industry	X		
Science	X		
Physiology of Reproduction		MS	PhD
Department of Biochemistry and Biophysics			
Biochemistry	BS	MS	PhD
Genetics	BS		

1 Jointly administered by the Dwight Look College of Engineering and the Mays Business School.

2 Administered by the Colleges of Agriculture and Life Sciences, Medicine, Science and Veterinary Medicine and Biomedical Sciences.

3 Joint program with Texas A&M University, Texas A&M University at Galveston and Texas A&M University–Corpus Christi.

4 Joint program with Texas A&M University and Texas A&M University Health Science Center

5 Also offered as joint program with Texas Tech University when offered by Distance Education.

6 Joint Program with College of Education and Human Development. Degrees conferred in College of Agriculture and Life Sciences.

X Indicates option in major shown above.

College of Agriculture and Life Sciences	Baccalaureate	Masters	Doctorate
Department of Biological and Agricultural Engineering			
Agricultural Systems Management	BS	MS, MAgr	
Biological and Agricultural Engineering	BS	MS, MEng	PhD
Department of Ecosystem Science and Management			
Ecological Restoration	BS		
Forestry	BS		
Natural Resources Development		MNRD	
Rangeland Ecology and Management	BS	MS, MAgr	PhD
Ranch Management	X		
Rangeland Resources	X		
Spatial Sciences	BS		
Department of Entomology			
Entomology	BS	MS	PhD
Forensic and Investigative Sciences	BS		
Department of Horticultural Sciences			
Horticulture	BA, BS	MS, MAgr	PhD
Horticulture (Cooperative Program with Texas A&M University-Kingsville)			PhD
Plant Breeding		MS	PhD
Department of Nutrition and Food Science			
Food Science and Technology	BS	MS*, MAgr*	PhD*
Food Science	X		
Industry	X		
Nutrition		MS*	PhD*
Nutritional Sciences	BS		
Department of Plant Pathology and Microbiology			
Bioenvironmental Sciences	BS		
Plant Pathology		MS	PhD
Department of Poultry Science			
Poultry Science	BS	MS, MAgr	PhD
Department of Recreation, Park and Tourism Sciences			
Community Development	BS		
Natural Resources Development		MNRD	
Recreation, Park and Tourism Sciences	BS	MS	PhD
Parks and Conservation	X		
Community Recreation and Park Administration	X		
Tourism Management	X		
Youth Development	X		
Recreation and Resources Development		MRRD	
Department of Soil and Crop Sciences			
Agromony	BS	MS	PhD
Soil and Crop Management	X		
Plant Breeding		MS	PhD
Plant and Environmental Soil Science	BS		
Soil Science		MS	PhD
Turfgrass Science	BS		

* Move of existing degrees from Interdisciplinary to the Department of Nutrition and Food Science pending approval by the Texas Higher Education Coordinating Board. Visit theeb.state.tx.us for a current listing.

X Indicates option in major shown above.

College of Agriculture and Life Sciences	Baccalaureate	Masters	Doctorate
Department of Wildlife and Fisheries Sciences			
Natural Resources Development		MNRD	
Wildlife and Fisheries Sciences	BS	MS	PhD
Vertebrate Zoology	X		
Wildlife Ecology and Conservation	X		
Wildlife Science		MWSC	
College of Architecture			
Department of Architecture			
Architecture		MS, MArch	PhD
Environmental Design	BED		
Architectural Studies	X		
Department of Construction Science			
Construction Science	BS		
Construction Management		MS	
Department of Landscape Architecture and Urban Planning			
Landscape Architecture	BLA	MLA	
Land and Property Development		MLPD	
Urban and Regional Planning	BS	MUP	
Urban and Regional Sciences			PhD
Department of Visualization			
Visualization	BS	MS, MFA	
Mays Business School			
	Baccalaureate	Masters	Doctorate
Interdepartmental Degree Programs			
Business Administration		MBA	PhD
Business Honors	BBA		
College of Business			
		MBA	PhD
Department of Accounting			
Accounting	BBA	MS	
Business Administration—Accounting			X
Department of Finance			
Finance	BBA	MS	
Business Administration—Finance			X
Land Economics and Real Estate		MRE	
Department of Information and Operations Management			
Information and Operations Management	BBA		
Management Information Systems		MS	
Department of Management			
Management	BBA	MS	
Business Administration—Management			X
Department of Marketing			
Marketing	BBA	MS	
Business Administration—Marketing			X
College of Education and Human Development			
Interdepartmental Degree Program			
Interdisciplinary Studies	BSIS		
Human Resource Development	BS		
Technology Management	BS		

X Indicates option in major shown above.

College of Education and Human**Development**

Baccalaureate Masters Doctorate

Department of Educational Administration and**Human Resource Development**

Educational Administration		MS, MEd	PhD, EdD ⁷
Educational Human Resource Development		MS	PhD

Department of Educational Psychology

Bilingual Education		MS, MEd	
Counseling Psychology			PhD
Educational Psychology		MS, MEd	PhD
Educational Technology		MEd	
School Psychology			PhD
Special Education		MS, MEd	

Department of Health and Kinesiology

Athletic Training		MS	
Health	BS		
Community Health	X		
Health Education		MS	PhD
Kinesiology	BS	MS	PhD
Sport Management	BS	MS	

Department of Teaching, Learning and Culture

Curriculum and Instruction		MS, MEd ⁸	PhD, EdD ⁹
Interdisciplinary Studies	BS		

Dwight Look College of Engineering**Interdepartmental Degree Programs**

Engineering		MEng	DEng
Interdisciplinary Engineering		MS	PhD
Safety Engineering		MS	

Department of Aerospace Engineering

Aerospace Engineering	BS	MS, MEng	PhD
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Department of Biomedical Engineering

Biomedical Engineering	BS	MS, MEng	PhD
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Artie McFerrin Department of**Chemical Engineering**

Chemical Engineering	BS	MS, MEng	PhD
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Zachry Department of Civil Engineering

Civil Engineering	BS	MS, MEng	PhD
Ocean Engineering	BS	MS, MEng	PhD

Department of Computer Science and**Engineering**

Computer Engineering	BS	MS, MEng	PhD
Computer Science	BS	MS, MCS	PhD

Department of Electrical and Computer**Engineering**

Computer Engineering	BS	MS, MEng	PhD
Electrical Engineering	BS	MS, MEng	PhD

⁷ Also offered as a Cooperative Doctoral Program with Texas A&M International University.

⁸ Also offered as a dual degree program with Qatar University.

⁹ Also offered as a Cooperative Doctoral Program with Texas A&M International University.

X Indicates option in major shown above.

Dwight Look College of Engineering	Baccalaureate	Masters	Doctorate
Department of Engineering Technology and Industrial Distribution			
Engineering Technology	BS		
Electronics Engineering Technology	X		
Manufacturing and Mechanical Engineering Technology	X		
Industrial Distribution	BS	MID	
Department of Industrial and Systems Engineering			
Industrial Engineering	BS	MS, MEng	PhD
Department of Mechanical Engineering			
Mechanical Engineering	BS	MS, MEng	PhD
Department of Nuclear Engineering			
Health Physics		MS	
Nuclear Engineering	BS	MS, MEng	PhD
Radiological Health Engineering	BS		
Harold Vance Department of Petroleum Engineering			
Petroleum Engineering	BS	MS, MEng	PhD
College of Geosciences			
Interdepartmental Degree Programs			
Environmental Geoscience	BS		
Environmental Studies	BS		
Geoscience		MGsc	
Spatial Sciences	BS		
Department of Atmospheric Sciences			
Atmospheric Sciences		MS	PhD
Meteorology	BS		
Department of Geography			
Geography	BS	MS	PhD
Geographic Information Science	X		
Department of Geology and Geophysics			
Geology	BA, BS	MS	PhD
Geophysics	BS	MS	PhD
Department of Oceanography			
Oceanography		MS	PhD
College of Liberal Arts			
Interdepartmental Degree Programs			
Women's and Gender Studies	BA		
Department of Anthropology			
Anthropology	BA	MA	PhD
Department of Communication			
Communication	BA	MA	PhD
Telecommunication Media Studies	BA, BS		
Department of Economics			
Economics	BA, BS	MS	PhD
Department of English			
English	BA	MA	PhD

X Indicates option in major shown above.

College of Liberal Arts	Baccalaureate	Masters	Doctorate
Department of Hispanic Studies			
Hispanic Studies			PhD*
Modern Languages		MA	
Spanish		X	
Spanish	BA		
Department of History			
History	BA	MA	PhD
Department of International Studies			
Classics	BA		
International Studies	BA		
Modern Languages	BA		
Department of Performance Studies			
Music	BA		
Performance Studies		MA	
Theatre Arts	BA		
Department of Philosophy and Humanities			
Philosophy	BA	MA	PhD
Department of Political Science			
Political Science	BA, BS	MA	PhD
Department of Psychology			
Psychology	BA, BS	MS	PhD
Community/Clinical			X
Industrial/Organizational			X
Department of Sociology			
Sociology	BA, BS	MS	PhD
College of Science			
Department of Biology			
Biology	BA, BS	MS	PhD
Microbiology	BS	MS	PhD
Molecular and Cell Biology	BS		
Zoology	BS		
Department of Chemistry			
Chemistry	BA, BS	MS	PhD
Department of Mathematics			
Applied Mathematical Sciences ¹⁰	BS		
Mathematics	BA, BS	MS	PhD
Department of Physics and Astronomy			
Physics	BA, BS	MS	PhD
Applied Physics			PhD
Department of Statistics			
Statistics ¹¹		MS	PhD
College of Veterinary Medicine and Biomedical Sciences			
Laboratory Animal Medicine		MS	
Science and Technology Journalism		MS	
Veterinary Medicine			DVM Professional
Biomedical Sciences	BS	MS	

¹⁰ Joint program between the Department of Statistics and Mathematics.

¹¹ Also offered through Distance Education.

* Step 1 Doctoral Program with Texas A&M International University, Texas A&M University-Corpus Christi, and Texas A&M University-Kingsville.

X Indicates option in major shown above.

**College of Veterinary Medicine and
Biomedical Sciences**

	Baccalaureate	Masters	Doctorate
Department of Veterinary Integrative Biosciences			
Veterinary Public Health – Epidemiology Biomedical Sciences		MS MS	PhD
Department of Veterinary Large Animal Clinical Sciences			
Biomedical Sciences		MS	PhD
Department of Veterinary Pathobiology			
Veterinary Pathobiology Biomedical Sciences		MS	PhD PhD
Department of Veterinary Physiology and Pharmacology			
Biomedical Sciences		MS	PhD
Department of Veterinary Small Animal Clinical Sciences			
Biomedical Sciences		MS	PhD

**The Bush School of Government and Public
Service**

International Affairs		MIA	
Public Service and Administration		MPSA	

Texas A&M University at Galveston

Department of General Academics			
Maritime Studies	BA		
University Studies	BA, BS		
Department of Marine Biology			
Marine Biology	BS	MS ¹²	PhD ¹²
Marine Fisheries	BS		
Department of Marine Engineering Technology			
Marine Engineering Technology	BS		
Department of Marine Sciences			
Marine Resources Management		MMRM	
Marine Sciences	BS		
Ocean and Coastal Resources	BS		
Department of Maritime Administration			
Maritime Administration	BS		
Maritime Administration and Logistics		MMAL	
Department of Maritime Systems Engineering			
Maritime Systems Engineering	BS		
Department of Maritime Transportation			
Marine Transportation	BS		

Texas A&M University at Qatar

Dwight Look College of Engineering			
Chemical Engineering	BS	MS, MEng	
Electrical Engineering	BS		
Mechanical Engineering	BS		
Petroleum Engineering	BS		

12 Joint program between Texas A&M University, Texas A&M University at Galveston and Texas A&M University–Corpus Christi.

The Degree of Master of Science

The **Master of Science (MS)** curriculum is designed to develop new understanding through research and creativity. Students have the option to pursue a thesis or non-thesis Master of Science degree.

Residence (See Residence Requirements, [page 33](#))

In partial fulfillment of the residence requirement for the degree of Master of Science, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisory committee, department head or Chair of the Interdisciplinary Program, if appropriate, and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition, however, must be approved prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of his or her major or administrative department (or intercollegiate faculty, if applicable) concerning appointment of the chair of his or her advisory committee. With the exception of the Mays Business School non-thesis option and the Master of Science for a student with a major in Educational Human Resource Development, HRD option, the student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's major department (or intercollegiate faculty, if applicable), and **at least one or more of the members must have an appointment to a department other than the student's major department**. The outside member for students in an intercollegiate program must have an appointment to a department different from the chair of the student's committee.

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University-Temple Campus or Institute of Biosciences and Technology-Houston, may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's research and thesis, has the responsibility for calling required meetings of the committee and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, thesis or professional paper, and is registered for 684, 691, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the research proposal, the thesis and the final examination. In addition, the committee as a group and as individual members are responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college or interdisciplinary degree program, if applicable, and no later than 90 days prior to the date of the final oral examination or thesis defense.**

A student should submit the degree plan using the online Automated Degree Plan Submission System located on the website ogsdpps.tamu.edu.

A student submitting a proposed degree plan for a Master of Science degree should designate on the official degree plan form the program option desired by checking "thesis option" or "non-thesis option."

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination or Request for Final Examination Exemption is approved.

Credit Requirement

A minimum of 32 semester credit hours of approved courses and research is required for the thesis option Master of Science degree with the exception of the Master of Science in Visualization, which requires 48 hours. A minimum of 36 semester credit hours of approved coursework is required for the Non-Thesis Option.

Ordinarily the student will devote the major portion of his or her time to work in one or two closely related fields. Other work will be in supporting fields of interest.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Not more than 12 hours may be used in any combination of the following categories:
 - Not more than 8 hours in the combination of 691 (research) or 684 (Professional Internship) may be used.
 - Not more than 8 hours of 685 (Directed Studies) may be used.
 - Not more than 3 hours of 690 (Theory of Research) may be used.
 - Not more than 3 hours of 695 (Frontiers in Research) may be used.
4. A maximum of 2 hours of Seminar (681).

5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. Continuing education courses may not be used for graduate credit.
9. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Continuous Registration

A student in the thesis option of the Master of Science program who has completed all coursework on his/her degree plan other than 691 (Research) is required to be in continuous registration until all requirements for the degree have been completed. See Continuous Registration Requirements, [page 202](#).

Foreign Languages

No specific language requirement exists for the Master of Science degree.

Thesis Proposal

For the thesis option Master of Science degree, the student must prepare a thesis proposal for approval by the advisory committee and the head of the major department or chair of the intercollegiate faculty, if applicable. This proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the submission of the request for the final examination.

Compliance issues must be addressed if a graduate student is performing research involving human subjects, animals, infectious biohazards and recombinant DNA. A student involved in these types of research must check with the Office of Research Compliance, Office of the Vice President for Research at (979) 845-8585 to ensure that he/she has met all compliance responsibilities. Additional information can also be obtained on the website researchcompliance.tamu.edu.

Thesis Defense/Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and there must be no unabsolved grades of D, F or U for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. If applicable, an approved thesis proposal must be on file in the Office of Graduate Studies according to published deadlines.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded).

For thesis option students, the final examination covers the thesis and all work taken on the degree plan and at the option of the committee may be written or oral or both. The final examination may not be administered before the thesis is available to all members of the student's advisory committee in substantially final form, and all members have had adequate time to review the document. The examination is conducted by the student's advisory committee as finally constituted. A thesis option student must be registered in the University in the semester or summer term in which the final examination is taken. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department, or interdisciplinary degree program, may have a stricter requirement provided there is consistency within all degree programs within a department or interdisciplinary program.

A thesis option candidate may petition to be exempt from his/her final examination provided his/her degree plan GPR is 3.500 or greater and he/she has the approval of the advisory committee, the head of the student's major department, or intercollegiate chair, if appropriate, and the Office of Graduate Studies. It is required that the petition for exemption be submitted the same semester the student intends to submit the thesis.

For non-thesis option students, a final comprehensive examination is required. The Master of Science in Educational Human Resource Development, HRD option, and the Master of Science Program in the Mays Business School do not have final examination requirements. Otherwise, exemptions from final examinations are not allowed. The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled. If a student has completed all required degree plan coursework, the student is not required to be registered for classes in the semester the final examination is administered (unless he/she holds an assistantship).

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Thesis Option

An acceptable thesis is required for the Master of Science degree for a student who selects the thesis option program. The finished work must reflect a comprehensive understanding of the pertinent literature and express in clear English, the problem(s) for study, the method, significance and results of the student's original research. Guidelines

for the preparation of the thesis are available in the *Thesis Manual*, which is available online at thesis.tamu.edu.

After successful defense (or exemption) and approval by the student's advisory committee and the head of the student's major department (or chair of the intercollegiate faculty, if appropriate), the student must submit his/her thesis to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website, thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. The PDF file and the signed approval form are required by the deadline.

Deadline dates for submitting are announced each semester or summer term in the "Office of Graduate Studies Calendar" (see Time Limit statement). These dates also can be accessed via the website ogs.tamu.edu/current-students/dates-and-deadlines/.

Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at the Fiscal Department. After commencement, theses are digitally stored and made available through the Texas A&M Libraries.

A thesis that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student's department head (or chair of the intercollegiate faculty, if applicable). The manuscript must be resubmitted as a new document, and the entire review process must begin again. All original submittal deadlines must be met during the resubmittal process to graduate that semester.

Non-Thesis Option

For the non-thesis option, a thesis is not required. A final comprehensive examination is required for all non-thesis Master of Science programs except the Master of Science programs offered by the Mays Business School and the Master of Science with a major in Educational Human Resource Development, HRD option. No exemptions are allowed. The requirements as to level of courses and examinations are the same as for the thesis option Master of Science degree. The final examination cannot be held prior to the mid point of the semester if questions on the examination are based on courses in which the student is currently enrolled.

A student pursuing the non-thesis option is not allowed to enroll in 691 (Research) for any reason and 691 may not be used for credit toward a non-thesis option Master of Science degree. A maximum of 4 credit hours of 684 (Professional Internship), 8 credit hours of 685 (Directed Studies), and up to 3 credit hours of 690 (Theory of Research) or 695 (Frontiers in Research) may be used toward the non-thesis option Master of Science degree. In addition, any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan. All requirements for the non-thesis option Master of Science degree other than those specified above are the same as for the thesis option degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

A student who has chosen the thesis option must have the final corrected version of the thesis cleared by the Thesis Office no later than one year after the final examination, or approval of a petition for exemption from the final exam, or within the seven-year time limit, whichever occurs first. Failure to do so will result in the degree not being awarded.

Application for Degree

A graduate degree is conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. A student should check the website of the Office of the Registrar at graduation.tamu.edu/ceremon.html to determine the date and time of his/her graduation ceremony.

Steps to Fulfill Master's Degree Requirements

1	Meet with departmental graduate advisor to plan course of study for first semester.	➔	When: Before first semester registration. Approved by: Graduate advisor or chair of the intercollegiate faculty.
2	Establish advisory committee. Submit a degree plan.*	➔	When: Prior to the deadline imposed by the student's college and no later than 90 days prior to final oral or thesis defense. Approved by: Advisory committee, department head or chair of the intercollegiate faculty, and Office of Graduate Studies (OGS).
3	If thesis is required, submit thesis proposal to the Office of Graduate Studies.	➔	When: At least 25 working days prior to the submission of the Request for the Final Examination. Approved by: Advisory committee, department head or chair of the intercollegiate faculty and OGS.
4	Apply for degree**; pay graduation fee.	➔	When: During the first week of the final semester, see OGS calendar.
5	Check to be sure degree program and advisory committee are up to date and all ELPE requirements (if applicable) and coursework are complete.	➔	When: Well before submitting request to schedule final examination.
6	Complete residence requirement.	➔	When: If applicable, before or during final semester. Approved by: OGS.
7	Submit request for permission to schedule final examination.	➔	When: Must be received by OGS at least 10 working days before exam date. See OGS calendar for deadlines. Approved by: Advisory committee, department head or chair of the intercollegiate faculty, and OGS.
8	If required, upload one approved final copy of thesis as a single PDF file (thesis.tamu.edu) and submit signed approval form to the Thesis Office.	➔	When: See OGS calendar for deadlines. Approved by: Advisory committee, department head or chair of the intercollegiate faculty and OGS.
9	Graduation; arrange for cap and gown.	➔	For more information, contact the University Bookstore.

* The online Automated Degree Plan Submission System is located on the website ogsdps.tamu.edu.

** Complete the application for degree form via the student's Howdy portal.

The Degree of Master of Arts

The **Master of Arts (MA)** curriculum is designed to provide broad preparation through research and creativity. Students have the option to pursue a thesis or non-thesis Master of Arts degree.

Residence (See Residence Requirements, [page 33](#).)

In partial fulfillment of the residence requirement for the degree of Master of Arts, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition must be approved, however, prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of his or her major or administrative department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair, or one of the co-chairs, of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department**.

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's research and thesis, has the responsibility for calling required meetings of the committee and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, thesis or professional paper and is registered for 684, 691, 692 or 693 courses,

the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the research proposal, the thesis and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan and it must include study in more than one area of specialization, but these areas may be contained within the course offerings of a single department. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination or thesis defense.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdps.tamu.edu.

A student submitting a proposed degree plan for a Master of Arts degree should designate on the official degree plan form the program option desired by checking "thesis option" or "non-thesis option."

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes to the degree plan can be made once the student's Request for Final Examination or Request for Final Examination Exemption is approved.

Credit Requirement

A minimum of 30 semester credit hours of approved courses and research is required for the thesis option Master of Arts degree. A minimum of 36 semester credit hours of approved courses is required for the non-thesis option Master of Arts degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted**

for transfer credit. Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations:

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses, taken in residence at an accredited U.S. institution or approved international institution, with a final grade of B or greater, will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Not more than 12 hours may be used in any combination of the following categories:
 - Not more than 6 hours in combination of 691 (Research) or 684 (Professional Internship) may be used.
 - Not more than 8 hours of 685 (Directed Studies) may be used.
 - Not more than 3 hours of 690 (Theory of Research) may be used.
 - Not more than 3 hours of 695 (Frontiers in Research) may be used.
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 684 (Professional Internship) may be used for the degree of Master of Arts non-thesis option with the exception of a student pursuing the Master of Arts in Philosophy, non-thesis option, who may use up to 6 hours of 684 (Professional Internship).
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Continuous Registration

A student in the thesis option of the Master of Arts program who has completed all coursework on his/her degree plan other than 691 (Research) is required to be in continuous registration until all requirements for the degree have been completed. See Continuous Registration Requirements, [page 202](#).

Foreign Languages

For the degree of Master of Arts, a reading knowledge (usually represented by two years of college study) of at least one foreign language is normally required.

Thesis Proposal

For the thesis option Master of Arts degree, the student must prepare a thesis proposal for approval by the advisory committee and the head of the major department. This proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the submission of the Request for the Final Examination.

Compliance issues must be addressed if a graduate student is performing research involving human subjects, animals, infectious biohazards and recombinant DNA. A student involved in these types of research must check with the Office of Research Compliance, Office of the Vice President for Research at (979) 845-8585 to ensure that they have met all compliance responsibilities. Additional information can also be obtained on the website researchcompliance.tamu.edu.

Thesis Defense/Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan**. To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. If applicable, an approved thesis proposal must be on file in the Office of Graduate Studies.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded).

For thesis option students, the final examination covers the thesis and all work taken on the degree plan and at the option of the committee may be written or oral or both. The final examination may not be administered before the thesis is available to all members of the student's advisory committee in substantially final form, and all members have had adequate time to review the document. The examination is conducted by the student's advisory committee as finally constituted. A thesis option student must be registered in the University in the semester or summer term in which the final examination is taken. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A student shall be given only one opportunity to repeat the final examination for the master of arts degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). A department can have a stricter requirement provided there is consistency within all degree programs within a department.

A thesis option candidate may petition to be exempt from his/her final examination provided their degree plan GPR is 3.500 or greater and they have approval of the advisory committee, the head of the student's department and the Office of Graduate Studies. It is recommended that the petition for exemption be submitted the same semester the student intends to submit the thesis.

For non-thesis option students, a final comprehensive examination is required. Exemptions from the final examination are not allowed. The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled. If a student has completed all required degree plan coursework, the student is not required to be registered for classes in the semester the final examination is administered (unless he/she holds an assistantship).

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Thesis Option

An acceptable thesis is required for the Master of Arts degree for a student who selects the thesis option program. The finished work is expected to be a competently executed development and exposition of the student's original research topic. Guidelines for the preparation of the thesis are available in the *Thesis Manual*, which is available online at thesis.tamu.edu.

After successful defense (or exemption) and approval by the student's advisory committee and the head of the student's major department, a student must submit his/her thesis to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website, thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline.

Deadline dates for submitting are announced each semester or summer term in the "Office of Graduate Studies Calendar" (see Time Limit statement). These dates also can be accessed via the website ogs.tamu.edu/current-students/dates-and-deadlines/.

Before a student can be “cleared” by the Thesis Office, a processing fee must be paid at the Fiscal Department. After commencement, theses are digitally stored and made available through the Texas A&M Libraries.

A thesis that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student’s department head. The manuscript must be resubmitted as a new document, and the entire review process must begin again. All original submittal deadlines must be met during the resubmittal process to graduate that semester.

Non-Thesis Option

For the non-thesis option, a thesis is not required. A final comprehensive examination is required for all non-thesis Master of Arts students. No examination may be held prior to the mid-point of the semester or summer term in which a student will complete all remaining courses on the degree plan.

A student pursuing the non-thesis option is not allowed to enroll in 691 (Research) for any reason and 691 may not be used for credit toward a non-thesis option Master of Arts degree. No credit hours of 684 (Professional Internship) may be used for the degree of Master of Arts non-thesis option, with the exception of the non-thesis option Master of Arts in Philosophy, for which a student may use up to 6 credit hours of 684. A maximum of 8 credit hours of 685 (Directed Studies), and up to 3 credit hours of 690 (Theory of Research) and up to 3 credit hours of 695 (Frontiers in Research) may be used toward the non-thesis option Master of Arts degree. In addition, any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan.

All requirements for the non-thesis option Master of Arts degree other than those specified above are the same as for the thesis option degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

A student who has chosen the thesis option must have the final corrected version of the thesis cleared by the Thesis Office no later than one year after the final examination, or approval of a petition for exemption from the final exam, or within the seven-year time limit, whichever occurs first. Failure to do so will result in the degree not being awarded.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma

fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Agribusiness

This professional curriculum is designed to provide a broad preparation for economic, financial, and marketing analysis of agribusiness, food and fiber industry decisions. To further enhance their career preparation, a student may avail himself/herself of traditional University strengths in a wide range of supporting areas and departments. The **Master of Agribusiness (MAB)** degree program is non-thesis, interdisciplinary and jointly administered by the College of Agriculture and Life Sciences and the Mays Business School. Program administration includes a Program Director, Program Executive Committee and an Intercollegiate Faculty. This program is one of a select cadre of national programs designed to successfully cut across the business and agriculture disciplines to focus on food and agribusiness management.

The requirements of the Master of Agribusiness degree are flexible to meet the needs and goals of a student. Enrollees who have taken business courses as undergraduates will be able to build on what they learned in these foundation courses and specialize their training to pursue specific career goals. Those who have not completed these foundation courses may complete them as part of their degree program. A student will work closely with his/her advisory committee in developing a program to meet his/her unique backgrounds and career goal.

Residence (See Residence Requirements, [page 33](#).)

In partial fulfillment of the residence requirement for the degree of Master of Agribusiness, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition must be approved, however, prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the Chair of the Intercollegiate Faculty of Agribusiness concerning program structure and requirements. The Chair of the Intercollegiate Faculty of Agribusiness has the responsibility of approving the proposed degree plan for a MAB student and is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies. No other advisory committee members are required.

Degree Plan

The degree plan must be completed and filed with the Office of Graduate Studies by the student's second semester, and no later than dates announced in the OGS calendar of deadlines for graduation.

This proposed degree plan should be submitted using the online Automated Degree Plan System located on the website ogsdps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary to correct deficiencies in the student's academic preparation.

Credit Requirement

The minimum requirements for this degree are the completion of 39 credit hours of coursework. To emphasize the integration and application of subject matter learned and the development of written and oral communication skills, a student will be required to take capstone courses consisting of AGEC 629 and AGEC 630 during the last fall semester. This 6 credit hour course requirement replaces the Final Examination.

A student may select 6 credit hours of electives within 39 credit hour requirement in consultation with his/her advisor. These elective hours may include an AGEC 684 (Internship). At least one elective course is to be from the Mays Business School, preferably in the international area.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit. Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:

- Graduate and/or upper-level undergraduate courses, taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater, will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
 3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 4 hours of 684 (Professional Internship) and/or
 - 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
 4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. No credit hours of 691 (Research) may be used.
 9. Continuing education courses may not be used for graduate credit.
 10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student with permission from the Intercollegiate Chair and Associate Department Head for Graduate Programs and approved by the Office of Graduate Studies.

Foreign Languages

No specific language requirement exists for the Master of Agribusiness degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old may not be used to satisfy degree requirements.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week

of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all of their degree requirements will not be allowed to cancel their graduation.

The electronic application can be accessed via the student's Howdy portal. The Registrar attempts each semester to balance the size of each ceremony. Thus, the makeup of the ceremony by colleges does change from semester to semester. Graduation times are posted each semester on the website of the Office of the Registrar. A student should check the website at graduation.tamu.edu/ceremon.html to determine the date and time of the graduation ceremony.

Final Examination

To emphasize the integration and application of subject matter learned and the development of written and oral communication skills, a student will be required to take capstone courses consisting of AGEC 629 and 630 during the last fall semester. This 6 credit hour course requirement allows waiving of the Final Examination. Completion of these capstone courses serves as the final examination for this program.

The Degree of Master of Agriculture

The Master of Agriculture (MAgr) degree is designed for a student who wants professional graduate training with a management orientation in agriculture, food and natural resources. It is intended to emphasize the problem solving skills involved in the use of science and technology to benefit humanity, not as a research degree.

An individual with a baccalaureate degree from a college or university of recognized standing, or a qualified Texas A&M University senior during his/her last semester, may apply for admission to graduate studies to pursue the non-thesis degree of Master of Agriculture. The candidate's advisory committee shall specify prerequisite work where necessary.

The student must demonstrate problem solving capabilities. Degree candidates may gain such capabilities by completing a professional internship that is designed to provide meaningful, applied, practical experiences, and which may vary in duration from three to nine months depending upon departmental requirements.

The degree may be earned in select academic departments of the College of Agriculture and Life Sciences and in four interdisciplinary areas: food science and technology, agricultural development, and plant protection.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Agriculture degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of his or her major or administrative department or chair of the intercollegiate faculty, if applicable, concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department or intercollegiate faculty, if appropriate, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the professional paper and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college or**

interdisciplinary degree program, if applicable, and no later than 90 days prior to the date of the final oral examination or thesis defense.

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee or chair of intercollegiate faculty, if applicable, to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 36 hours is required for the Master of Agriculture degree. Approximately 12 credit hours are to be taken outside of the student's degree option.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit. Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply.
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.

- Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
 3. Any combination of 684, 685, 690 and 693 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 693 (Professional Studies).
 4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. No credit hours of 691 (Research) may be used.
 9. Continuing education courses may not be used for graduate credit.
 10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

No specific language requirement exists for the Master of Agriculture degree.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

A professional paper, which is a scholarly report of a problem solving nature, will be prepared by each student. The professional paper must be submitted to the student's advisory committee for approval prior to the final examination. The final examination will cover all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must

excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department or interdisciplinary degree program can have a stricter requirement provided there is consistency within all degree programs within a department or interdisciplinary program.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. An examination which is not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as a failure. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

A candidate for the Master of Agriculture degree does not qualify to petition for an exemption from his/her final examination.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all of their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. Thus, the makeup of the ceremony by colleges does change from semester to semester. Graduation times are posted each semester on the website of the Office of the Registrar. A student should check the website at graduation.tamu.edu/ceremon.html to determine the date and time of the graduation ceremony.

The Degree of Master of Architecture

The Department of Architecture in the College of Architecture offers a program of graduate study intended to provide its graduates with the requisite educational background to enter the professional practice of architecture and its numerous variants and/or to prepare them for further graduate studies.

The **Master of Architecture (MArch)** is a non-thesis degree and requires the completion of a minimum of 52 hours of coursework and a satisfactory comprehensive final examination. Holders of the Bachelor of Environmental Design (BED) degree from Texas A&M University and holders of other four-year pre-professional architectural degrees will enter the program directly, subject to admission approval by the department. Holders of other baccalaureate degrees will normally be required to complete a Career Change Program (a structured three-semester leveling sequence) to attain BED equivalency.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Architecture degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the professional paper and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 52 semester credit hours of approved courses is required for the Master of Architecture degree. A student who is admitted to the Career Change Program will normally be required to complete a structured three-semester leveling sequence in addition to the 52 semester credit hours required for the degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses, taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater, will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. No more than 16 hours may be used in any combination of the following categories:
 - A maximum of 8 hours of 684 (Professional Internship); and/or
 - A maximum of 8 hours of 685 (Directed Studies), or
 - A maximum of 8 hours of 693 (Professional Studies), and
 - Up to 3 hours of 690 (Theory of Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 12 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses taken are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

No specific language requirement exists for the Master of Architecture degree.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree

must return to the campus for the final examination. The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed. Departmental requirements and regulations related to degree plans, professional internships, etc., may be found in the departmental brochure. A student will not normally be permitted to undertake 684 (Professional Internship) as the final course in the sequence of study leading to the master's degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

A request for permission to hold and announce the final examination **must** be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

A candidate for the Master of Architecture degree does not qualify to petition for an exemption from his/her final examination.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all of their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Biotechnology

The **Master of Biotechnology (MBIOT)** is designed for a student who wants professional graduate training with an industry orientation in the life sciences. It is intended to emphasize the use of problem solving and technical skills in the life sciences. The Master of Biotechnology degree program is non-thesis, interdisciplinary and jointly administered by five colleges (Agriculture and Life Sciences, Liberal Arts, Mays Business School, Science, Veterinary Medicine). Program administration includes a Program Chair and Faculty of Biotechnology. This program is one of a select few nationally that is designed to cut across the business and life science disciplines to better prepare a student for the variety of career pathways associated with the life science industries. It is a degree combining business and science and requires the completion of a minimum of 39 hours of coursework and a satisfactory comprehensive final exam.

An individual with a baccalaureate degree in a life science field from a college or university of recognized standing, or a qualified senior in his/her last semester, may apply for admission to the program. As a result of the combination of professional and technical classes, prerequisites may be required before a student can take the core curriculum courses. The Program Chair will specify prerequisite work when necessary.

Residence (See Residence Requirements, [page 33](#).)

In partial fulfillment of the residence requirement for the degree of Master of Biotechnology, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition must be approved, however, prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and **before** enrolling for coursework, the student will consult with the Professional Program in the Biotechnology Office. The student's advisory committee for the master's degree will consist of **no fewer than three members** (more than one department must be represented by the members of the advisory committee). The committee chair or co-chair of the advisory committee must be a member of the Intercollegiate Faculty of Biotechnology and at least one or more of the members must have graduate faculty membership through another academic program.

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. The chair of the committee has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship and is registered for 684 courses, the student may request, in writing, that the Program Chair appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the professional portfolio and the final oral defense. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies no later than 90 days prior to graduation.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 39 hours of coursework is required for the Master of Biotechnology degree. To emphasize the integration and application of subject matter learned and the development of written and oral communication skills, a student will be required to take BIOT 684 (Professional Internship) during his/her last semester. A student may select 6 credit hours of electives within the 39 credit hour requirement in consultation with his/her advisory committee. These elective hours may be from any course on the list of approved electives or other courses if approved by the advisory committee.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.

3. A maximum of 6 hours of 684 (Professional Internship), and 8 hours of 685 (Directed Studies).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 6 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 690 (Theory of Research), 691 (Research) or 695 (Frontiers in Research) may be used.
9. Undergraduate courses may not be used to satisfy the required business courses.
10. Continuing education courses may not be used for graduate credit.
11. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Scholastic Requirements

To maintain good academic standing, a MBIOT student must maintain a minimum cumulative 3.000 GPR each semester. If a student fails to attain a cumulative 3.000 GPR, he or she is placed on academic probation. A student on academic probation must raise his/her cumulative GPR to 3.000 or above by the end of the next 9 hours of coursework. If this requirement is not met, the Program Chair will recommend that the Office of Graduate Studies block the student from further enrollment. If a student is blocked from further enrollment in the MBIOT program, he or she shall not be permitted to enroll in other MBIOT courses.

Foreign Languages

No specific language requirement exists for the Master of Biotechnology degree.

Internship

A student who undertakes a professional internship of no less than 375 hours in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree must return to the campus for the final examination. The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed. A student on academic probation will not be allowed to participate in an internship.

Time Limit

All degree requirements for a master's degree must be completed within a period of seven consecutive years. Coursework which is over seven calendar years old may not be applied to a master's degree. Time limits for coursework on the degree plan also apply to transfer courses.

Final Examination

A student must return to campus after the professional internship and pass a final examination. In order to be eligible to take the exam, a student's cumulative and degree

plan GPRs must be at least a 3.000. He/she must not have any unabsolved grades of D, F, I or U for any course listed on the degree plan. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination.

The BIOT 684 Professional Internship, Professional Portfolio and oral defense of the contents of that portfolio will constitute the final examination. Each student will prepare a professional portfolio on topics relating to the student's course of study and the internship. The professional portfolio must be submitted to the student's advisory committee for approval prior to the examination. The student's advisory committee will conduct the examination, which will include an oral presentation prepared by the student. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. All committee members should attend the final examination. If one of the members cannot attend the examination, he or she must find an appropriate substitute. The committee chair may not be substituted.

The request for permission to hold the final examination must be submitted to the Office of Graduate Studies at least ten working days prior to the exam. Please see the Office of Graduate Studies website (ogs.tamu.edu/incoming-students/student-forms-and-information/) for the forms. It also should include the signatures of approval of the committee chair and the chair of the intercollegiate faculty certifying the student's eligibility for the exam. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester. The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled. A Master of Biotechnology student does not qualify to petition for an exemption from the final exam.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. Thus, the makeup of the ceremony by colleges does change from semester to semester. Graduation times are posted each semester on the website of the Office of the Registrar. A student should check the website at graduation.tamu.edu/ceremon.html to determine the date and time of his/her graduation ceremony.

The Degree of Master of Business Administration

The Mays Business School offers a graduate program leading to the degree of **Master of Business Administration (MBA)**. Enrollment in the Mays MBA Program and related courses is restricted to students in the classification G7 BUAD. A G6 student is not eligible to enroll in Mays MBA Program courses.

The Mays MBA Program is a 49 credit hour, lock-step program. All core course enrollments are handled through the Mays MBA Program Office. Details regarding the Mays MBA Program curriculum may be obtained by contacting the MBA Program Office or at the website mba.tamu.edu. The Mays MBA Program is a non-thesis degree for which a final oral examination is not required. Admission to the program is in the fall semester only. The Mays Business School is accredited by the Association to Advance Collegiate Schools of Business (AACSB) at all program levels.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Business Administration degree.

Student's Advisory Committee

The Mays MBA student's advisory committee consists of the Director of the Mays MBA Program or the Associate Dean for Graduate Programs within the Mays Business School. The Director or the Associate Dean has the responsibility of approving the proposed degree plan for an MBA student. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies.

Degree Plan

The degree plan must be completed and processed by the MBA office and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college and no later than dates announced in the OGS calendar of deadlines for graduation. It is recommended that a student who is planning to take additional courses after the completion of the Mays MBA core courses meet with the academic advisor in the Mays MBA Program Office. Additional coursework may be added to the approved degree plan by petition.

Course Requirements

The course requirements for the Mays MBA degree consist of 43 credit hours of core courses, 3 credit hours of a designated specialization course, and 3 credit hours of an approved elective course. In addition, a student has the option of completing a certificate program or additional specialization courses beyond the degree requirements. The details of the certificates and specializations are found on the Mays MBA website at mba.tamu.edu.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Normally the use of such courses is not permitted within the Mays MBA core courses.

Transfer of Credit

Because of the nature and structure of the Mays MBA program, the transfer of credit for the MBA core courses is not accepted.

Scholastic Requirements

To maintain good academic standing and to be eligible for graduation, a Mays MBA student must maintain a minimum cumulative 3.000 GPR in each term of the Mays MBA Program. A degree-seeking graduate student is considered to be scholastically deficient if either his or her cumulative GPR or the GPR for courses listed on the degree plan falls below 3.000.

In the event a degree-seeking graduate student becomes scholastically deficient, he or she may be subject to one of the following actions, initiated by a recommendation from the Director of the Mays MBA Program or the Associate Dean for Graduate Programs within the Mays Business School:

1. Permitted to continue in the program on scholastic probation. A student failing to attain a 3.000 GPR by the end of the next term may be dismissed from the program.
2. Immediate dismissal from the program due to the severity of their scholastic deficiency.

The Director of the Mays MBA Program or Associate Dean for Graduate Programs will evaluate all scholastic probation students at the end of each of the program's terms and take appropriate action. When necessary, recommendations regarding the blocking of the student from further enrollment will be made to the Office of Graduate Studies.

A student who withdraws or is dismissed from the Mays MBA Program may not reenter the program. An exception may be granted in the case of voluntary withdrawal in good academic standing with prior approval at the time of withdrawal from the Director of the Mays MBA Program or the Associate Dean of Graduate Programs. A student who withdraws, or who is dismissed from the program, after the University deadline for refunds will not receive any refund of tuition and fees.

Foreign Languages

No specific language requirement exists for the Master of Business Administration degree.

TOEFL Requirements

The Mays MBA Program requires a score of at least 600 paper-based or 250 computer-based on the TOEFL for consideration for admission. If presenting the TOEFL iBT, a score of 100 is required. As an alternative to the TOEFL, an international student may present the IELTS with a score of 7 or higher.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old may not be used to satisfy degree requirements.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

Final Examination

A final oral examination is not required for the Master of Business Administration degree.

The Degree of Master of Business Administration Mays Executive MBA Program

The Mays Business School offers an Executive MBA Program (EMBA) leading to the degree of Master of Business Administration (MBA) for working professionals with significant professional and managerial experience. Selected EMBA participants only are eligible to enroll in the Mays Executive MBA Program courses.

The Mays Executive MBA Program is a 45 credit hour, lock-step program. All course enrollments are handled through the Mays Executive MBA Program Office. The Mays EMBA Program class sessions are held at CityCentre III in Houston, Texas. It is required that all class sessions must be attended by participants in person on the scheduled Friday and Saturday weekends, 9 a.m. – 4:30 p.m. Details regarding the Mays EMBA Program may be obtained by contacting the Mays EMBA Program Office or at the website emba.tamu.edu. The Mays EMBA Program is a non-thesis degree for which a final oral examination is not required. Admission to the program is in the fall semester only. The Mays Business School is accredited by the Association to Advance Collegiate Schools of Business (AACSB) at all program levels.

EMBA Participant's Advisory Committee

The Mays Executive MBA participant's advisory committee consists of the Director of the Mays EMBA Program or the Associate Dean for Graduate Programs within the Mays Business School. The Director or the Associate Dean has the responsibility of approving the proposed degree plan for EMBA participants. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies.

Degree Plan

The degree plan must be completed and filed by the Mays EMBA Program office with the Office of Graduate Studies following the deadline imposed by the participant's college and no later than dates announced in the OGS calendar of deadlines for graduation.

Course Requirements

The course requirements for the Mays Executive MBA Program degree consist of 45 credit hours. No options are provided for completing a certificate program or additional courses beyond the degree requirements.

Limitations on the Use of Transfer, Extension and Certain Other Courses

The use of such courses is not permitted within the Mays Executive MBA Program curriculum.

Transfer of Credit

The transfer of credit for Mays EMBA courses is not accepted because of the nature and structure of the Mays Executive MBA Program curriculum.

Scholastic Requirements

To maintain good academic standing and to be eligible for graduation, a Mays Executive MBA Program participant must maintain a cumulative 3.000 GPR in the Mays Executive MBA Program curriculum, and he/she must not have any unabsolved grades of D, F, or U on any course on his/her degree plan. To absolve deficient grades, the student must repeat the course at Texas A&M University attaining a final grade of C or better. A student failing to attain or maintain a cumulative 3.000 GPR by the end of the next term may be dismissed from the program. The Director of the Mays Executive MBA Program and the Associate Dean for Graduate Programs will evaluate all scholastic probation participants at the end of each of the program's terms and take appropriate action. When necessary, recommendations regarding the blocking of a student from further enrollment will be made to the Office of Graduate Studies.

An EMBA participant who withdraws or is dismissed from the Mays Executive MBA Program may not reenter the program. An exception may be granted in the case of voluntary withdrawal in good academic standing with prior written approval at the time of withdrawal from the Director of the Mays Executive MBA Program and the Associate Dean for Graduate Programs. A participant who withdraws or who is dismissed from the program after the deadline for refund will not receive any refund of tuition and fees.

GMAT and TOEFL Requirements

Students in the Mays Executive MBA Program are exempt from the GMAT and TOEFL.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. **The electronic application for degree can be accessed via the student's Howdy portal.**

Final Examination

A final oral examination is not required for the Executive Master of Business Administration degree.

The Degree of Master of Business Administration Mays Professional MBA Program

The Mays Business School offers a Professional MBA Program (PMBA) leading to the degree of Master of Business Administration (MBA) for working professionals with professional work experience. Selected PMBA participants only are eligible to enroll in the Mays Professional MBA Program courses.

The Mays Professional MBA Program is a 45 credit hour, lock-step program. All course enrollments are handled through the Mays Professional MBA Program Office. The Mays PMBA Program class sessions are held at CityCentre III in Houston, Texas. It is required that all class sessions must be attended by participants in person on the scheduled weekends; Fridays from 6:00 p.m. – 10:00 p.m. and Saturdays from 9:00 a.m. – 6:00 p.m. Details regarding the Mays PMBA Program may be obtained by contacting the Mays MBA Program Office or at the website pmba.tamu.edu. The Mays PMBA Program is a non-thesis degree for which a final oral examination is not required. Admission to the program is in the fall semester only. The Mays Business School is accredited by the Association to Advance Collegiate Schools of Business (AACSB) at all program levels.

PMBA Participant's Advisory Committee

The Mays Professional MBA participant's advisory committee consists of the Director of the Mays PMBA Program or the Associate Dean for Graduate Programs within the Mays Business School. The Director or the Associate Dean has the responsibility of approving the proposed degree plan for PMBA participants. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies.

Degree Plan

The degree plan must be completed and filed by the Mays PMBA Program office with the Office of Graduate Studies following the deadline imposed by the participant's college and no later than dates announced in the OGS calendar of deadlines for graduation.

Course Requirements

The course requirements for the Mays Professional MBA Program degree consist of 45 credit hours. No options are provided for completing a certificate program or additional courses beyond the degree requirements.

Limitations on the Use of Transfer, Extension and Certain Other Courses

The use of such courses is not permitted within the Mays Professional MBA Program curriculum.

Transfer of Credit

The transfer of credit for Mays PMBA courses is not accepted because of the nature and structure of the Mays Professional MBA Program curriculum.

Scholastic Requirements

To maintain good academic standing and to be eligible for graduation, a Mays Professional MBA Program participant must maintain a cumulative 3.000 GPR in the Mays Professional MBA Program curriculum, and he/she must not have any unabsolved grades of D, F, or U on any course on his/her degree plan. To absolve deficient grades, the student must repeat the course at Texas A&M University attaining a final grade of C or better. A student failing to attain or maintain a cumulative 3.000 GPR by the end of the next term may be dismissed from the program. The Director of the Mays Professional MBA Program and the Associate Dean for Graduate Programs will evaluate all scholastic probation participants at the end of each of the program's terms and take appropriate action. When necessary, recommendations regarding the blocking of a student from further enrollment will be made to the Office of Graduate Studies.

A PMBA participant who withdraws or is dismissed from the Mays Professional MBA Program may not reenter the program. An exception may be granted in the case of voluntary withdrawal in good academic standing with prior written approval at the time of withdrawal from the Director of the Mays Professional MBA Program and the Associate Dean for Graduate Programs. A participant who withdraws or who is dismissed from the program after the deadline for refund will not receive any refund of tuition and fees.

GMAT and TOEFL Requirements

Students in the Mays Professional MBA Program are required to take the GMAT or GRE exam. International students are required to meet a minimum TOEFL score or receive a waiver.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. The electronic application for degree can be accessed via the student's Howdy portal.

Final Examination

A final oral examination is not required for the Professional Master of Business Administration degree.

The Degree of Master of Computer Science

The degree of **Master of Computer Science (MCS)** is a non-thesis degree, designed to complement the Master of Science degree in Computer Science. The degree requires the completion of a minimum of 30 hours of coursework and a satisfactory comprehensive final examination.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Computer Science degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department or the department head's designee (e.g. departmental graduate advisor) concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the Master of Computer Science will consist of **at least one member of the graduate faculty. Typically, this member may be the departmental graduate advisor and will serve as the student's committee chair or, the departmental graduate advisor may appoint/approve another departmental faculty member to serve as the appropriate chair of the student's advisory committee. Depending on the departmental policy, additional committee members may be required. If additional committee members are deemed necessary by the department,** the chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project, and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of

the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination or Request for Final Examination Exemption is approved.

Credit Requirement

A minimum of 30 semester credit hours of approved courses is required for the Master of Computer Science degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

No specific language requirement exists for the Master of Computer Science degree.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree must return to the campus for the final examination. The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years

after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the “Office of Graduate Studies Calendar” unless the student has been exempted from the examination. **The Office of Graduate Studies must be notified in writing of any cancellation.** The candidate is eligible to petition for an exemption from the final examination with departmental and committee approval. The approved petition should be submitted to the Office of Graduate Studies by the deadline announced for the student’s final semester (or semester of graduation) in the Office of Graduate Studies Calendar. See Office of Graduate Studies website ogs.tamu.edu/current-students/dates-and-deadlines/.

A request for permission to hold and announce the final examination **must** be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given **only one** opportunity to repeat the final examination for the master’s degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

To be eligible to take the final examination, a student’s GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student’s advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application can be accessed via the student's Howdy portal.**

The Degree of Master of Education

A graduate student majoring in agricultural leadership, education and communication; educational administration; educational curriculum and instruction; educational psychology; educational technology or health education may become a candidate for the degree of **Master of Education (MEd)**. This is a non-thesis degree which requires a minimum of 36 hours of coursework and a satisfactory comprehensive final examination.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Education degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must be from a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, thesis or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project, and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination or Request for Exemption from the Final Examination is approved.

Credit Requirement

A minimum of 36 semester credit hours of approved courses is required for the Master of Education degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply.

Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit. Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685 or 690 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

No specific language requirement exists for the Master of Education degree.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree must return to the campus for the final examination. The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F, or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

The candidate is not eligible to petition for an exemption from the final examination, except for a student in the Department of Educational Psychology. A request for permission to hold and announce the final examination **must be** submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination

date will be recorded as failures. A student may be given **only one** opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

A Master of Education student in the Department of Educational Psychology is eligible to petition for an exemption from the final examination with departmental and committee approval. The petition should be submitted to the Office of Graduate Studies by the deadline announced for the student's final semester (or semester of graduation) in the Office of Graduate Studies Calendar. See the Office of Graduate Studies website ogs.tamu.edu/current-students/dates-and-deadlines/.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Engineering

A student holding a Bachelor of Science degree in engineering or a qualified senior during the last semester may apply for admission to graduate studies to work toward the non-thesis degree of **Master of Engineering (MEng)**, majoring in his or her particular field of engineering. Approximately one-third of the required 30 credit hours of coursework will be taken in fields outside of the major field.

The work in the major field will include one or two written reports (not necessarily involving results of research conducted by the candidate).

Residence (See Residence Requirements, [page 33](#).)

No residence requirement exists; however, attention is directed to the rules regarding Limitations on the Use of Transfer, Extension and Certain Other Courses.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department or the department head's designee (e.g., departmental graduate advisor) concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the Master of Engineering

will consist of at least one member of the graduate faculty. Typically this member may be the departmental graduate advisor and will serve as the student's committee chair or, the departmental graduate advisor may appoint/approve another departmental faculty member to serve as the appropriate chair of the student's advisory committee. Depending on the departmental policy, additional committee members may be required. If additional committee members are deemed necessary by the department, the chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project, and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination. No exceptions are allowed.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination or Request for Exemption from Final Examination is approved.

Credit Requirement

A minimum of 30 semester credit hours of approved courses is required for the Master of Engineering degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 6 hours of 684 (Professional Internship) and/or
 - A maximum of 6 hours of 685 (Directed Studies), and

- Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. No credit hours of 691 (Research) may be used.
 9. Continuing education courses may not be used for graduate credit.
 10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

No specific language requirement exists for the Master of Engineering degree.

Internship

The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the "Office of Graduate Studies Calendar" unless the student has been exempted from the examination. **The Office of Graduate Studies must be notified in writing of any cancellation.** The candidate is eligible to petition for an exemption from the final examination with departmental or chair of intercollegiate faculty, if applicable, and committee approval. The approved petition should be submitted to the Office of Graduate Studies by the deadline announced for the student's final semester (or semester of graduation) in the Office of Graduate Studies Calendar. Please see the Office of Graduate Studies website at ogs.tamu.edu/current-students/dates-and-deadlines/.

To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

A request for permission to hold and announce the final examination **must be** submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. Thus, the makeup of the ceremony by colleges does change from semester to semester. Graduation times are posted each semester on the website of the Office of the Registrar. A student should check the website at graduation.tamu.edu/ceremon.html to determine the date and time of the graduation ceremony.

The Degree of Master of Fine Arts

The **Master of Fine Arts (MFA)** in Visualization is designed for a student seeking a computing technology-infused terminal degree in the visual arts applicable to employment in digital media fields, working as a contemporary artist, and teaching in post-secondary digital arts programs. The MFA in Visualization is a non-thesis degree requiring the completion of 60 hours of coursework and a satisfactory presentation of a

body of work by the candidate. A written document addressing issues pertinent to the final study is also required.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 18 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Fine Arts in Visualization degree. A minimum of 15 credit hours of 693 must be completed as resident hours. At most, Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and before completion of the first semester of the second year of course work, the student will consult with the graduate program coordinator or head of the department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of no fewer than three members of the graduate faculty representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and at least one or more of the members must have an appointment to a department other than the student's major department.

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campus at College Station may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional co-chair member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, thesis or professional paper and is registered for 684, 691, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the research proposal, the final presentation and written document. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicates their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college or degree program, and no later than 90 days prior to the date of the final presentation of the student's body of work.

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Proposal or Request for Exemption from the Final Proposal is approved.

Credit Requirement

A minimum of 60 semester credit hours of approved courses is required for the Master of Fine Arts in Visualization degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit. This is permissible if at the time the courses were completed, the student was in degree-seeking status at Texas A&M University or at the institution at which the courses were taken. Further, if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution, that coursework may be considered for transfer credit. Otherwise, the limitations stated in the preceding section apply. Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit. Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 15 hours or one-fourth (1/4) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 601, 684, 685, and 690 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 3 hours of 601 (Research Foundations) and/or
 - Up to 8 hours of 684 (Professional Internship) and/or
 - Up to 9 hours of 685 (Directed Studies) and
 - Up to 4 hours of 690 (Professional Practice).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 6 hours of advanced undergraduate courses (300- or 400-level).
6. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
7. No credit may be obtained by correspondence study.
8. Continuing education courses may not be used for graduate credit.
9. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Fine Arts in Visualization degree.

Internship

An internship is not required as part of the Master of Fine Arts in Visualization degree requirement in order for the student to graduate. A student can receive credit for up to 8 hours of internship.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework that is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Presentation and Written Document

The candidate must conduct a final presentation and submit a written document reflecting the presentation's content. This is done by dates announced each semester or summer term in the Office of Graduate Studies Calendar. The Office of Graduate Studies must be notified in writing of any cancellations. To be eligible to conduct the final presentation, a student's GPR must be at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree. There shall be no grades of D, F or U for any course listed on the degree plan. To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the presentation and written document.

The candidate is not eligible to petition for an exemption from the final presentation. A request for permission to hold and announce the final presentation must be submitted to the Office of Graduate Studies a minimum of 10 working days in advance of the scheduled date for the presentation. A presentation that is not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled presentation date(s) will be recorded as a failure. A student may be given only one opportunity to repeat the final presentation for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded).

The final presentation shall consist of a focused body of work resulting in an appropriate form of public dissemination that reflects the student's studies within his or her research studio. Such forms might include an exhibition, screening, or installation. Internet art does not satisfy this interactive, participatory, multi-media formats specific to the Internet. A written document addressing issues pertinent to the final study is also required. The written document must be prepared appropriately for publication submission to a peer-reviewed venue agreed upon with the chair. At an agreed upon time and date the student will make a formal presentation of the body of work to members of the graduate committee. Committee members will then meet privately to review the presentation (if relevant, all visitors must excuse themselves from the proceedings). A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her presentation and written document. If deemed successful by the advisory committee, the student will have completed the academic requirements for graduation.

Presentation and written document evaluation results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. The electronic application for degree can be accessed via the student's Howdy portal.

The Degree of Master of Geoscience

The College of Geosciences offers a non-thesis program that leads to the degree of **Master of Geoscience (MGsc)**. The degree is multidisciplinary, encompassing all aspects of the geosciences. This advanced degree program is especially appropriate for K–12 science teachers and public- and private-sector professionals working in the environmental field. It offers opportunities to study a broad range of environmental and geoscience topics. The program is not intended as a teacher-certification curriculum.

The Master of Geoscience degree is an undifferentiated college-wide degree which allows each department to offer the Master of Geoscience.

All documents submitted to the Office of Graduate Studies must be signed by the student's department head.

Residence (See Residence Requirements, [page 33](#).)

In partial fulfillment of the residence requirement for the degree of Master of Geoscience, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition must be approved, however, prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's "home" department. The "home" department must be one of the two areas of specialization comprising the major. **At least one or more of the members must have an appointment to a department other than the**

student's "home" department. The department head will sign the degree plan.

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Temple, Houston or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project, and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

The minimum requirements for the degree are 36 hours of coursework and a satisfactory final comprehensive oral examination. A student is required to take at least 18

hours of credit in Geosciences in two areas of specialization. The areas of specialization for this degree are Atmospheric Sciences, Geography, Geology and Geophysics and Oceanography. A specialization consists of at least 6 credit hours. In addition, a student is required to complete a 6 credit hour supporting field in a discipline other than the two specialization fields.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684 and 685 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:

- A maximum of 4 hours of 684 (Professional Internship) and
 - Up to 8 hours of 685 (Directed Studies).
4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. No credit hours of 690 (Theory of Research), 691 (Research) or 695 (Frontiers in Research) may be used.
 9. Continuing education courses may not be used for graduate credit.
 10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Geoscience degree.

Internship

The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** See the Office of Graduate Studies website at ogs.tamu.edu/current-students/dates-and-deadlines/. To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

The candidate is not eligible to petition for an exemption from the final examination. A request for permission to hold and announce the final examination **must be** submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and

reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given **only one** opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application can be accessed via the student's Howdy portal.**

The Degree of Master of Industrial Distribution

The Dwight Look College of Engineering offers a graduate program leading to the degree of **Master of Industrial Distribution (MID)**. Enrollment in MID classes is restricted to students who have been admitted to the MID program. The program of study has been designed for individuals within both manufacturing and industrial distribution companies.

The MID degree is a non-thesis degree for which a final oral examination is not required. The majority of MID courses are offered via web-based distance learning. New students are admitted in the fall semester only.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 6 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Industrial Distribution degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the MID Program Office concerning program structure and requirements. The MID student's "committee" consists of the Director of the MID Program Office. The Director has the responsibility for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

Degree Plan

The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college or by dates announced in the OGS calendar.

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the MID Program Director to correct deficiencies in the student's academic preparation.

Credit Requirement

A minimum of 30 semester credit hours of approved courses is required for the Master of Industrial Distribution degree.

Limitations on the Use of Transfer, Extension and Certain Other Courses

1. No transfer credit is allowed.
2. No credit may be obtained by correspondence study.
3. A maximum of 12 credit hours of 685 (Directed Studies) may be used with the approval of the MID Program Director.
4. A maximum of 3 hours of 689 (Special Topics) may be used with the approval of the MID Program Director.
5. A maximum of 3 hours of 693 (Professional Study) may be used with the approval of the MID Program Director.
6. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's program and approved by the Director of the Master of Industrial Distribution Program and the Office of Graduate Studies.

Transfer of Credit

No transfer of credit is allowed for the Master of Industrial Distribution degree.

Scholastic Requirements

To maintain good academic standing, an MID student must maintain a minimum cumulative 3.000 GPR each semester. If a student fails to attain a cumulative 3.000 GPR, he or she is placed on academic probation. A student on academic probation must raise his/her cumulative GPR to 3.000 or above by the end of the next 9 hours of coursework or within one calendar year, whichever comes first. If this requirement is not met, the MID Program Director will recommend that the Office of Graduate Studies block the student from further enrollment. If a student is blocked from further enrollment in the MID program, he or she shall not be permitted to enroll in other MID courses.

An MID student must attain a minimum cumulative 3.000 GPR on MID core courses.

Foreign Languages

A foreign language is not required for the Master of Industrial Distribution degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it was taken. Graduate credit for coursework which is more than seven calendar years old may not be used to satisfy degree requirements.

Final Examination

A final oral examination is not required for the Master of Industrial Distribution degree. Except as noted above, the requirements for the degree of Master of Industrial Distribution are identical with those for the degree of Master of Science.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master in International Affairs

The George Bush School of Government and Public Service offers a non-thesis program leading to the degree of **Master in International Affairs (MPIA)**. This program is designed for individuals planning careers in public international affairs. Courses are intended for those with such interests, and it enables a student to specialize in one of two career tracks: international economics and development and national security and diplomacy. The degree entails 48 credit hours of study.

The Master in International Affairs degree includes a core curriculum of five courses, a summer internship (or intensive language and cultural study) and a six-course specialization

in two selected areas of concentration. The professional nature of the program provides a curriculum taught by a multi-disciplinary faculty who also combine a mix of scholarly and professional international experience. The core curriculum includes seminars in leadership and public management in world affairs, international politics, global economics, research methods, and American foreign policy. In addition, all students participate in a final semester capstone project working as a team under the supervision of a faculty member to address a real world client's international problem. Capstone research culminates in a major written report to the client. Prerequisites exist for each of the two areas of concentration. The Bush School equips students having a disposition towards leadership and public service with the vital skills and knowledge critical for successful careers whether in government or non-governmental organizations. A foreign language background is not required for admission into the program. To graduate, however, a student must successfully pass a foreign language exam administered in accordance with the ratings of the American Council on the Teaching of Foreign Languages. For this test the student must demonstrate a minimal proficiency in speaking and comprehension at the established rating of "intermediate low."

The Bush School, in conjunction with the Economics department, also offers a dual degree program that enables students to receive both their Economics undergraduate degree and a Master of International Affairs (MPIA) degree in international economics and development in five years. Students admitted into this program will be enrolled in Bush School graduate courses with an undergraduate classification for the fall of their fourth year and will be re-classified as master's degree students upon completing 120 credit hours, typically following the second semester. To be eligible for the joint program, students must have a 3.25 GPA and completed the specific course prerequisites either for a Bachelor of Arts or a Bachelor of Science degree in Economics, as well as the courses required by the College of Liberal Arts and by Texas A&M University for an undergraduate degree by the end of their third year. Students who are admitted will complete the same two-year, 48-hour curriculum and language requirement as other students admitted to the Bush School's MPIA program.

The Bush School, in conjunction with the International Studies degree program in the College of Liberal Arts, also offers a dual degree program that enables students to receive both their International Studies undergraduate Bachelor of Arts degree and a Master of International Affairs graduate degree in five years. Students admitted to the joint degree program will have at least a 3.5 GPA, have taken all of their prerequisite courses within the politics and diplomacy emphasis track and have completed 96 hours by the fall of their fourth year. Students will be reclassified as master's degree students upon completing 120 credit hours, typically in the following semester. Admitted students are required to complete all courses required by the College of Liberal Arts and Texas A&M University for an undergraduate degree and the same 48 hour curriculum as other students admitted to the Bush School's Master's Degree in International Affairs.

For additional information on the international affairs degree at the Bush School, including requests for admissions materials, please contact: Bush School, Texas A&M University, 4220 TAMU, College Station, TX 77843-4220, email admissions@bush.tamu.edu or visit the website at bush.tamu.edu.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 hours of Texas A&M University resident credit to satisfy the residence requirement for the Master in International Affairs.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

The Bush School MIA student's advisory committee consists of the student's designated faculty advisor and the Program Director of the Bush School's MIA Program, who has the responsibility of approving the proposed degree plan for an MPIA student. The Program Director serves as chair. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than dates announced in the Office of Graduate Studies calendar of deadlines for graduation.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation.

Credit Requirement

A minimum of 48 semester credit hours of approved courses that include a core curriculum of six courses, a summer non-credit bearing internship and a specialized track of study, is required for the Masters Program in International Affairs.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses taken are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language background is not required for admission into the program. To graduate, however, a student must successfully pass a foreign language exam administered in accordance with the ratings of the American Council on the Teaching of Foreign Languages. For this test the student must demonstrate a minimal proficiency in speaking and comprehension at the established rating of "intermediate low."

Internship/Intensive Foreign Language and Cultural Study

During the summer term a student has the option of either participating in an internship related to his/her international career plans or enrolling in an intensive foreign language and cultural study. Internships in the United States or abroad provide practical experience in an organization or agency engaged in the conduct of some dimension of world affairs. A student who requires more preparation to successfully complete the foreign language test requirement may substitute enrollment in an approved immersion-type program of language instruction in place of the internship. A person who takes his/her language instruction at an institution other than Texas A&M University must obtain admission and cover all costs.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework that is more than seven calendar years old at the time of graduation may not be used to satisfy degree requirements.

Final Examination

The Bush School does not require a comprehensive final examination for completion of the Masters Program in International Affairs.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Land and Property Development

A student holding a baccalaureate degree may become a candidate for the degree of **Master of Land and Property Development (MLPD)**. This graduate program provides opportunities for individual and collaborative work. The minimum requirements for this degree are the completion of a minimum of 32 credit hours for the thesis track or 36 credit hours for the non-thesis track of coursework and satisfactory final examination.

An acceptable thesis is required for the Master of Land and Property Development degree for a student who selects the thesis option program.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the thesis option Master of Land and Property

Development. There is no residence requirement for the non-thesis Master of Land and Property Development; however, attention is directed to the rules regarding Limitations on the Use of Transfer, Extension and Certain Other Courses.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department or his delegate concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee.

Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree plan, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable. If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, thesis or professional paper and is registered for 684, 685, 689, 691, or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the research proposal, the thesis and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.** This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

A student submitting proposed degree plans for Master of Land and Property Development degrees should designate on the official degree plan form the program option desired by checking "thesis option" or "non-thesis option." Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination or Request for Exemption from the Final Examination is approved.

Credit Requirement

A minimum of 32 credit hours for the thesis track or 36 credit hours for the non-thesis track of coursework and satisfactory final examination is required for the Master of Land and Property Degree. An acceptable thesis is required for the Master of Land and Property Development degree for a student who selects the thesis option program.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University or at the institution at which the courses were taken, and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Non-Thesis Option

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree non-thesis option under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University or at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, and 693 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 3 hours of 684 (Professional Internship) and/or
 - Up to 8 hours of 685 (Directed Studies), or
 - Up to 3 hours of 693 (Professional Study).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Thesis Option

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree thesis option under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were

completed, the student was in degree-seeking status at Texas A&M University or at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.

- Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
 3. Any combination of 684, 685, 691 and 693 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours in the combination of 691 (Research) and 684 (Professional Internship) and/or
 - Up to 8 hours of 685 (Directed Studies), or
 - Up to 3 hours of 693 (Professional Study).
 4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. Continuing education courses may not be used for graduate credit.
 9. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Continuous Registration

A student in the thesis option of the Master of Land and Property Development program who has completed all coursework on his/her degree plan other than 691 (Research) is required to be in continuous registration until all requirements for the degree have been completed. Non-thesis option students are not required to be registered once they have completed all of the degree plan coursework. See Continuous Registration Requirements, [page 202](#).

Foreign Languages

A foreign language is not required for the Master of Land and Property Development degree.

Non-Thesis Option

A thesis is not required. A final comprehensive examination is required for the non-thesis Master of Land and Property Development program and no exemptions are allowed. The requirements as to level of courses and examinations are the same as for the thesis option Master of Land and Property Development. The final exam cannot be held prior to the midpoint of the semester if questions on the exam are based on courses in which the student is currently enrolled.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree must return to the campus for the final examination. **The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.**

Thesis Option

An acceptable thesis is required for the Master of Land and Property Development degree for a student who selects the thesis option program. The finished work must reflect a comprehensive understanding of the pertinent literature and express in clear English, the problem(s) for study, the method, significance and results of the student's original research. Guidelines for the preparation of the thesis are available in the Thesis Manual, which is available online at thesis.tamu.edu.

After successful defense (or exemption) and approval by the student's advisory committee and the head of the student's major department, the student must submit his/her thesis to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline. Deadline dates for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement). These dates also can be accessed via the website thesis.tamu.edu. Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at the Fiscal Department. After commencement, theses are digitally stored and made available through the Texas A&M Libraries. A thesis that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student's department head. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All original submittal deadlines must be met during the resubmittal process in order to graduate that semester.

Thesis Proposal

For the thesis option Master of Land and Property Development degree, the student must prepare a thesis proposal for approval by the advisory committee and the head of the major department. This proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the scheduling of the final examination. Compliance issues must be addressed if a graduate student is performing research involving human subjects, animals, infectious biohazards and recombinant DNA. A student involved in these types of research must check with the Research Compliance Division, Office of the Vice President for Research at (979) 845-8585 in order to ensure that he/she has met all compliance responsibilities. Additional information can also be obtained on the website researchcompliance.tamu.edu.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written)

may not be used to satisfy degree requirements. A student who has chosen the thesis option must have the final corrected copies of the thesis cleared by the Thesis Office no later than one year after the final examination, or approval of a petition for exemption from the final exam, or within the seven-year time limit, whichever occurs first. Failure to do so will result in the degree not being awarded.

Thesis Defense/Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, For U can occur for any course listed on the degree plan.**

To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. A student in the thesis option must have an approved thesis proposal on file in the Office of Graduate Studies. A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies **a minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given **only one** opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded).

The final examination covers the thesis and all work taken on the degree plan and at the option of the committee may be written or oral or both. For a student in the thesis option, the final examination may not be administered before the thesis is available to all members of the student's advisory committee in substantially final form, and all members have had adequate time to review the document. For a student in the non-thesis option, no examination may be held prior to the mid-point of the semester or summer term in which a student will complete all remaining courses on the degree plan. The examination is conducted by the student's advisory committee as finally constituted. Thesis-option a student must be registered in the University in the semester or summer term in which the final examination is taken.

Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings.

A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department. Thesis-option candidates may petition to be exempt from their final examination provided their degree plan GPR is 3.500 or greater and they have the approval of the advisory committee, the head of the student's major department and

the Office of Graduate Studies. It is recommended that the petition for exemption be submitted the same semester the student intends to submit the thesis.

A non-thesis option student cannot be exempted from the final examination. Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. A student should check the website of the Office of the Registrar at graduation.tamu.edu/ceremony.html to determine the date and time of his/her graduation ceremony.

The Degree of Master of Landscape Architecture

The College of Architecture offers a non-thesis program leading to the degree of **Master of Landscape Architecture (MLA)**. The degree requires the completion of a minimum of 45 hours of coursework and a satisfactory comprehensive final examination.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Landscape Architecture degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, professional paper and is registered for 684, 685 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 45 semester credit hours of approved courses is required for the Master of Landscape Architecture degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - Up to 4 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).

5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Landscape Architecture degree.

Internship

An internship is required as part of the Master of Landscape Architecture degree requirement in order for the student to graduate. The internship requirement may be met as a "full summer work internship" or a "Fall or Spring internship." Students who complete an internship during the fall or spring semester should register for Land 684 credit. Internships completed during the summer are reported as "summer work" and students should report it to the Coordinator of the MLA program. **The final examination is not to be administered until all requirements for the degree, including any internship, have been substantially completed.**

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellations.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

The candidate is not eligible to petition for an exemption from the final examination. A request for permission to hold and announce the final examination **must be** submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. An examination which is not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as a failure. A student may be given **only one** opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided exists is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Natural Resources Development

The **Master of Natural Resources Development (MNRD)** degree is designed for a student who wants professional graduate training with a management orientation in natural resources. It is intended to emphasize the problem solving skills involved in the use of science and technology to benefit humanity, not as a research degree.

Individuals with a baccalaureate degree from a college or university of recognized standing, or qualified Texas A&M University seniors during their last semester, may apply for admission to graduate studies to pursue the non-thesis degree of Master of Natural Resources Development. The candidate's advisory committee shall specify prerequisite work where necessary.

The student must demonstrate problem solving capabilities. Degree candidates may gain such capabilities by completing a professional internship that is designed to provide meaningful, applied, practical experiences, and which may vary in duration from three to nine months depending upon departmental requirements.

The degree may be earned in the Departments of Ecosystem Science and Management, Recreation, Park and Tourism Sciences, and Wildlife and Fisheries Sciences in the College of Agriculture and Life Sciences. It is possible for working professionals to earn this degree via distance education.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Natural Resources Development degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of his or her major or administrative department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campus at College Station or Galveston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or record of study and is registered for 684 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the professional paper and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 36 hours is required for the Master of Natural Resources Development degree. Approximately 12 credit hours are to be taken outside of the student's degree option.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply.
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 693 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 693 (Professional Studies).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Natural Resources Development degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellations.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination. Master of Natural Resources Development degree candidates do not qualify to petition for an exemption from their final examination.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

A professional paper, which is a scholarly report of a problem solving nature, will be prepared by each student. The professional paper must be submitted to the student's advisory committee for approval prior to the final examination. The final examination will cover all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as formally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Peace Corps Masters International Program

The **Peace Corps Masters International Program (MI)** is designed to allow a student to complement the coursework for a master's degree with related overseas service in one of the more than 60 countries where the Peace Corps serves.

A student studying for a Master of Science, Master of Agriculture, Master of Education, Master of Wildlife Science, Master of Natural Resource Development, or Master of Engineering in 12 participating departments of the College of Agriculture and Life Sciences' 14 academic departments can earn 4–12 credit hours for his/her Peace Corps service of his/her degree program's 32–36 required credit hours. A student studying in five interdisciplinary areas—agribusiness, genetics, molecular and environmental plant sciences, and water management and hydrological sciences—is also eligible for the MI program.

A student wishing to participate in this program should apply for admission into graduate school at Texas A&M University. Upon receiving acceptance into graduate school, they should apply to the Peace Corps and for acceptance into the Peace Corps Master's International Program in the College of Agriculture and Life Sciences. Materials sent to the MI Program Coordinator are in addition to materials required and submitted as part of the application for Texas A&M graduate programs and include: copy of the Peace Corps application, copy of the graduate school application, essay on why the student wishes to take part in the MI program and Peace Corps, resume including past international experience and language capability, and three references.

Applicants to the MI program must demonstrate problem solving capabilities, self reliance, and a willingness to learn from other cultures as well as serve. Language studies are not required but will be viewed favorably by reviewers.

The Degree of Master of Public Service and Administration

The George Bush School of Government and Public Service offers an interdisciplinary, non-thesis program leading to the **Master of Public Service and Administration (MPSA)** degree. The MPSA curriculum provides a professional education for those seeking careers at any level of government or in the nonprofit sector. It includes a solid academic and practical grounding in management and policy analysis, as well as an opportunity to refine critical leadership skills such as team building, motivation, conflict resolution, and effective written and oral communication.

The MPSA program offers a two-year, full-time course of study in one of two tracks: Public Management or Public Policy Analysis. In addition, students have the option to choose a concentration in a substantive area such as non-profit management; state and local policy and management; energy, environment, and technology policy and management; security policy and management; and health policy and management. The program includes a non-credit-bearing internship and two semesters of capstone policy seminars which give students the opportunity to apply their knowledge and skills to a real-world problem or issue.

The Master of Public Service and Administration Program, in conjunction with the Political Science, Economics, and Sociology departments, also offers dual degree programs which enable students to receive a Political Science, Economics, or Sociology undergraduate degree and a Master of Public Service and Administration (MPSA) degree in five years. Students admitted into one of the dual degree programs will be enrolled in Bush School graduate courses with an undergraduate classification for the fall of their fourth year. They will be reclassified as a graduate student upon completing 108 credit hours, typically the following semester. To be eligible for admission into a dual degree program, students must have a GPA of at least 3.25 and must have completed the specific course prerequisites either for a Bachelor of Arts or a Bachelor of Science degree in Political Science, Economics, or Sociology, as well as the courses required by the College of Liberal Arts and by Texas A&M University for an undergraduate degree by the end of their third year. Students who are admitted into the dual degree program will complete the same two-year, 48-hour curriculum as other students admitted to the Bush School's MPSA program.

For further information about the Bush School, including requests for admission materials, please contact: Bush School, Texas A&M University, 4220 TAMU, College Station, TX 77843-4220, email admissions@bush.tamu.edu or on the website bush.tamu.edu.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Public Service and Administration degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

The Bush School MPSA student's advisory committee consists of the student's designated faculty advisor and the Program Director of the Bush School's MPSA Program, who has the responsibility of approving the proposed degree plan for an MPSA student. The Program Director serves as chair. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than the dates announced in the OGS calendar of deadlines for graduation.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdps.tamu.edu.

Credit Requirement

A minimum of 48 semester credit hours of approved courses are required for the Master of Public Service and Administration Program: five common courses, two track core courses, two track elective courses, five additional elective courses, two capstone policy seminar courses, and non-credit-bearing internship.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater, **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree

for a student in degree-seeking status at the host institution.

- Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
 3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
 4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. No credit hours of 691 (Research) may be used.
 9. Continuing education courses may not be used for graduate credit.
 10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Public Service and Administration degree.

Internship

During the summer between their first and second year, a student participates in a non-credit-bearing internship related to his/her career plans. The internship requirement can be waived if the student has at least two years of recent professional-level public service experience related to his/her career goals and to the degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old may not be used to satisfy degree requirements.

Final Examination

A final comprehensive examination is not required for the Master of Public Service and Administration.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Real Estate

Through its Department of Finance, the Mays Business School offers a non-thesis program leading to the degree of Master of Real Estate (MRE). This program of study in the Mays Business School uses appropriate education offerings throughout the University.

This professional curriculum is primarily designed to provide broad preparation for the practice of commercial real estate consulting, valuation, brokerage, development, lending and capital markets, investment, asset management and corporate real estate. In addition, a student may avail himself/herself of traditional University strengths in a wide range of supporting areas and departments to prepare for careers in these fields.

Most holders of a bachelor's degree in business administration will normally be prepared to go directly into graduate courses leading to the MRE degree. Others may be required to take preprofessional courses to fulfill prerequisites and the Common Body of Knowledge (CBK) requirements.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Real Estate degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

The MRE student's advisory committee consists of the **Director of Real Estate Programs or the Head of the Department of Finance within Mays Business School**. The Director or Department Head has the responsibility of approving the proposed degree plan for the MRE students. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies.

Degree Plan

The degree plan must be completed and processed by the Mays MRE Program office and filed with the Office of Graduate Studies following the deadline imposed by the student's college and no later than dates announced in the OGS calendar of

deadlines for graduation. It is recommended that students who are planning to take additional courses after the completion of the Mays MRE core courses meet with the academic counselor in the Mays MRE Program office. Additional coursework may be added to the approved degree plan by petition.

Credit Requirement

A minimum of 37 semester credit hours of approved courses is required for the Master of Real Estate degree. Elective courses beyond the 3 semester credit hours included in the program would add to the total number of hours in the program.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater, might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.

2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 3 hours of 684 (Professional Internship) and/or
 - Up to 4 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Real Estate degree.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree must return to the campus for an examination. An examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

A final oral examination is not required for the Master of Real Estate degree.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required

graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Recreation and Resources Development

The **Master of Recreation and Resources Development (MRRD)** degree is designed for a student who wants professional graduate training with a management orientation in recreation resources. It is intended to emphasize the problem solving skills involved in the use of science and technology to benefit humanity, not as a research degree.

Individuals with a baccalaureate degree from a college or university of recognized standing, or qualified Texas A&M University seniors during their last semester, may apply for admission to graduate studies to pursue the non-thesis degree of Master of Recreation and Resources Development. The candidate's advisory committee shall specify prerequisite work where necessary.

The student must demonstrate problem solving capabilities. Degree candidates may gain such capabilities by completing a professional internship that is designed to provide meaningful, applied, practical experiences, and which may vary in duration from three to nine months depending upon departmental requirements.

The degree may be earned in the Recreation, Park and Tourism Sciences department in the College of Agriculture and Life Sciences.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Recreation and Resources Development degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of his or her major or administrative department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine

whether he or she is willing to serve. Only graduate faculty members located on the campus at College Station may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or record of study and is registered for 684 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the professional paper and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 36 hours is required for the Master of Recreation and Resources Development degree. Approximately 12 credit hours are to be taken outside of the student's degree option.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater, **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply.
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 693 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), and
 - Up to 3 hours of 693 (Professional Studies).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).

6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Recreation and Resources Development degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellations.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination. A candidate for the Master of Recreation and Resources Development degree does not qualify to petition for an exemption from the final examination.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

A professional paper, which is a scholarly report of a problem solving nature, will be prepared by each student. The professional paper must be submitted to the student's advisory committee for approval prior to the final examination. The final examination will cover all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as formally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. Cancellations made after the application deadline will not receive a refund of the diploma fee. Students who have completed all of their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Science in Engineering Systems Management

Through the departments of Industrial and Systems Engineering and Information and Operations Management, the **Master of Science—Engineering Systems Management (MS)** degree is offered under the joint auspices of the Dwight Look College of Engineering and the Mays Business School. The program is non-thesis, interdisciplinary and jointly administered by the Engineering and Business faculty to provide a student with comprehensive assemblage of manufacturing management skills.

The engineering systems management issues begin with product design continuing to manufacturing, inspection and acceptance, shipping, maintenance and product disposal. The curriculum for the Engineering Systems Management program is unique and covers a broad set of both engineering and business topics, including advanced manufacturing technology, total quality management, an engineering systems management approach to product design, production, distribution and disposal, and to interrelation with the other functional areas of the organization.

The minimum requirements for this degree are the completion of at least 36 hours of coursework and a satisfactory internship review, provided by the student's industry

sponsor. Internships must have prior approval by the program administration. Also central to the curriculum is a number of opportunities for hands-on practice-oriented learning. An internship is required of **all** students; normally this will occur in the summer after completing two semesters in the program. The purpose of this internship is twofold. First, to provide an online laboratory setting in which a student can apply concepts and techniques learned during the first segment of the program; and to provide material for a formal project report and case study analysis to be presented in courses taken during the second segment of the program.

Residence (See Residence Requirements, [page 33](#).)

In partial fulfillment of the residence requirement for the degree of Master of Science, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition must be approved, however, prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the chair of the intercollegiate faculty concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the intercollegiate faculty, and **at least one or more of the members must have an appointment to a department other than the chair's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual from the intercollegiate faculty. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdps.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation.

Credit Requirement

A minimum of 36 semester credit hours of approved courses is required for the Master of Science in Engineering Systems Management degree. Twelve credit hours of elective courses, and up to 12 hours of foundation tool courses, depending on the student's background, can be selected to support specific student needs.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater, might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from

any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 4 hours of 684 (Professional Internship) and/or
 - Up to 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), or
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Science in Engineering Systems Management degree.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree must return to the campus for the final examination. **The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.**

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F, or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

The candidate is not eligible to petition for an exemption from the final examination. A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given **only one** opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote

by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. An interdisciplinary degree program can have stricter requirements provided there is consistency within the interdisciplinary degree program.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.** A graduate student in Engineering Systems Management should attend the ceremony of the Dwight Look College of Engineering.

The Degree of Master of Urban Planning

A student holding the baccalaureate degree may become a candidate for the degree of **Master of Urban Planning (MUP)**. This two-year interdisciplinary program provides opportunities for individual and collaborative work. The minimum requirements for this degree are the completion of 48 hours of coursework and a satisfactory final examination. An acceptable thesis is required for the Master of Urban Planning degree for a student who selects the thesis option program.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the thesis option Master of Urban Planning. There is no residence requirement for the non-thesis Master of Urban Planning; however, attention is directed to the rules regarding Limitations on the Use of Transfer, Extension and Certain Other Courses.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of the department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty**

representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. The chair of the committee, who usually has immediate supervision of the student's research and thesis, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship, thesis or professional paper and is registered for 684, 691, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the research proposal, the thesis and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadlines imposed by the student's college, and no later than 90 days prior to the date of the final oral examination.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

A student submitting proposed degree plans for Master of Urban Planning degrees should designate on the official degree plan form the program option desired by checking "thesis option" or "non-thesis option."

Additional coursework may be added to the approved degree plan by petition if it

is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination or Request for Exemption from the Final Examination is approved.

Credit Requirement

A minimum of 48 semester credit hours of approved courses is required for the Master of Urban Planning Degree.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. **Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Non-Thesis Option

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree non-thesis option under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University or at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6)

classification at Texas A&M University which may be considered for application to the degree plan is 12.

3. Any combination of 684, 685, 690 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 2 hours of 684 (Professional Internship) and/or
 - Up to 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), or
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No credit hours of 691 (Research) may be used.
9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Thesis Option

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree thesis option under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University or at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684, 685, 690, 691 and 695 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours in the combination of 691 (Research) and 684 (Professional Internship) and/or
 - Up to 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), or
 - Up to 3 hours of 695 (Frontiers in Research).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
6. No credit may be obtained by correspondence study.

7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. Continuing education courses may not be used for graduate credit.
9. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Continuous Registration

A student in the thesis option of the Master of Urban Planning program who has completed all coursework on his/her degree plan other than 691 (Research) is required to be in continuous registration until all requirements for the degree have been completed. Non-thesis option students are not required to be registered once they have completed all of the degree plan coursework. See Continuous Registration Requirements, [page 202](#).

Foreign Languages

A foreign language is not required for the Master of Urban Planning degree.

Non-Thesis Option

A thesis is not required. A final comprehensive examination is required for the non-thesis Master of Urban Planning program and no exemptions are allowed. The requirements as to level of courses and examinations are the same as for the thesis option Master of Urban Planning degree.

The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

Internship

A student who undertakes a professional internship in partial fulfillment of master's degree requirements after completing all course requirements for the master's degree **must return to the campus for the final examination. The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.**

Thesis Option

An acceptable thesis is required for the Master of Urban Planning degree for a student who selects the thesis option program. The finished work must reflect a comprehensive understanding of the pertinent literature and express in clear English, the problem(s) for study, the method, significance and results of the student's original research. Guidelines for the preparation of the thesis are available in the *Thesis Manual*, which is available online at thesis.tamu.edu.

After successful defense (or exemption) and approval by the student's advisory committee and the head of the student's major department, the student must submit his/her thesis to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline.

Deadline dates for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement). These dates also can be accessed via the website thesis.tamu.edu.

Before a student can be “cleared” by the Thesis Office, a processing fee must be paid at the Fiscal Department. After commencement, theses are digitally stored and made available through the Texas A&M Libraries.

A thesis that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student’s department head. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All original submittal deadlines must be met during the resubmittal process in order to graduate that semester.

Thesis Proposal

For the thesis option Master of Urban Planning degree, the student must prepare a thesis proposal for approval by the advisory committee and the head of the major department. This proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the scheduling of the final examination.

Compliance issues must be addressed if a graduate student is performing research involving human subjects, animals, infectious biohazards and recombinant DNA. A student involved in these types of research must check with the Research Compliance Division, Office of the Vice President for Research at (979) 845-8585 in order to ensure that he/she has met all compliance responsibilities. Additional information can also be obtained on the website researchcompliance.tamu.edu.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

A student who has chosen the thesis option must have the final corrected copies of the thesis cleared by the Thesis Office no later than one year after the final examination, or approval of a petition for exemption from the final exam, or within the seven-year time limit, whichever occurs first. Failure to do so will result in the degree not being awarded.

Thesis Defense/Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** To be eligible to take the final examination, a student’s GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, For U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. A student in the

thesis option must have an approved thesis proposal on file in the Office of Graduate Studies.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given **only one** opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded).

The final examination covers the thesis and all work taken on the degree plan and at the option of the committee may be written or oral or both. For a student in the thesis option, the final examination may not be administered before the thesis is available to all members of the student's advisory committee in substantially final form, and all members have had adequate time to review the document. For a student in the non-thesis option, no examination may be held prior to the mid-point of the semester or summer term in which a student will complete all remaining courses on the degree plan. The examination is conducted by the student's advisory committee as finally constituted. Thesis-option a student must be registered in the University in the semester or summer term in which the final examination is taken. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Thesis-option candidates may petition to be exempt from their final examination provided their degree plan GPR is 3.500 or greater and they have the approval of the advisory committee, the head of the student's major department and the Office of Graduate Studies. It is recommended that the petition for exemption be submitted the same semester the student intends to submit the thesis. A non-thesis option student cannot be exempted from the final examination.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to

cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.**

The Degree of Master of Water Management

The **Master of Water Management (MWM)** is a non-thesis degree designed to prepare a student for a career in the critically important areas of water management and hydrology. It is structured to enhance problem solving and technical skills along with managerial principles. The degree program integrates an interdisciplinary curriculum with an intercollegiate faculty. Program administration includes a Council of Participating Deans, Program Chair and Faculty of Water Management and Hydrological Science. It is a degree combining principles from economics, engineering, management, policy analysis and science and requires the completion of a minimum of 36 hours of coursework and a satisfactory comprehensive final exam. This approach provides a student with the necessary education and training to enable him/her to contribute to advancements in managing water quality and quantity for the world, the nation and the State of Texas.

An individual with a baccalaureate degree, or a qualified senior in his/her last semester may apply for admission to the program. Because of the combination of professional, science and technical classes, prerequisites may be required before a student can take the core curriculum and common body of knowledge courses.

Residence (See Residence Requirements, [page 33](#).)

In partial fulfillment of the residence requirement for the degree of Master of Water Management, the student must complete 9 resident credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student's advisor committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition must be approved, however, prior to the student's registration for the final 9 credit hours of required coursework.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to the graduate studies and enrolling for coursework, the student will consult with the graduate coordinator concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty**. The chair or one of the co-chairs of the advisory committee must be from the Water Management and Hydrological Science faculty. At least one or more of the members must be from an academic program other than Water Management and Hydrological Science.

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members from the faculty of Water Management and Hydrological Science may serve as chair of a student's advisory committee. Other graduate faculty members may serve as co-chair with an

individual from the Water Management and Hydrological Science faculty. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the Program Chair appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, any professional study or project, and the final examination. In addition, the committee, as a group and as individual members, are responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. The degree plan must be completed and filed with the Office of Graduate Studies prior to the second semester of registration, and no later than 90 days prior to the date of the final oral examination.

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

The minimum requirements for the degree are 36 hours of coursework and a satisfactory final comprehensive oral examination. A student is required to complete 8 hours of required core water courses, 12 hours of common body of knowledge courses, 12–15 hours of designated electives, and 4–8 hours of free electives.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence

at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations:

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses, taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.
 - Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
3. Any combination of 684 and 685 may not exceed a total of 6 credit hours.
 - A maximum of 4 hours of 684 (Professional Internship); and
 - Up to 6 hours of 685 (Directed Studies).
4. A maximum of 2 hours of Seminar (681).
5. A maximum of 9 hours of advanced undergraduate courses (400-level).
6. No credit may be obtained by correspondence study.
7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
8. No more than 3 credit hours of 690 (Theory of Research) or 695 (Frontiers in Research) may be used.

9. Continuing education courses may not be used for graduate credit.
10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master in Water Management degree.

Internship

The final examination is not to be administered until all other requirements for the degree, including any internship, have been substantially completed.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellations.** See the Office of Graduate Studies website ogs.tamu.edu/current-students/dates-and-deadlines/. To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency requirements must be satisfied prior to scheduling the examination.

The candidate is not eligible to petition for an exemption from the final examination. A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

The final examination covers all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the

graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. An interdisciplinary degree program can have a stricter requirement provided there is consistency within the interdisciplinary program.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. Thus, the make-up of the ceremony by colleges does change from semester to semester. Graduation times are posted each semester on the website of the Office of the Registrar. A student should check the website at graduation.tamu.edu/ceremon.html to determine the date and time of the graduation ceremony.

The Degree of Master of Wildlife Science

The **Master of Wildlife Science (MWSC)** degree is designed for a student who wants professional graduate training with a management or policy orientation in wildlife or natural resources. It is intended to emphasize the problem solving skills involved in the use of science and technology to benefit humanity, not as a research degree.

An individual with a baccalaureate degree from a college or university of recognized standing or qualified Texas A&M University seniors during his/her last semester may apply for admission to graduate studies to pursue the non-thesis degree of Master of Wildlife Science. The candidate's advisory committee shall specify prerequisite work where necessary.

The student must demonstrate problem solving capabilities. Degree candidates may gain such capabilities by completing a professional internship that is designed to provide meaningful, applied, practical experiences, and which may vary in duration from three to nine months depending on departmental requirements.

It is possible for working professionals to fulfill the degree requirements for the Master of Wildlife Science via distance education. The degree may be earned in the Department of Wildlife and Fisheries Sciences.

Residence (See Residence Requirements, [page 33](#).)

A student must complete 12 credit hours of Texas A&M University resident credit to satisfy the residence requirement for the Master of Wildlife Science degree.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling for coursework, the student will consult with the head of his or her major or administrative department concerning appointment of the chair of his or her advisory committee. The student's advisory committee for the master's degree will consist of **no fewer than three members of the graduate faculty** representative of the student's fields of study and research. The chair or one of the co-chairs of the advisory committee must be from the student's department, and **at least one or more of the members must have an appointment to a department other than the student's major department.**

The chair, in consultation with the student, will select the remainder of the advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members located on the campuses at College Station or Galveston, may serve as chair of a student's advisory committee. Other graduate faculty members, including The Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station or Galveston. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

If the chair of the student's advisory committee is unavailable for an extended time in any academic period during which the student is involved in activities relating to an internship or professional paper and is registered for 684, 692 or 693 courses, the student may request, in writing, that the department head appoint an alternate advisory committee chair during the interim period.

The duties of the committee include responsibility for the proposed degree plan, the professional paper and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

The committee members' approval on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*.

Degree Plan

The student's advisory committee, in consultation with the student, will develop the proposed degree plan. **The degree plan must be completed and filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the date of the final oral examination or thesis defense.**

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

Additional coursework may be added to the approved degree plan by petition if it is deemed necessary by the advisory committee to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Credit Requirement

A minimum of 36 hours is required for the Master of Wildlife Science degree. Approximately 12 credit hours are to be taken outside of the student's degree option.

Transfer of Credit

A student who has earned 12 hours of graduate credit in residence at Texas A&M University may be authorized to transfer courses in excess of the limits prescribed above upon the advice of the advisory committee and with the approval of the Office of Graduate Studies. Graduate and/or upper-level undergraduate courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater **might** be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Otherwise, the limitations stated in the preceding section apply. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. An official transcript from the university at which the transfer coursework was taken must be sent directly to the Office of Admissions.

Grades for courses completed at other institutions are not included in computing the GPR, with the exception of courses taken at the Texas A&M Health Science Center.

Limitations on the Use of Transfer, Extension and Certain Other Courses

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The maximum number of credit hours which may be considered for transfer credit is the greater of 12 hours or one-third (1/3) of the total hours of a degree plan. The following restrictions apply:
 - Graduate and/or upper-level undergraduate courses, taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses

were taken; and if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution.

- Courses previously used for another degree are not acceptable for degree plan credit.
2. The maximum number of credit hours taken in post-baccalaureate non-degree (G6) classification at Texas A&M University which may be considered for application to the degree plan is 12.
 3. Any combination of 684, 685, 690 and 693 may not exceed 25 percent of the total credit hour requirement shown on the individual degree plan:
 - A maximum of 8 hours of 684 (Professional Internship) and/or
 - A maximum of 8 hours of 685 (Directed Studies), and
 - Up to 3 hours of 690 (Theory of Research), or
 - Up to 3 hours of 693 (Professional Studies).
 4. A maximum of 2 hours of Seminar (681).
 5. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
 6. No credit may be obtained by correspondence study.
 7. For graduate courses of three weeks' duration or less, taken at other institutions, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
 8. No credit hours of 691 (Research) may be used.
 9. Continuing education courses may not be used for graduate credit.
 10. Extension courses are not acceptable for credit.

Exceptions will be permitted only in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Foreign Languages

A foreign language is not required for the Master of Wildlife Science degree.

Time Limit

All degree requirements must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old at the time of the final examination (oral or written) may not be used to satisfy degree requirements.

Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. **The Office of Graduate Studies must be notified in writing of any cancellation.** To be eligible to take the final examination, a student's GPR must be **at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and no unabsolved grades of D, F or U can occur for any course listed on the degree plan.** To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English language proficiency

requirements must be satisfied prior to scheduling the examination. Master of Wildlife Science degree candidates do not qualify to petition for an exemption from their final examination.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). The final exam cannot be held prior to the mid point of the semester if questions on the exam are based on courses in which the student is currently enrolled.

A professional paper, which is a scholarly report of a problem solving nature, will be prepared by each student. The professional paper must be submitted to the student's advisory committee for approval prior to the final examination. The final examination will cover all work taken on the degree plan and at the option of the committee may be written or oral or both. The examination is conducted by the student's advisory committee as finally constituted. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal**

The Degree of Doctor of Philosophy

Work leading to the degree of **Doctor of Philosophy (PhD)** is designed to give the candidate a thorough and comprehensive knowledge of his or her professional field and training in methods of research. The final basis for granting the degree shall be the candidate's grasp of the subject matter of a broad field of study and a demonstrated

ability to do independent research. In addition, the candidate must have acquired the ability to express thoughts clearly and forcefully in both oral and written languages. The degree is not granted solely for the completion of coursework, residence and technical requirements, although these must be met.

For a student who has completed a master's degree, a DVM or MD at a U.S. institution, a minimum of 64 hours is required on the degree plan for the degree of Doctor of Philosophy. For a student who has completed a baccalaureate degree but not a master's degree or a U.S. DVM or MD, a minimum of 96 hours is required on the degree plan for the degree of Doctor of Philosophy.

A student who is pursuing the Doctor of Philosophy in philosophy, who does not already hold a graduate degree in a field other than philosophy, must pursue concurrently a master's degree at Texas A&M University in a supporting field. The supporting master's degree program must be completed in accordance with the requirements stipulated above for that program. This student's doctoral degree plans will carry a minimum of 64 hours. (See the Department of Philosophy and Humanities, [page 513](#).)

Residence (See Residence Requirements, [page 33](#).)

A student who enters the doctoral degree program with a baccalaureate degree must spend one academic year plus one semester in resident study. A student who holds master's degree when he/she enters doctoral degree program must spend one academic year in resident study. One academic year may include two adjacent regular semesters or one regular semester and one adjacent 10-week summer semester. The third semester is not required to be adjacent to the one year. Enrollment for each semester must be a minimum of 9 credit hours each to satisfy the residence requirement.

To satisfy the residence requirement, the student must complete a minimum of 9 credit hours per semester or 10-week summer semester for the required period. A student who enters a doctoral degree programs with a baccalaureate degrees may fulfill residence requirements in excess of one academic year (18 credit hours) by registration during summer sessions or by completion of a less-than-full course load (in this context a full course load is considered 9 credit hours per semester).

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies. An employee should submit verification of his/her employment at the time he/she submits the degree plan. See Registration, [page 201](#).

Time Limit

All requirements for doctoral degrees (except for Mays Business School) must be completed within a period of ten consecutive calendar years for the degree to be granted. For Mays Business School time limit, see the following section. A course will be considered valid until 10 years after the end of the semester in which it is taken. Graduate credit for coursework more than ten calendar years old at the time of the final oral examination may not be used to satisfy degree requirements.

After passing the required preliminary oral and written examinations for a doctoral degree, the student must complete the final examination within four calendar years. Otherwise, the student will be required to repeat the preliminary examination.

A final corrected version of the dissertation or record of study in electronic format as a single PDF file must be cleared by the Thesis Office no later than one year after the final examination or within the 10-year time limit, whichever occurs first. Failure to do so will result in the degree not being awarded.

The Degree of Doctor of Philosophy—Mays Business School

Work leading to the degree of **Doctor of Philosophy (PhD) in Mays Business School** is designed to give a candidate thorough and comprehensive knowledge of his or her professional field and training in methods of research. **Mays exceptions to the University requirements include:** a) all requirements for the doctoral degree must be completed within a period of **five** consecutive calendar years for the degree to be granted; b) a course will be considered valid until **five** years after the end of the semester in which it is taken and credit for coursework more than **five** calendar years old at the time of the final oral examination may **not** be used to satisfy degree requirements; and c) a final corrected version of the dissertation or record of study in electronic format as a single PDF file must be cleared by the Thesis Office no later than one year after the final examination or within the five year time limit, whichever occurs first. Failure to do so will result in the degree not being awarded.

Guidelines for the preparation of the dissertation are available in the *Thesis Manual*, which is available online at thesis.tamu.edu. After successful defense and approval by the student's advisory committee and the head of the student's major department (or Chair of the Intercollegiate Faculty, if appropriate), a student must submit his/her dissertation to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website at thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline.

99-Hour Cap on Doctoral Degrees

In Texas, public colleges and universities are funded by the state according to the number of students enrolled. In accordance with legislation passed by the Texas Legislature, the number of hours for which state universities may receive subvention funding at the doctoral rate for any individual is limited. Texas A&M University and other universities will not receive subvention for hours in excess of the limit.

The law affected Texas A&M for the first time in the fall semester of 1994 with a limit of 130 hours. The most recent action by the Legislature in spring of 1997 reduced that limit to 100 hours. This change in state funding became effective in September 1999. When the Legislature passed the "cap," however, it considered the potential loss of funding and voted to allow institutions of higher education to charge the equivalent of nonresident tuition to a resident doctoral student who has enrolled in 100 or more semester credit hours of doctoral coursework.

A doctoral student at Texas A&M has seven years to complete his/her degree before being charged out-of-state tuition. A doctoral student who, after seven years of study, has accumulated 100 or more doctoral hours will be charged tuition at a rate equivalent to out-of-state tuition. Please note that the tuition increases will apply to Texas residents as well as students from other states and countries who currently are charged tuition at the resident rate. This includes those doctoral students who hold GAT, GANT, and GAR appointments of 20 or more hours and recipients of competitive fellowships who receive more than \$1,000 per semester. Doctoral students who, after seven years of study, have

not accumulated 100 hours are eligible to pay in-state tuition if otherwise eligible.

For count purposes, a year is counted as three semesters, normally fall, spring and summer. Using this system, a student is allowed 21 semesters as a G8 student to complete the doctoral degree before being penalized with the higher tuition rate. Any semester in which a G8 student is enrolled for a doctoral level course is counted.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling, the student will consult with the head of his or her major or administrative department (or chair of the intercollegiate faculty) concerning appointment of the chair of the advisory committee. The student's advisory committee will consist of **no fewer than four members of the graduate faculty** representative of the student's several fields of study and research, where the chair or co-chair must be from the student's department (or intercollegiate faculty, if applicable), and **at least one or more of the members must have an appointment to a department other than the student's major department.** The outside member for a student in an interdisciplinary degree program must be from a department different from the chair of the student's committee.

The chair, in consultation with the student, will select the remainder of the advisory committee. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other Texas A&M University graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple or Galveston. If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

The committee members' signatures on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign *en masse*. The chair of the committee, who usually has immediate supervision of the student's research and dissertation or record of study, has the responsibility for calling all meetings of the committee. The duties of the committee include responsibility for the proposed degree plan, the research proposal, the preliminary examination, the dissertation or record of study and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

Degree Plan

The student's advisory committee will evaluate the student's previous education and degree objectives. The committee, in consultation with the student, will develop a proposed degree plan and outline a research problem which, when completed, as indicated by the dissertation (or its equivalent for the degree of Doctor of Education or the degree of Doctor of Engineering), will constitute the basic requirements for the degree. **The degree plan must be filed with the Office of Graduate Studies prior to**

the deadline imposed by the student's college and no later than 90 days prior to the preliminary examination.

This proposed degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpps.tamu.edu. A minimum of 64 hours is required on the degree plan for the Doctor of Philosophy for a student who has completed a master's degree. A student who has completed a DVM or a MD at a U.S. institution is also required to complete a minimum of 64 hours. A student who has completed a baccalaureate degree but not a master's degree will be required to complete a 96-hour degree plan. Completion of DVM or MD degrees at a foreign institution requires completion of a minimum of 96 hours for the Doctor of Philosophy. A field of study may be primarily in one department or in a combination of departments. A degree plan must carry a reasonable amount of 691 (Research).

Additional coursework may be added by petition to the approved degree plan by the student's advisory committee if it is deemed necessary to correct deficiencies in the student's academic preparation. No further changes can be made to the degree plan once the student's Request for Final Examination is approved.

Selected courses offered by The Texas A&M University System Health Science Center—College of Medicine may be used for graduate credit. Approval to enroll in any professional course (900-level) should be obtained from the head of the department (or Chair of the intercollegiate faculty, if applicable) in which the course will be offered before including such a course on a degree plan. Coursework completed at the Health Science Center must be transferred to Texas A&M University by submission of an official transcript to the Office of Admissions.

No credit may be obtained by correspondence study, by extension or for any course of fewer than three weeks duration.

Transfer of Credit

Courses for which transfer credits are sought must have been completed with a grade of B or greater and must be approved by the student's advisory committee and the Office of Graduate Studies. These courses must not have been used previously for another degree. Except for officially approved cooperative doctoral programs, credit for thesis or dissertation research or the equivalent is not transferable. Credit for "internship" coursework in any form is not transferable. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Credit for coursework taken by extension is not transferable. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours, or equated to semester credit hours. Grades for courses completed at other institutions, except for the Texas A&M University System Health Science Center, are not included in computing the GPR. An official transcript from the university at which transfer courses are taken must be sent directly to the Office of Admissions.

Languages

A student is required to possess a competent command of English. For English language proficiency requirements, see the Admissions section of this catalog. The doctoral (PhD) foreign language requirement at Texas A&M University is a departmental option, to be administered and monitored by the individual departments of academic instruction.

Preliminary Examination

The student's major department (or chair of the intercollegiate faculty, if applicable) and his or her advisory committee may require qualifying, cumulative or other types of examinations at any time deemed desirable. These examinations are entirely at the discretion of the department and the student's advisory committee.

The preliminary examination is required. The preliminary examination for a doctoral student shall be given no earlier than a date at which the student is within 6 credit hours of completion of the formal coursework on the degree plan (i.e., all coursework on the degree plan except 681, 684, 690, 691 and 692 courses). The student is strongly encouraged to complete the Preliminary Examination no later than the end of the semester following the completion of the formal coursework on the degree plan. The Office of Graduate Studies must receive the results of the preliminary examination at least 14 weeks prior to the final examination date. The examination shall be oral and written unless otherwise recommended by the student's advisory committee and approved by the Office of Graduate Studies. The written part of the examination will cover all fields of study included in the student's degree plan. Each member of the advisory committee is responsible for administering a written examination in his or her particular field, **unless he or she chooses to waive participation in this part of the examination.** Two or more members of the advisory committee may give a joint written examination. One or more members may require a student to take a departmental or intercollegiate faculty examination to supplement or replace a written examination. Each written examination must be completed and reported as satisfactory to the chair of the advisory committee before the oral portion of the examination may be held. In case any written examination is reported unsatisfactory, the entire advisory committee must agree (1) to proceed with the oral portion of the preliminary examination, or (2) to adopt another course of action regarding the unsatisfactory written examination.

Prior to scheduling the preliminary examination with the other committee members, the committee chair will review with the student eligibility criteria, using the Preliminary Examination Checklist to ensure the student is ready for the examination. The following list of eligibility requirements applies.

- Student is registered at Texas A&M University for the semester or summer term during which any portion of the preliminary examination may fall. If the entire examination falls between semesters, then the student must be registered for the term immediately preceding the examination.
- An approved degree plan was on file with the Office of Graduate Studies at least 90 days prior to the first written examination.
- Student's cumulative GPR is at least 3.000.
- Student's degree plan GPR is at least 3.000.
- All English language proficiency requirements have been satisfied.
- All committee members have scheduled or waived the written portion and agreed

to attend the oral portion of the examination or have found a substitute. Only one substitution is allowed and it cannot be for the committee chair.

- At the end of the semester in which the exam is given, there are no more than 6 hours of coursework remaining on the degree plan (except 681, 684, 690, 691 and 692). The head of the student's department (or Chair of the Intercollegiate Faculty, if applicable) has the authority to approve a waiver of this criterion.
- The time span from the first written examination to the oral is **no more than three weeks**. (In cases of department-wide written examinations, this criterion is not applicable.) The head of the student's department (or chair of the intercollegiate faculty, if applicable) has the authority to approve a waiver of this criterion.

Once all requirements are met, departments or interdisciplinary degree programs may announce the schedule of the written and oral parts of the examination.

Credit for the preliminary examination is not transferable. If a departmental or intercollegiate faculty examination is used as part of the written portion of the preliminary examination, it must be the **last** examination offered prior to the date scheduled for the preliminary examination. In the schedule of **the written portion, all members of the student's advisory committee are to be included**.

Through the preliminary examination, the student's advisory committee should satisfy itself that the student has demonstrated the following qualifications:

- a. a mastery of the subject matter of all fields in the program;
- b. an adequate knowledge of the literature in these fields and an ability to carry out bibliographical research.

In case a student is required to take, as a part of the written portion of a preliminary examination, an examination administered by a department or intercollegiate faculty, the department or intercollegiate faculty must:

- a. offer the examination at least once every six months. The departmental or interdisciplinary degree program examination should be announced at least 30 days prior to the scheduled examination date.
- b. assume the responsibility for marking the examination satisfactory or unsatisfactory, or otherwise graded, and in the case of unsatisfactory, stating specifically the reasons for such a mark.
- c. forward the marked examination to the chair of the student's advisory committee within one week after the examination.

The chair of the student's advisory committee is responsible for making all written examinations available to the members of the advisory committee at or before the oral portion of the examination. A positive vote by all members of the graduate committee with at most one dissention is required to pass a student on his or her exam. A department or interdisciplinary degree program can have a stricter requirement provided there is consistency within all degree programs within a department or interdisciplinary program.

The chair of the advisory committee will promptly report the results of the Preliminary Examination to the Office of Graduate Studies, using the Report of Doctoral Preliminary Examination form and the Preliminary Examination checklist. Both forms must have the appropriate signatures. These forms should be submitted to the Office of Graduate Studies within 10 working days of the scheduled examination.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies. The original signature of the department head is also required for results for the preliminary examination.

After passing the required preliminary oral and written examinations for the doctoral degree, the student must complete the final examination for the degree within four calendar years. Otherwise, the student will be required to repeat the preliminary examination.

Upon approval of the student's advisory committee, with no more than one member dissenting, and the approval by the Office of Graduate Studies, a student who has failed the preliminary examination may be given one re-examination, when adequate time has been given to permit the student to address the inadequacies emerging from the first examination (normally six months). The student and the advisory committee should jointly negotiate a mutually acceptable date for this purpose.

A student must be registered at Texas A&M University for a minimum of one semester credit hour in the semester or summer term in which they will take any portion of the Preliminary Examination.

For the Doctor of Philosophy specific to Mays Business School, please visit the website mays.tamu.edu/degrees-and-majors/phd/.

Steps for Completing the Preliminary Examination

1	Establish advisory committee. Submit a degree plan.	➔	<p>When: Prior to the deadline set by the student's college, and no later than 90 days prior to preliminary examination.</p> <p>Approved by: Advisory committee, department or intercollegiate faculty chair, and Office of Graduate Studies (OGS).</p>
2	Complete English language proficiency requirements (if applicable), and coursework detailed on degree plan.	➔	<p>When: Before preliminary examination.</p>
3	Student and chair review eligibility requirements for the preliminary exam using the "Preliminary Examination Checklist."	➔	<p>When: Several weeks before the proposed date of the preliminary examination. Checklist must be signed by chair and department head, or intercollegiate faculty chair.</p>
4	Student checks the availability of committee members.	➔	<p>When: Several weeks before the proposed date of the preliminary examination.</p>
5	Students prepares and submits any petitions found necessary by the review of the eligibility requirements.	➔	<p>When: At least three weeks before the proposed date of the preliminary examinations.</p> <p>Approved by: Advisory committee, department head or intercollegiate faculty chair, and OGS.</p>
6	When exam date is determined, the department may announce the schedule.	➔	<p>Approved by: Committee chair, department head or intercollegiate faculty chair.</p>
7	Chair submits the Report of the Preliminary Examination and the Preliminary Examination Checklist to OGS.	➔	<p>When: Within 10 working days of the date of the scheduled oral examination and no later than 14 weeks prior to the final defense date.</p> <p>Approved by: Advisory committee.</p>
8	Office of Graduate Studies notifies the student and chair of any actions necessary to rectify any deficiencies.	➔	<p>When: Upon receipt of the report of the doctoral Preliminary Examination.</p>

Continuous Registration

A student in a program leading to a Doctor of Philosophy who has completed all coursework on his/her degree plan other than 691 (Research) are required to be in continuous registration until all requirements for the degree have been completed (see Continuous Registration Requirements, [page 202](#)).

Research Proposal

The general field of research to be used for the dissertation should be agreed on by the student and the advisory committee at their first meeting, as a basis for selecting the proper courses to support the proposed research.

As soon thereafter as the research project can be outlined in reasonable detail, the dissertation research proposal should be completed. The research proposal should be approved at a meeting of the student's advisory committee, at which time the feasibility of the proposed research and the adequacy of available facilities should be reviewed. The approved proposal, signed by all members of the student's advisory committee, the head of the student's major department (or chair of the intercollegiate faculty, if applicable), must be submitted to the Office of Graduate Studies at least 15 working days prior to the submission of the Request for the Final Examination.

Compliance issues must be addressed if a graduate student is performing research involving human subjects, animals, infectious biohazards and recombinant DNA. A student involved in these types of research must check with the Office of Research Compliance, Office of the Vice President for Research at (979) 845-8585 to ensure that his/her has met all compliance responsibilities. Additional information can also be obtained on the website researchcompliance.tamu.edu.

Admission to Candidacy

To be admitted to candidacy for a doctoral degree, a student must have: (1) completed all formal coursework on the degree plan with the exception of any remaining 681, 684, 690 and 691, (2) a 3.0 Graduate GPA and a Degree Plan GPA of at least 3.0 with no grade lower than C in any course on the degree plan, (3) passed the preliminary examination (written and oral portions), (4) submitted an approved dissertation proposal, (5) met the residence requirements. The final examination will not be authorized for any doctoral student who has not been admitted to candidacy.

Dissertation

The ability to perform independent research must be demonstrated by the dissertation, **which must be the original work of the candidate**. Whereas acceptance of the dissertation is based primarily on its scholarly merit, it must also exhibit creditable literary workmanship. The format of the dissertation must be acceptable to the Thesis Office. Guidelines for the preparation of the thesis are available in the *Thesis Manual*, which is available online at thesis.tamu.edu.

After successful defense and approval by the student's advisory committee and the head of the student's major department (or chair of the intercollegiate faculty, if applicable), a student must submit his/her dissertation to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website, thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline.

Deadline dates for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement). These dates also can be accessed via the website ogs.tamu.edu/current-students/dates-and-deadlines/.

Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at the Fiscal Department. This processing fee includes a charge for microfilming services

and inclusion in Digital Dissertation database through ProQuest. After commencement, dissertations are digitally stored and made available through the Texas A&M Libraries.

A dissertation that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student's department head or chair of the intercollegiate faculty. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All original submittal deadlines must be met during the resubmittal process in order to graduate.

Final Examination/Dissertation Defense

The candidate for the doctoral degree must pass a final examination by deadline dates announced in the "Office of Graduate Studies Calendar" each semester or summer term. The doctoral student is allowed only one opportunity to take the final examination. No student may be given a final examination unless his or her current official cumulative and degree plan GPAs are **3.000 or better and he or she has been admitted to candidacy. No unabsolved grades of D, F, or U for any course can be listed on the degree plan.** To absolve a deficient grade, a student must have repeated the course and have achieved a grade of C or better. A student must have completed all coursework on his or her degree plan with the exception of 691 (Research) or 692 (Professional Study) hours. The student must be registered for all remaining hours; no hours remain to be taken on the degree plan. A doctoral student in counseling psychology or school psychology may have 684 Professional Internship on the degree plan that is remaining for which he or she must be registered. The preliminary examination results must have been submitted to the Office of Graduate Studies 14 weeks prior to the date of the defense. The research proposal must have been submitted to the Office of Graduate Studies 25 working days prior to the date of the final examination/defense. Any changes to the degree plan must be approved by the Office of Graduate Studies prior to the approval of the final examination. The request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a **minimum of 10 working days in advance** of the scheduled date. Examinations/Defenses that are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination/defense date will be recorded as failures. **The Office of Graduate Studies must be notified in writing of any cancellations.**

The student's advisory committee will conduct this examination. **The final examination is not to be administered until the dissertation or record of study is available in substantially final form to the student's advisory committee, and all concerned have had adequate time to review the document.** Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. Whereas the final examination may cover the broad field of the candidate's training, it is presumed that the major portion of the time will be devoted to the dissertation and closely allied topics. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, be invited to attend a final examination for an advanced degree. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings.

The advisory committee will submit its recommendations on the appropriate Report of the Final Examination for Doctoral Candidates form to the Office of Graduate Studies regarding acceptability of the candidate for the doctoral degree. A student must be registered in the University in the semester or summer term in which the final examination is taken.

Exam results must be submitted with original signatures of only the committee members approved by the Office of Graduate Studies. If an approved committee member substitution (1 only) has been made, his/her signature must also be submitted to the Office of Graduate Studies.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. A candidate for an advanced degree who expects to complete his/her work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. A cancellation made after the application deadline will not receive a refund of the diploma fee. Students who have completed all their degree requirements will not be allowed to cancel their graduation. **The electronic application for degree can be accessed via the student's Howdy portal.** The Registrar attempts each semester to balance the size of each ceremony. Thus, the make-up of the ceremony by colleges does change from semester to semester. Graduation times are posted each semester on the website of the Office of the Registrar. A student should check the website at graduation.tamu.edu/ceremon.html to determine the date and time of the graduation ceremony.

Steps to Fulfill Doctoral Degree Requirements

1	Meet with departmental/intercollegiate graduate advisor to plan course of study for first semester.	➔	When: Before first semester registration. Approved by: Graduate advisor.
2	Establish advisory committee. Submit a degree plan.	➔	When: Prior to the deadline imposed by the student's college or intercollegiate programs, and no later than 90 days prior to preliminary examination. Approved by: Advisory committee, department head or intercollegiate faculty chair, and Office of Graduate Studies (OGS).
3	Complete English Language Proficiency requirements (if applicable), and coursework detailed on degree plan.	➔	When: Before preliminary examination.
4	Complete the preliminary examination.	➔	When: See steps for completing the preliminary examination. The preliminary examination results must have been submitted to OGS 14 weeks prior to the date of the defense. Approved by: Advisory committee, department head or chair of the intercollegiate faculty, and OGS.
5	Submit proposal for dissertation or record of study to the Office of Graduate Studies.	➔	When: No later than 25 working days prior to the submission of the Request for the Final Examination. Approved by: Advisory committee, department head or intercollegiate faculty chair, and OGS.
6	Complete residence requirement.	➔	When: Before submitting request to schedule final oral examination. Approved by: OGS.
7	Apply for degree; pay graduation fee.	➔	When: During the first week of the final semester; see OGS calendar for deadlines.
8	Submit request for permission to hold and announce final oral examination.	➔	When: Must be received by OGS at least 10 working days before requested exam date. See OGS calendar for deadlines. Approved by: Advisory committee, department head or intercollegiate faculty chair, and OGS.
9	Upload one approved final copy of the dissertation or record of study as a single pdf file (thesis.tamu.edu) and submit a signed approval form to the Thesis Office.	➔	When: See OGS calendar for deadlines. Approved by: Advisory committee, department head or intercollegiate faculty chair, and Thesis Office.
10	Graduation; arrange for cap and gown.	➔	For more information, contact University Bookstore.

Note: Once formal coursework is complete, you must be continuously registered until all degree requirements have been met. (See Continuous Registration Requirements on [page 202](#).)

The Degree of Doctor of Education

The **Doctor of Education (EdD)** degree is a professional degree designed to prepare a candidate for a position of leadership in the full range of educational settings, including public and private schools and colleges, business, government, industry and the military establishment. The program is designed for the practitioner; a graduate may be expected to fill instructional, supervisory and administrative positions in which educational services are to be rendered.

Although substantively different from the PhD degree in education, the EdD degree requires equivalent admission qualifications, standards of scholarship and breadth and depth of study. Because graduates of the program are expected to demonstrate a high level of professional skill and educational statesmanship, only those candidates who show a consistently high level of professional performance in their academic studies, in their role-related studies, in their internship experience, and in the completion of their records of study will be recommended for the degree. The EdD degree may be earned in agricultural education, educational administration, curriculum and instruction, and health education. Details of the requirements are presented below.

Admission

An applicants must hold the master's degree, must have completed at least three years of professional experience in an educationally related setting, and must submit scores for the Graduate Record Examination and an academic record acceptable to the department to which he/she applies. He/she also must complete a written instrument which assesses the knowledge of the requirements and duties of the professional roles to which he/she aspire and demonstrates his/her ability to write with clarity, organization and correctness.

Student's Advisory Committee

After receiving admission to graduate studies and enrolling, the student will consult with the head of his or her major or administrative department (or chair of the intercollegiate faculty) concerning appointment of the chair of the advisory committee. The student's advisory committee will consist of no fewer than four members of the graduate faculty representative of the student's several fields of study and research, where the chair or co-chair must be from the student's department (or intercollegiate faculty, if applicable), and at least one or more of the members must have an appointment to a department other than the student's major department. The outside member for a student in an interdisciplinary degree program must be from a department different from the chair of the student's committee.

The chair, in consultation with the student, will select the remainder of the advisory committee. Only graduate faculty members located on the campuses at College Station, Galveston, Texas A&M University–Temple Campus or Institute of Biosciences and Technology–Houston may serve as chair of a student's advisory committee. Other Texas A&M University graduate faculty members, including the Texas A&M University System graduate faculty, may serve as co-chair with an individual located at College Station, Houston, Temple, or Galveston. If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

The committee members' signatures on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a committee cannot resign en masse. The chair of the committee, who usually has immediate supervision of the student's research and dissertation or record of study, has the responsibility for calling all meetings of the committee. The duties of the committee include responsibility for the proposed degree plan, the research proposal, the preliminary examination, the dissertation or record of study and the final examination. In addition, the committee, as a group and as individual members, is responsible for counseling the student on academic matters and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies.

Degree Plan

Each student's proposed degree plan will be individually designed on the basis of the student's career objectives and the competencies associated with the professional role to which the student aspires. It will contain a minimum of 64 semester hours, including the following components:

- a. At least 6 semester hours of proseminars stressing the foundation concepts with which every EdD student should be familiar;
- b. A set of courses selected to prepare the candidate for a specific professional role within a field of specialization;
- c. One or more courses that develop basic understanding of the procedures and applications of research;
- d. At least one supporting field of 12 or more semester hours or two supporting fields of 9 or more semester hours each;
- e. A professional internship of at least 6 semester hours related to the professional role to which the student aspires;
- f. A record of study involving at least 12 semester hours of credit.

The degree plan must be filed with the Office of Graduate Studies prior to the deadline imposed by the student's college, and no later than 90 days prior to the preliminary examination.

Transfer of Credit

Courses for which transfer credits are sought must have been completed with a grade of B or greater and must be approved by the student's advisory committee and the Office of Graduate Studies. These courses must not have been used previously for another degree. Except for officially approved joint degree programs with other Texas A&M University System institutions, credit for theses or dissertation research or the equivalent is not transferable. Credit for "internship" coursework in any form is not transferable. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Credit for coursework taken by extension is not transferable coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P,**

S, U, H, etc.) is not accepted for transfer credit. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours, or equated to semester credit hours. Grades for courses completed at other institutions are not included in computing the GPR. An official transcript from the university at which transfer courses are taken must be sent directly to the Office of Admissions.

Residence

The residence requirement for the EdD degree is 30 resident credit semester hours. Of these 30 semester hours, at least 18 must be taken as a full-time student. The residence requirement must be fulfilled within five consecutive calendar years. This requirement may be satisfied by a student who presents any combination of full-time study during summer sessions of at least five weeks duration and/or work as a full-time student during regular sessions which totals in the aggregate at least 18 semester hours, accomplished within a five-year period beginning with the first course proposed to apply to this requirement.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Internship

Each EdD degree candidate will complete a university-directed internship in a professional employment setting with a minimum duration of 300 clock hours accrued at the rate of 10–40 hours per week. The internship will require of the student full participation and responsibility in experiences directly related to the student's career specialization. Credit for the internship will not be given for a continuation of regular employment activities (e.g., continuing to serve as a junior college teacher or as an elementary school principal), but only for completing an entirely new work experience. The internship may be on a paid or unpaid basis, must be undertaken after the student has a degree plan on file, and must be supported by prior or concurrent coursework (usually toward the end of the degree program). Prior to its beginning, the internship must be approved in writing as to details by all members of the student's doctoral committee. At the conclusion of the internship, a formal written summary of its nature and results must be approved by the student's advisory committee.

Continuous Registration

A student in a program leading to the EdD who has completed all coursework on his/her degree plan other than 692 (Professional Study) is required to be in continuous registration until all requirements for the degree have been completed. See Continuous Registration Requirements, on [page 202](#).

Record of Study

The EdD student will produce a major research document called a record of study. The research project may involve such topics as (1) a field study on a problem of major proportions in time or extent; (2) a curriculum development project validated through pilot and field testing; or (3) action research on a curricular, instructional, supervisory or administrative problem based on empirical data. The EdD student must have primary

responsibility for the design and development of the research, and the record of study must be the sole and original work of the candidate.

Whatever the nature of the research project undertaken by the candidate, he or she will be required to prepare a record of study that explains and supports the activities undertaken in the project and supports its conclusions with adequate investigations, empirical data and a comprehensive bibliography. Procedures used in the student's research will be described in sufficient detail for educators in other locations to apply or extend the procedures. All records of study should be characterized by accuracy of observation and measurements, thoroughness of analysis and synthesis, and accuracy and completeness of presentation.

Guidelines for the preparation of the record of study are available in the *Thesis Manual* which is available online at thesis.tamu.edu. After successful defense and approval by the student's advisory committee and the head of the student's major department, a student must submit his/her record of study to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline.

Deadline dates for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement). These dates also can be accessed via the website ogs.tamu.edu/current-students/dates-and-deadlines/.

Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at the Fiscal Department. This processing fee includes a charge for microfilming services and inclusion in Digital Dissertations database through ProQuest. After commencement, records of study are digitally stored and made available through the Texas A&M Libraries.

A record of study that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student's department head. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All original submittal deadlines must be met during the resubmittal process to graduate.

Examinations

Each EdD degree candidate is required to take a departmentally prepared written qualifying examination prior to the completion of 30 hours of doctoral work. Although not an absolute requirement, the student is encouraged to take the required 6 hours of proseminar before taking the qualifying examination. Continuation in the program and/or any additional required study is dependent on the results of this qualifying examination. The chair of the student's advisory committee will report in writing to the Office of Graduate Studies the results of the qualifying examination. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department may have a stricter requirement provided there is consistency within all degree programs within a department.

In addition, each candidate must successfully complete an oral and written preliminary examination prior to admission to candidacy and a final oral examination upon completion of the record of study. Both of these examinations will conform to the requirements for the PhD preliminary examination and final examination.

Except as noted in the sections above, the requirements for the Doctor of Education degree are identical to those for the degree of Doctor of Philosophy.

The Degree of Doctor of Engineering

The Doctor of Engineering (DEng) program has as its objective the education of men and women to function at the highest levels of the engineering profession, with emphasis on solving problems which arise in the use of technology to benefit society at large. Since these problems frequently have a societal impact which is non-technical in nature and since technological advances are implemented through business and industry, the Doctor of Engineering program seeks to couple understanding of the characteristics of social and business institutions with high competence in solving engineering problems.

The curriculum is a 96 semester credit hour professional program beyond the baccalaureate degree. A minimum of 64 credit hours beyond the master's degree is required. These totals include a maximum of 16 credit hours for a professional internship.

Following entry into the Doctor of Engineering program, the student will complete a minimal 36-semester-credit-hour course of study prior to a one calendar year (4 credit hours per semester) internship in which the student will extend his or her education in a practice-oriented environment such as an industrial organization. The Doctor of Engineering program is administered by the Dwight Look College of Engineering with the Office of Graduate Studies.

The final oral/written examination for the Doctor of Engineering degree is administered by the student's advisory committee, as approved by the College of Engineering and the Office of Graduate Studies. Additional information can be obtained from the Office of Graduate Studies, the College of Engineering, or any department in the College of Engineering.

Admission

Prior to applying to the Doctor of Engineering program, an individual must first be admitted by a graduate program within the College of Engineering. An individual possessing a minimum of an ABET-accredited bachelor's degree in engineering or the equivalent may apply for program admission. A person applying with only a bachelor's degree must have a graduate point average of at least 3.00/4.00. An individual applying with a master's degree in engineering must have a grade point average of at least 3.25 for his/her overall graduate studies. To be admitted to the Doctor of Engineering program by the College of Engineering, an applicant must complete the appropriate application form, provide transcripts of all academic work taken beyond the secondary school level, prepare a 300-word essay dealing with the applicant's motivation for seeking admission to the program, be recommended by his/her respective department, be interviewed by the admissions subcommittee of the Doctor of Engineering program committee, and be approved by the College of Engineering. A student is required to pass the oral and written examinations associated with the Doctor of Engineering qualifying examination described in "Examinations."

Transfer of Credit

Courses for which transfer credits are sought must have been completed with a grade of B or greater and must be approved by the student's advisory committee and the Office of Graduate Studies. These courses must not have been used previously for another degree. Except for officially approved joint degree programs with other Texas A&M University System institutions, credit for thesis or dissertation research or the equivalent is not transferable. Credit for "internship" coursework in any form is not transferable.

Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Credit for coursework taken by extension is not transferable. Coursework **in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit.** Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours, or equated to semester credit hours. Grades for courses completed at other institutions are not included in computing the GPR. An official transcript from the university at which transfer courses are taken must be sent directly to the Office of Admissions.

Residence

A student who enters the DEng program with baccalaureate degrees must spend two academic years in resident study. A student who holds a master's degree when he/she enters the program must spend one academic year in resident study. In this context, an academic year is defined as two regular semesters, two 10-week summer semesters or a regular semester and a 10-week summer semester. To satisfy the residence requirement, the student must complete a minimum of 9 credit hours per semester or 10-week summer semester for the required period.

Students who are employed full-time while completing their degree may fulfill total residence requirements by completion of less-than-full time course loads each semester. In order to be considered for this, the student is required to submit a Petition for Waivers and Exceptions along with verification of his/her employment to the Office of Graduate Studies.

Student's Advisory Committee

After receiving admission to the Doctor of Engineering program, the student will consult with the head of his or her administrative department concerning appointment of the chair of the advisory committee. The student's advisory committee will consist of not fewer than four members of the graduate faculty representative of the student's several fields of study. One member of the committee must have an appointment to a department other than the student's administrative department.

The student's internship supervisor, a practicing engineer, also is a member of the advisory committee. The chair, in consultation with the student will select the remainder of the advisory committee. The chair will notify the tentative members of the advisory committee, giving the student's name and field of study, requesting that they consider serving on the advisory committee. The student will interview each prospective committee member to determine whether he or she will accept the assignment.

The student's advisory committee has the responsibility for guiding and directing the entire academic and internship programs of the student and for initiating all actions concerning the student. The chair of the advisory committee, who usually has immediate supervision of the student's program, has the responsibility for calling required meetings of the advisory committee and calling meetings at any other time considered desirable.

The duties of the advisory committee include responsibility for the proposed degree program, the Doctor of Engineering qualifying examination (written and oral), the

technical adequacy of the internship program, the qualifications of the student to embark on the internship, the internship report, and the final examination. In addition, the advisory committee, as a group and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Dean of the College of Engineering and the Dean of Graduate Studies.

Degree Plan

The student's advisory committee will evaluate the student's previous education and degree objectives. The committee, in consultation with the student, will develop a proposed degree plan which will constitute the basic academic requirements for the degree. The degree plan must be filed with the Office of Graduate Studies following the deadline imposed by the student's college, and no later than 90 days prior to the preliminary examination. The degree plan should be submitted through the online Automated Degree Plan System located on the website ogsdpss.tamu.edu.

The graduate portion of the proposed degree plan will include a minimum of 96 semester credit hours. Of these, 80 semester credit hours of coursework are required; the Professional Internship (see section on "Internship") will earn 4 semester credit hours per semester and per summer term.

The 80 semester credit hours of graduate coursework shall include a minimum of 20 semester credit hours of required core coursework, 12 semester credit hours of elective professional development courses, 32 semester credit hours of department-oriented graduate level courses, 12 semester credit hours of engineering design courses and 4 semester credit hours of professional development seminar.

Additional coursework may be added by petition to the approved degree plan by the student's advisory committee if such additional coursework is deemed necessary to correct deficiencies in the student's academic preparation.

Scholarship

To remain in good standing, a student admitted to the Doctor of Engineering program must maintain a GPR of 3.250 during his/her graduate studies.

Examinations

A student admitted to the program is required to pass a comprehensive written and oral examination called the Doctor of Engineering Qualifying Examination. It will be administered when semester credit hours equivalent to the number required for a Master of Engineering degree have been accumulated. An individual holding a master's degree when he/she enters the Doctor of Engineering program will be expected to take the Doctor of Engineering Qualifying Examination during his/her first semester of enrollment. The examination determines whether or not the student is prepared to continue study toward the Doctor of Engineering degree. A student who fails the Qualifying Examination may, with the approval of the advisory committee, retake the examination once. The second examination will be administered after a suitable period of preparation, normally not less than six months, upon the recommendation of the advisory committee.

The student's major department and advisory committee may require departmental, cumulative or other types of examinations at any time deemed desirable. These examinations

are entirely at the discretion of the department and the student's advisory committee. For instance, these examinations may be used for determining the technical depth and breadth required for the internship project. The candidate for the degree of Doctor of Engineering must pass a final oral examination in the final semester following the internship. **The student is allowed only one opportunity to take the final examination.** This exam will include presentation of results of internship work. The student's advisory committee, as finally constituted, will conduct this examination, which will include the internship experience and closely allied topics as well as the broad field of the candidate's training. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department can have a stricter requirement provided there is consistency within all degree programs within a department. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. The advisory committee will submit its recommendations through the Dean of Engineering to the Office of Graduate Studies regarding the acceptability of the candidate for the doctoral degree.

If the chair of a student's advisory committee voluntarily leaves the University and the student wants the chair to continue to serve as the committee chair, the student is responsible for adding an additional member of the current University Graduate Faculty, from the student's academic program and located on the College Station campus, to serve as the co-chair of the committee.

Internship

As part of the degree requirements after completing courses on the approved degree plan (except ENGR 684 Internship hours), each student will spend a minimum of one calendar year working under the supervision of a practicing engineer in industry, business or government. The objectives of the internship are two-fold: (1) to enable the student to demonstrate the ability to apply both knowledge and technical education by making an identifiable contribution in an area of practical concern to the organization or industry in which the internship is served, and (2) to enable the student to function in a non-academic environment in a position in which he or she will become aware of the organizational approach to problems, in addition to those of traditional engineering design or analysis. During the internship phase of the program, the student must be continuously enrolled in the University.

The nature of the internship experience will be determined by mutual consent among the student, the advisory committee and the supervising organization prior to commencement of the internship period. It is expected that the internship experience will be at a level in the organization which will enable the student to deal with broadly based problems affecting more than one facet of the organization, rather than a single narrow or specific technical problem. The student is responsible for identifying and arranging a suitable internship. Specific arrangements for the internship will be made through the student's major department, and an internship agreement must be negotiated between the student and the advisory committee, and the internship supervisor and appropriate representatives of the industrial organization. Copies of all agreements must be approved by the College of Engineering.

Continuous Registration

A student in a program leading to a Doctor of Engineering who has completed all coursework on his/her degree plan other than 684 (Internship) is required to be in continuous registration until all requirements for the degree have been completed. See Continuous Registration Requirements, on [page 202](#). However, colleges or departments may have additional or higher requirements.

Record of Study

A record of study, which usually is a report of the student's internship experiences, must be prepared in accordance with guidelines issued by the Doctor of Engineering program committee. By deadlines announced each semester, the candidate must submit to the Office of the Dean of Engineering one copy of the record of study in final form. The suggestions and corrections of the members of the advisory committee must be incorporated, and the report must bear the signature of the department head and the members of the student's advisory committee. The record of study must be the original work of the candidate. This record of study must also be approved by the Thesis Office as in the case of a PhD dissertation.

Guidelines for the preparation of the record of study are available in the *Thesis Manual*, which is available online at thesis.tamu.edu. After successful defense and approval by the student's advisory committee and the head of the student's major department (or chair of the Intercollegiate Faculty, if appropriate), a student must submit his/her record of study to the Thesis Office in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website at thesis.tamu.edu. Additionally, a signed approval form must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval form are required by the deadline.

Except as noted in the sections above, the requirements for the Doctor of Engineering degree are identical to those for the Doctor of Philosophy.

Deadlines for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement). These dates also can be accessed via the website thesis.tamu.edu.

Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at the Fiscal Department. This processing fee includes a charge for microfilming services and inclusion in Digital Dissertation database through ProQuest. After commencement, records of study are digitally stored and made available through the Texas A&M Libraries.

A record of study that is deemed unacceptable by the Thesis Office because of excessive corrections will be returned to the student's department head. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All original submittal deadlines must be met during the resubmittal process to graduate.

Admission

General Information

A formal application is required from a person seeking admission or readmission to graduate studies. A statewide ApplyTexas application can be used to apply to any public university in the state of Texas and can be accessed at www.applytexas.org. Applicants may submit only one degree-seeking application for a particular semester.

An application fee of \$50 for U.S. citizens and permanent residents or \$90 for international applicants is required to process an application for admission. The application fee is nonrefundable. Checks or money orders (U.S. currency) should be made payable to Texas A&M University. All financial dealings with Texas A&M University may be done by check or money order provided it displays an agency bank in the U.S. and has magnetic ink character recognition (MICR) routing numbers at the bottom of the check. The \$50 fee required of U.S. citizens or permanent residents may be waived, but only in exceptional cases, for low-income applicants. In such cases, an applicant should include with the application for admission a letter from his/her financial aid officer or other knowledgeable officer verifying the need for a waiver. Waiver of the \$90 international application fee is not available.

With the approval from the degree granting unit providing admission, admission to graduate studies normally remains valid for one year from the term of acceptance with one \$50 or \$90 (as appropriate) application fee. An extension to the one-year time limit may be granted, if requested by the applicant in writing and approved by the degree granting unit.

Departments may have admission requirements in addition to those of the University. In such cases, higher departmental requirements supersede those of the University.

The normal requirement for admission to graduate studies is a scholastic record which, over at least the last two years of full-time academic study in a degree program, gives evidence of the applicant's ability to do successful graduate level work.

An applicant whose academic record is not satisfactory, or who is changing fields of study, may be required to take additional work in preparation for graduate study. Such work will normally be arranged in conference with the graduate advisor or the head of the student's major department. Before accepting a student for graduate study, a department may require that the student pass a comprehensive examination covering the basic undergraduate work in that field.

To allow time for processing, application forms should be filed at least six weeks prior to the opening of the semester. Admission to graduate studies cannot be completed until all the credentials requested in the application form have been received and evaluated. Applicants may submit only one degree-seeking application for a particular semester.

In addition to the records sent to the Office of Admissions, an applicant should have in his/her possession a copy of his/her record for use in conferences with the graduate advisor or graduate faculty in his/her department. An applicant, otherwise qualified for admission to graduate studies, may not be approved in instances where the facilities and staff available in the particular field are not adequate to take care of the needs of the student. All applicants to Mays Business School (MBA, EMBA, MS, MRE, PhD) should refer to the website mays.tamu.edu and use the Mays online application system.

Regular Admission Status

Admission to graduate programs at Texas A&M University is evaluated by individual degree programs. The overall admission criteria for the University are based on the entire record of the applicant and availability of departmental resources. The items considered include:

- holding an accredited baccalaureate degree (of at least three years) from a college, institution or university of recognized standing, or its equivalent, guarantees consideration for admission,
- an official score on a standardized test is required unless otherwise specified by the graduate program to which an applicant is applying. A program can request exceptions to the Office of Graduate Studies. The scores can only be evaluated in a manner which complies with Chapter 51, Subchapter W of the Texas Education Code, Admissions and Scholarship policies for Graduate and Professional Programs, House Bill 1641,
- transcripts, official transcript (with degree confirmation),
- letters of recommendation,
- professional and/or academic experience and performance,
- promise of ability to pursue advanced study and research satisfactorily,
- adequate preparation to enter graduate school in the specific discipline or field of study,
- Statement of Purpose Essay.

In addition to the above University admission requirements, some colleges, departments and programs require indicators of success, such as a portfolio or personal interview. Each applicant is directed to check the specific program admission requirements and deadlines.

During 2012–2013, the GRE and GMAT will be given at various centers, including Texas A&M University, throughout the United States and in other countries. The GRE is also offered by computer at Texas A&M University which allows a more rapid score reporting. To determine the most convenient locations to take either the GRE or GMAT, prospective applicants should write to either the appropriate division of the Educational Testing Service, Princeton, NJ, or to Measurement and Research Services, Texas A&M University, at the address, or call the telephone number, given in the front of this catalog. **All applicants to Mays Business School (MBA, EMBA, MS, MRE, PhD) should refer to the website mays.tamu.edu and use the Mays online application system.**

Applicants who do not possess a degree considered to be equivalent to a U.S. Bachelor's degree or higher will be denied admission.

Readmission to Graduate Studies

(A student who has previously enrolled in Graduate Studies at Texas A&M University.)

1. A returning graduate student (G7, G8, G9) who has attended Texas A&M University within the past 12 months will not have to submit an application for readmission.
2. a. An application from a returning graduate student (G7, G8, G9) who has not attended Texas A&M for a period of over one year will be sent to the respective department for approval before the student is readmitted.

3. An application from a returning student who has not attended Texas A&M for one year or more and who was classified as G6 when last enrolled will be forwarded to the respective department for approval. A G6 student in a certification program, however, will not have to reapply if he/she has attended Texas A&M within the preceding year.
4. The department, college, or Office of Graduate Studies is responsible for placing academic or administrative blocks. The Office of Admissions will check for blocks before a student is readmitted.

International Admission Status

An applicant from another country seeking admission to graduate studies must meet the same requirements for admission as applicants from the United States. In addition, he or she must demonstrate the ability to read, write, speak and understand the English language. A prospective student whose native language is not English may take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) exam. Both exams are offered at locations around the world. Applications for these exams together with additional information about these examinations may be found on their websites; TOEFL information may be obtained at www.ets.org/toefl and IELTS information from www.ielts.org. Currently, the TOEFL is offered in more than 200 locations around the world and the IELTS is offered in more than 400 world-wide venues. Applicants from non-English speaking countries must present a TOEFL score of at least 550 paper-based, 80 Internet-based or an IELTS score of at least 6.0 overall band to be admitted to graduate studies. An applicant may be exempt from the TOEFL requirements by completing all credits of a baccalaureate degree or higher in the United States or scoring a 400 or 146 (on new scale) or higher on the Verbal section of the GRE. Additionally, applicants from the following countries will be exempt from the TOEFL requirement:

American Samoa	Guyana
Australia	Ireland
Bahamas	Jamaica
Barbados	Liberia
Belize	New Zealand
Canada (except Quebec)	Sierra Leone
Dominica	Trinidad/Tobago
Grenada	United Kingdom
Grand Cayman	U.S. Pacific Trust

Some departments reserve the right to require a TOEFL score even though it may be waived by one of the above criteria.

Official TOEFL scores are reported directly by the Educational Testing Service to Texas A&M University using institution code 6003. The departmental code is not necessary. IELTS scores should be sent electronically from the test center to:

Measurement and Research Services
 Texas A&M University
 4239 TAMU
 College Station, Texas 77843-4239

Postbaccalaureate Non-degree Status (G6)

Application for postbaccalaureate non-degree classification requires a completed application form (www.applytexas.org), a statement about the applicant's need for the proposed coursework at Texas A&M University and his or her ability to successfully complete that coursework, the required application processing fee and a complete, official transcript showing completion of a baccalaureate degree. An applicant for postbaccalaureate non-degree classification must indicate a department of affiliation when he/she applies. Admission to postbaccalaureate non-degree classification requires departmental approval along with approval of the Office of Admissions. Admission to postbaccalaureate non-degree status (G6) normally remains valid for one year from the date of acceptance.

Enrollment of a postbaccalaureate non-degree student may be limited by college or departmental policies.

Postbaccalaureate non-degree classification is intended for a student with a baccalaureate degree from an institution of higher education.

If at a later date, a postbaccalaureate non-degree student decides to pursue a graduate degree, the student must understand that limitations may be placed on coursework taken while in G6 status. Specifically, the student must understand that a college or a department may decide whether or not to accept any G6 work toward the student's graduate degree; however, with the approval of the student's graduate advisory committee, the department head and the Office of Graduate Studies, a maximum of 12 credit hours taken in postbaccalaureate non-degree status may be used on a student's degree plan. Admission to postbaccalaureate non-degree status does not establish eligibility for admission to degree-seeking status.

A postbaccalaureate non-degree classification application is handled on a first come, first served basis. An application submitted within one month of registration may not be processed in time to begin that semester or term.

Enrollment of a G6 student in courses may be limited by college and departmental policies. Each postbaccalaureate non-degree student must be reviewed by his or her department of affiliation for continuation at the end of each semester.

A postbaccalaureate non-degree student must maintain at least a 3.000 GPR on all coursework attempted to remain eligible to register. University departments and colleges may have additional and higher requirements.

For a scholastically deficient postbaccalaureate non-degree student, the student's home department shall determine eligibility, and the department is responsible for placing a registration block on the student.

A postbaccalaureate non-degree status normally is not available to an international student.

Senior Citizens

A senior citizen, 65 years old or older, may audit courses with the permission of the instructor, if space is available in the assigned classroom. This individual need not be admitted to the University and academic records of attendance will not be maintained.

English Language Proficiency Requirements

An international graduate student whose native language is not English must fulfill an English proficiency requirement, through either English Proficiency Verification or English Language Certification. **This proficiency requirement should be met early in a student's program, and it must be completed before scheduling either the final examination for the master's degree or the preliminary examination for the doctoral degree.**

Two levels of English Proficiency Status for a graduate student include: English Proficiency Verified and English Proficiency Certified. **English Proficiency Certification is required, by the State of Texas, before a graduate student is eligible to serve as a Graduate Assistant-Teaching, or any other position considered to be a teaching position (e.g., instructor, lecturer, etc.).** All other students must be either English Proficiency Verified or English Proficiency Certified.

English Proficiency Verification can be achieved by presenting:

- a TOEFL score of at least 550 paper-based (80 Internet-based), or
- an IELTS score of at least 6.0, or
- a GRE Verbal score of at least 400 or 146 (on new scale), or
- a GMAT Verbal score of at least 22.
- An individual may be exempt from the TOEFL requirements by completing all credits of a four-year baccalaureate degree or higher in the United States.

Individual colleges may choose to establish minimum TOEFL standards that exceed the University minimum for English Proficiency Verification. Scores from TOEFL examinations administered more than two years before submission of the application for admission shall not be eligible for English Proficiency Verification.

English Proficiency Certification can be achieved by:

- scoring at least 80 on each of the sections of the English Language Proficiency Examination (ELPE),
- obtaining grades of A or B in English Language Institute (ELI) courses at the 300-level or higher, or
- requesting alternative certification by the Office of Graduate Studies. A student who has received a baccalaureate degree following four years of study at an accredited U.S. institution will qualify automatically for English Proficiency Certification under this alternative.

A graduate student who has completed an equivalent English training program at an institution other than Texas A&M may request English Proficiency Verification or Certification. Verification or Certification is requested through the Departmental Graduate Advisor. The student should provide the Departmental Graduate Advisor with documentation to support Verification or Certification. If the department concurs with the request, the Departmental Graduate Advisor will submit a letter recommending and requesting Verification or Certification (with documentation attached) to the Office of Graduate Studies. The Office of Graduate Studies will determine on a case-by-case basis whether Verification or Certification is granted.

English Language Proficiency Examination

A graduate student who scores below 550 paper-based on the TOEFL or 6.0 on the IELTS (or has not submitted official TOEFL or IELTS scores to Texas A&M) and has not obtained English Proficiency Verification or Certification by other means (GRE/GMAT scores, U.S. four-year baccalaureate degree or higher, or Office of Graduate Studies waiver) must take the English Language Proficiency Examination (ELPE) prior to registering for Texas A&M courses in his/her first semester. The ELPE evaluates English skills in the areas of reading, listening, written composition and oral communication. English Language Institute (ELI) course placements for a graduate student will be made by the Departmental Graduate Advisor in consultation with personnel from the Office of Graduate Studies, English Language Institute and Measurement and Research Services. The English Language Institute, in the College of Liberal Arts, offers a comprehensive program of courses designed to help an international student improve his/her English language ability in order to enter and participate in academic programs at Texas A&M University. A graduate student who has not had his/her English Proficiency Verified through the TOEFL, IELTS, GRE Verbal, GMAT Verbal, or a four-year U.S. baccalaureate degree or higher, and takes the ELPE may be allowed to postpone some or all remaining English Proficiency requirements the first semester of enrollment. He/she must begin to take ELI courses (in at least one of the areas not yet passed) no later than his/her second semester enrolled at Texas A&M. A graduate student will be allowed to take a combination of Texas A&M and ELI courses up to a total of 15 hours in fall or spring semesters and up to a total of 12 hours for a 10-week summer semester.

Non-degree Status International Students

A postbaccalaureate non-degree status student (G6 classification) **must** meet the graduate English Language Proficiency requirements unless he/she is included in one of the following categories:

1. A postbaccalaureate non-degree status student admitted to Texas A&M under a special arrangement approved by the Associate Vice President for International Programs or a Memorandum of Agreement (MOA) that postpones the English Language Proficiency requirements for the duration of the program. (For this category, the student's Departmental Graduate Advisor must request the postponement through the Office of Graduate Studies.)
2. A reciprocal educational exchange program student admitted to Texas A&M through the Study Abroad Programs Office. (For this category, postponement of the English proficiency requirement for the duration of the reciprocal educational exchange program will be done by the Office of Admissions.) Please contact Study Abroad Programs for additional information about this type of student.

An appeal for a postbaccalaureate international non-degree status student should be made through the Departmental Graduate Advisor.

Registration and Academic Status

General Information

Before registering for the first time, a student should seek assistance from the Departmental Graduate Advisor representing the field of his or her major interest. This advisor will assist in planning the student's first registration. An international student should consult the section on English Proficiency Requirements for information about additional requirements. Registration requirements for a graduate student holding an assistantship and/or fellowship are discussed in the section on Financial Assistance.

Full-Time Status

A graduate student (domestic or international) is considered full-time if he or she is registered for a minimum of:

- 9 semester credit hours during a fall or spring semester;
- 6 semester credit hours in a 10-week summer semester; or
- 3 semester credit hours in each five-week summer term.

A Q grade before the 12th class day does not count toward the certification of enrollment status.

Colleges and departments may impose additional semester credit hour requirements for a student holding an assistantship or fellowship which exceeds the minimum stated above.

Special considerations relate to "full time status" for an international student. Please refer to the information on this subject elsewhere in this section.

A student who has financial assistance should consult the Department of Student Financial Aid, (see [page 210](#)) Texas A&M University, 2nd floor, The Pavilion, 1252 TAMU, College Station, TX 77843-1252, (979) 845-3236, for registration requirements.

Maximum Schedule

Fall/Spring: A graduate student may register for a maximum of 15 hours. The college dean's office can approve/register a student through 18 hours. A request to register for more than 18 hours should be submitted to the Office of Graduate Studies on the Petition for Waivers or Exceptions to University Requirements and must include the course/section number and the semester of registration. If approved, hours will be added by the Office of Graduate Studies.

5-week summer session: A graduate student may register for a maximum of 6 hours. The college dean's office can approve/register a student through 9 hours. A request to register for more than 9 hours should be submitted to the Office of Graduate Studies on the Petition for Waivers or Exceptions to University Requirements and must include the course/section number and the semester of registration. If approved, hours will be added by the Office of Graduate Studies.

10-week summer session: A graduate student may register for a maximum of 12 hours. The college dean's office can approve/register a student through 15 hours. A request to register for more than 15 hours should be submitted to the Office of Graduate Studies on the Petition for Waivers or Exceptions to University Requirements and must include the course/section number and the semester of registration. If approved, hours will be added by the Office of Graduate Studies.

Continuous Registration Requirements

A student in a graduate degree program requiring a thesis, dissertation, internship or record of study, who has completed all coursework on his/her degree plans other than 691 (Research), 684 (Internship) or 692 (Professional Study) is required to be in continuous registration until all requirements for the degree have been completed. The continuous registration requirement may be satisfied by registering either *In Absentia* or In Residence.

To qualify for *In Absentia* registration, a student must not have access to or use facilities or properties belonging to or under the jurisdiction of The Texas A&M University System at any time during the semester or summer term for which he or she is enrolled. A student who qualifies for *In Absentia* registration is required to register each subsequent fall and spring semester for a minimum of one and maximum of four credit hours of 691, 684, 685 or 692. Departments and colleges may have additional or higher requirements.

A student who is subject to In Residence registration (i.e., on campus) is required to register each subsequent fall and spring semester and each 10-week summer semester for at least one credit hour. University departments and colleges may have additional or higher requirements. Unless a student plans to take examinations, or use University resources including any interaction with their graduate committee, registration during the summer will not be required to fulfill the continuous registration requirement. However, colleges, departments or intercollegiate programs may have additional or higher requirements.

An international student may have additional registration requirements depending on his/her visa status. He/she should consult with the International Student Services website or an International Student Services advisor to obtain current information on these requirements.

A student who does not comply with the continuous registration requirement will be blocked from registration. He/she will be allowed to register only after receiving a favorable recommendation from a departmental review committee (not the student's advisory committee), the endorsement of the department head, or Chair of the Intercollegiate Program and the approval of the Office of Graduate Studies.

A student holding an assistantship or fellowship must be registered full time.

In Absentia

A student may register *In Absentia* if enrolled in a course which is offered on an individual basis and conducted away from the College Station campus and System campuses or facilities such as Agricultural Research and Extension Centers, Research Stations or other properties under the jurisdiction of The Texas A&M University System. Such courses may include, but are not limited to internships, problems, practicums, etc. To qualify for *In Absentia* registration, the student must not have access to or use of facilities of The Texas A&M University System at any time during the semester or

summer term for which he or she is enrolled. The definition of “facilities” includes human resources and services such as those provided by graduate advisory committee members responding to drafts of theses, dissertations or records of study material, etc. Approval of the head of the department or Chair of the Intercollegiate Program offering the course is required for each student requesting *In Absentia* registration. A student holding a fellowship or assistantship may not register *In Absentia*. An international student may require work authorization or other authorizations when registered *In Absentia* and should complete an “*In Absentia* Letter” to start this process. Sample letters are available online or at the International Student Services Office. A student going outside the U.S. and registering *In Absentia* should complete online emergency notification information so university assistance is available during crisis situations. More details about this are available on the Study Abroad Programs website studyabroad.tamu.edu.

Leave of Absence

Under unusual circumstances, a student may petition for a leave of absence. The entire advisory committee, if formed, and head of the department or Chair of the Intercollegiate Program, if appropriate, must approve the petition and send it to the Office of Graduate Studies. If the Dean of Graduate Studies approves the petition, the registration requirement will be set aside during the period of leave. Leaves will be granted only under conditions that require the suspension of all activities associated with pursuing the degree. For certain types of approved leave, such as medical, the time period for the completion of the degree will stop with the leave and begin when the student returns to the program. Other types of leave may not stop the time limit for the degree. A student should refer to the sections on Time Limits for master’s and doctoral programs. A leave of absence is granted for one year. In case of extenuating circumstances, the leave of absence can be extended by the student’s committee and the Dean of Graduate Studies. A student who returns to the University after an approved leave of absence will not be required to submit an application for readmission to the Office of Graduate Admission. An international student should visit with an International Student Services advisor to find out how a Leave of Absence may impact his/her stay in or his/her re-entry into the U.S.

Limitations for Staff Members

The following limitations were set by the Academic Council of Texas A&M University concerning advanced degrees for members of the resident staff of the University.

1. A member of the faculty above the rank of assistant professor normally will not be granted the doctoral degree at this institution. He/she may, however, enroll for graduate work.
2. A member of the faculty normally will not be granted a graduate degree by the University after receiving tenure at this institution. He/she may, however, enroll for graduate work.
3. Any exceptions to the above regulations must have the written approval of the concerned department heads, college deans, the Office of Graduate Studies and the

Executive Vice President and Provost before the person applies for admission to graduate studies.

4. No department is to award a graduate degree to a faculty member above the rank of assistant professor of that same department.

Undergraduates Registering for Graduate Courses

A senior undergraduate student with a grade point ratio of at least 3.000 is eligible to enroll in a graduate course and reserve it for graduate credit by filing a petition obtained from the student's undergraduate college and approved by the course instructor, the student's major department head, the dean of the college offering the course and the dean of the student's undergraduate college.

An academically superior undergraduate student with a grade point ratio of at least 3.250 is eligible to apply graduate credit hours toward his/her undergraduate degree programs by filing a petition obtained from the student's undergraduate college and approved by the course instructor, the student's major department head, the dean of the college offering the course and the dean of the student's undergraduate college. Graduate credit hours used to meet the requirements for a baccalaureate degree may not be used to meet the requirements for a graduate degree.

VA Benefits

A veteran student should note that to receive full VA benefits he/she must be registered for not less than 9 credit hours of coursework each full semester or 3 credit hours per 5-week summer term.

Course Load Requirements for International (Non-Immigrant) Students

Unless he/she has prior authorization through a Department of Homeland Security or Department of State process that is documented in the International Student Services office, an international student must be in "full time status" as defined earlier in this section. Without prior written approval to drop below full time enrollment, the student is considered to be out of legal immigration status. Loss of legal immigration status is very serious and will result in a student being ineligible to be employed and may result in a student having to leave the United States. The student is responsible to uphold U.S. federal government and University regulations. Note that the U.S. government allows a student to register less than full time in certain circumstances. These reasons may be found in the "Reduced Course Load" form available on the International Student Services website. Also, in certain situations, the Registrar may be able to authorize that a student has full-time enrollment status, even though the student is enrolled for fewer than the normally required number of hours. Although this is the case, the student must still have a valid Reduced Course Load approved through International Student Services (ISS) to maintain legal immigration status prior to the end of the add/drop period at the start of each semester.

Although summer time is traditionally a vacation period, an international student who begins or ends his/her academic program during a summer semester is required to be in full-time status unless he/she has an approved Full Course Waiver form as

described above.

A student who registers for courses in the English Language Institute may count those courses toward U.S. immigration requirements for full time status; however, such courses may not/are not able to be counted toward the University policy for full time status. The student should verify the university requirement with the Office of Graduate Studies.

Aggie Honor Code

Integrity is a fundamental core value of Texas A&M University. Academic integrity requires a commitment by all faculty, students, and administrators to:

- Remain constantly focused on the quality of the academic programs;
- Achieve and maintain academic excellence in all courses and programs to assure the value of Texas A&M University degrees;
- Demand high academic standards from all members of the Aggie community.

All Texas A&M University students, graduate and undergraduate, part-time or full-time, in residence or in distance education, are expected to follow the guiding rule of the Aggie Honor Code:

“An Aggie does not lie, cheat, or steal or tolerate those who do.”

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System, which may be found at aggiehonor.tamu.edu. A student will be required to state his/her commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the Texas A&M community from the requirements or the processes of the Honor System.

The Honor System Office is charged with promotion of the honor code and administration of academic dishonesty cases. The Honor Council, comprised of students and faculty from colleges and offices across the University, will investigate all such infractions of the honor code and recommend appropriate sanctions. This office has a website which defines the types of infractions and the possible consequences. Students are urged to review this information.

In addition to adherence to the Honor Code, a student (graduate students in particular) who is completing a thesis, record of study, dissertation, and publication may fall under the additional federal requirements promulgated by the Office of Research Integrity (Scientific Misconduct Regulations – 42 CFR part 50), as well as Texas A&M System Regulations and Texas A&M University Rules (Texas A&M System Regulations – Ethics in Research and Scholarship – 15.99.03, and Texas A&M University rules and standard administrative procedures – Responsible Conduct in Research and Scholarship – 15.99.03.M1, 15.99.03.M1.01-06).

Classification

Each student has a classification which indicates the type of degree program in which the student is enrolled (undergraduate, graduate or professional), and reflects the student’s progress within that program at the undergraduate and professional levels. The classifications follow:

Code	Classification Definition
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G6	<p>Postbaccalaureate Non-degree</p> <p>Postbaccalaureate non-degree classification is intended for a student with a baccalaureate degree from an institution of higher education.</p> <p>If at a later date, a postbaccalaureate non-degree student decides to pursue a graduate degree, the student must understand that limitations may be placed on coursework taken while in G6 status. Specifically, the student must understand that a college or a department may decide whether or not to accept any G6 work toward the student's graduate degree; however, with the approval of the student's graduate advisory committee, the department head, or Chair of the Intercollegiate Program and the Office of Graduate Studies, a maximum of 12 credit hours taken in postbaccalaureate non-degree status may be used on a student's degree plan. Admission to postbaccalaureate non-degree status does not establish eligibility for admission to degree-seeking status. A postbaccalaureate non-degree student is not eligible to register for 691 Research hours.</p> <p>An application for a postbaccalaureate non-degree classification is handled on a first come, first served basis. An application submitted within one month of registration may not be processed in time to begin that semester or term.</p> <p>Enrollment of a G6 student in courses may be limited by college and departmental policies. Each postbaccalaureate non-degree student must be reviewed by his or her department of affiliation for continuation at the end of each semester.</p> <p>A postbaccalaureate non-degree student must maintain at least a 3.000 GPR on all coursework attempted to remain eligible to register. University departments and colleges may have additional and higher requirements.</p> <p>For the scholastically deficient postbaccalaureate non-degree student (G6 classification), the student's home department shall determine eligibility, and it is the department's responsibility to place a registration block on these students.</p> <p>Postbaccalaureate non-degree status normally is not available to an international student.</p>
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G7	<p>Graduate, Master's</p> <p>G7 classification denotes admission to a masters level program of study or admission to a doctoral program of a student who has not yet completed a master's degree or 30 hours of eligible coursework taken at Texas A&M.</p>
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G8	<p>Graduate, Doctoral</p> <p>G8 classification denotes admission to a doctoral level program of study.</p>
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G9	<p>Graduate, Master's/Doctoral Admitted</p> <p>G9 classification denotes admission to graduate study but signifies documents must be completed before a student is allowed to file a degree plan. When the required documents have been received, the student's classification will be changed. Approval of the Dean of Graduate Studies is required to change a student from G9 classification to the appropriate classification (i.e., G7 or G8).</p>
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Tuition, Fees and Other Financial Information

General Information

Educational expenses for nine months will vary according to personal needs and course of study. The Financial Aid Office's basic budget for a new graduate resident student including tuition and fees, books, supplies, transportation, on-campus room and board, incidental and living expenses comes to approximately \$20,455. Total expenses for a returning student during an academic year should be slightly less than those for a new student. The cost for a new non-resident or international student is approximately \$27,273. All tuition and fee amounts provided herein represent the most accurate figures available at the time of publication and are subject to change without notice. University Rules in place at the time of publishing are reflected here. All are subject to change. The most current information available will be maintained on the website sbs.tamu.edu.

Payment of Tuition and Fees

A student must meet all financial obligations to the University by the due dates to avoid late penalties. Failure to pay amounts owed may result in cancellation of the student's registration and being barred from future enrollment and receiving official transcripts. State law requires that tuition and fees be paid prior to the first day of classes. A student who wishes to pay fees in installments can select the option during registration or on the website howdy.tamu.edu. The Emergency Tuition and Fee Loan is available to help students pay their Texas A&M University tuition and required fees. The Emergency Tuition and Fee Loans are for required tuition and fees only. The online process can be accessed at financialaid.tamu.edu.

Obligation to Pay Tuition, Required Fees, Other Fees and Charges for Optional Services

By registering for classes, a student agrees to pay all tuition and required fees associated with his/her registration, optional services and other fees, whether paying in full or utilizing the installment payment option. Failure to pay tuition, fees and other charges may result in penalties, late registration fees, and/or possible cancellation of classes.

Financial Obligation for Graduating Students

According to Texas A&M University Student Rules and Chapter § 54.007 (d) of the Texas Education Code, all financial obligations to the University must be paid by the end of the semester. Failure to settle all financial obligations will result in withholding a student's diploma at graduation. Additionally, a block will be placed on the student's account which will prohibit registration in subsequent semesters and receipt of official transcripts.

Citations:

Section 14.15 of the Texas A&M University Rules states, "The student must have settled all financial obligations to the University."

Chapter § 54.007 (d) of the Texas Education Code states, “A student who fails to make full payment of tuition and fees, including any incidental fees, by the due date may be prohibited from registering for classes until full payment is made. A student who fails to make full payment prior to the end of the semester or term may be denied credit for the work done that semester or term.”

Scholarships, Grants and Loans

All scholarships, grants and loans are applied to any outstanding charges before installments are calculated.

Payment Methods

Student account payment options include:

- **On-Line** — E-checks, credit cards (American Express, Discover, and MasterCard) through Howdy! (howdy.tamu.edu)
- **Mail in Payment** — Checks or money orders.
Personal Checks may be used to pay tuition and fees unless barred from doing so because of previous returned checks. Payment of tuition and fees with a returned check may result in cancellation of the student’s registration and restrictions on use of personal checks across campus.
- May not exceed student account balance.

Installments

Tuition, most required fees, room, board and parking are payable in full, or in four equal installments. A \$15 per semester service charge to cover the cost of handling will be assessed to each student who chooses to use the installment plan. The service charge is not refundable once a payment is made under the installment plan or after the first installment due date.

Penalties and Late Registration Fees

Late Payment Penalty. Severe penalties occur for failure to pay student account balances and installments by the specified due dates. If a payment is delinquent when a semester ends, the student will be blocked and may not receive credit for academic work performed. A student will not be readmitted to the University until all past due balances, including late charges, are paid. A \$25 late fee will be assessed for each payment not received before it is due. If a student is removed from the rolls of the University or is withdrawn for failure to pay amounts owed the University, a \$50 reinstatement fee will be assessed in addition to any other late fees or penalties already incurred and must be paid before the student will be reinstated.

Late Registration Fees. A student who registers on or after the first day of classes is assessed a \$100 late registration fee. A student who registers after the official census date (12th class day for fall or spring and 4th class day for summer) is assessed a \$200 late registration fee. A student who adds classes after the official census date is assessed a \$50 late add fee. Note: Penalties, late registration and late add fees also apply to a student who is required to re-enroll because his/her registration was canceled for nonpayment.

Use of Collection Agencies and Credit Bureau. If amounts become past due, the University reserves the right to report the account to the Credit Bureau. This will also initiate internal collection efforts and could cause the University to employ an outside collection agency to recover the debt. If any collection efforts must be made, the student will be required to pay all collection costs, including collection agency fees, legal fees and other costs incurred in collecting the amounts due.

Canceling Your Registration

Once a student has registered for classes, he/she must select one course of action from the following to remain in good standing with the University:

- pay all amounts due by the specified due date;
- use the online registration system to drop all classes prior to the first day of classes; or
- contact the Dean's office of his/her college to withdraw from the University after the first day of classes; then contact the Registrar's Office at (979) 845-7117 and request that their registration be canceled.

Following this procedure is especially important for a student who has been awarded a scholarship or financial aid since the aid may automatically pay tuition and fees and cause the registration to be held even though the student has decided not to attend. Failure to request cancellation of an unwanted registration may result in grades of F or I in all courses for the semester. The student will be required to reimburse the University for scholarships and other financial aid applied to his or her account and will be held responsible for paying all fees for the semester, regardless of whether he or she attended classes.

Cancellation for Nonpayment of Tuition or Fees

The University reserves the right to cancel a registration not paid by the due date, or the official census date for a semester or summer term, to comply with state laws requiring payment of tuition and fees, to free the classroom spaces for other students, and to ensure the most efficient use of University resources.

Financial Assistance

Assistantships

- A graduate assistantship, teaching (GAT) and non-teaching (GANT), is available to a qualified student on a competitive basis. An assistantship requires service of 20 hours a week. Appointment to an assistantship is normally for nine months, although some may be available for up to twelve months. Most assistantships are awarded through the applicant's major department. An applicant should contact the department head or graduate advisor concerning the availability of assistantships.
- A graduate student (domestic or international) must register for the appropriate number of University semester credit hours to maintain full-time status during any semester or summer term in which they hold an assistantship. A graduate student who holds an assistantship or fellowship is required to satisfy the minimum load requirements.

- A Teaching Assistant, Research Assistant and Graduate Assistant Non-Teaching who is employed at least one-half time at a Texas institute of higher education and show job duties are related to teaching or research in an academic program associated with his/her field of study are entitled to register himself/herself, their spouse and their children in the employing Texas institute of higher education by paying the tuition and fees required of Texas residents.
- Termination of the student's employment (voluntary or involuntary) during the semester may result in revocation of the exemption, recalculation of tuition at the nonresident or international rate, and immediate payment of the tuition due.
- Employment must be for the entire semester in which the student is enrolled and actual paid work must commence on or before the official census date for the term (12th class day for fall and spring, 4th class day for summer), to be eligible for nonresident tuition exemption.
- Terms used to describe qualifying positions are intended to indicate an academic position, not a position title.
- Volunteer or unpaid work does not constitute employment.
- Student worker positions do not qualify.
- A graduate assistant must be enrolled full time (9 hours for spring and fall, 6 hours in any combination for summer).

Fellowships

Ordinarily, a graduate student holding a fellowship is not required to perform any services. Therefore, a fellowship holder is not considered an employee and FICA regulations do not apply. A graduate student (domestic or international) holding a fellowship administered through the Office of Graduate Studies must register for a minimum of:

- 9 semester credit hours during a fall or spring semester;
- 6 hours in any combination for summer.

A Q grade before the 12th class day does not count toward the certification of enrollment status.

Unless specifically excluded by the conditions of the fellowship award, a student holding a fellowship administered through the Office of Graduate Studies may concurrently hold an assistantship requiring service of 20 hours per week. A graduate student concurrently holding a fellowship with a one-quarter time assistantship normally has the same registration requirements as a student holding a one-half time assistantship. Colleges and departments may impose additional semester credit hour requirements for a student holding an assistantship or fellowship which exceeds the minimum stated above.

Scholarships & Financial Aid

The mission of Scholarships & Financial Aid is to provide students with information and financial resources to attend Texas A&M University, along with support programs that promote higher education and developmental opportunities. As a part of this commitment, we strive to provide financial solutions to students at all income levels and with varying academic, merit and leadership qualifications.

The need-based financial assistance program is designed for all students who have a demonstrated financial need, as defined by the Free Application for Federal Student

Aid (FAFSA), in order to assist the student in paying college expenses. All financial aid is contingent upon students making satisfactory academic progress, as defined by Scholarships & Financial Aid or the specific program.

Financial aid has two forms: gift aid and self-help.

Gift Aid

Grants (Federal, State, Institutional)
Scholarships
Waivers

Self Help

Loans (Federal, State, Institutional,
Alternative)
Student Employment (Work Study, Part-time
Employment, Internships, Assistantships)

Texas A&M University's packaging philosophy for need-based financial aid is to provide the greatest amount of gift aid to those students with the highest demonstrated need and to keep loan liability to a minimum. Financial aid is awarded on a first-come, first-served basis with a published priority date of March 15 prior to the fall semester for which the student is seeking aid.

To apply for financial assistance, a student must submit a FAFSA. Students are encouraged to submit their FAFSA on the Internet at www.fafsa.ed.gov as soon as possible. Only those students who have been accepted for enrollment and whose FAFSA results and other documents requested by Scholarships & Financial Aid are on file will be sent a financial aid offer. Financial aid offers will be sent beginning in March for the following academic year. To apply for summer financial assistance, complete the Summer Supplement form online via the Scholarships & Financial Aid portal at howdy.tamu.edu.

The FAFSA is available via the Internet at www.fafsa.ed.gov, most college or university student financial aid offices, high school counselors or by contacting:

Scholarships & Financial Aid
Texas A&M University
P. O. Box 30016
College Station, TX 77842-3016
(979) 845-3236
financialaid@tamu.edu
financialaid.tamu.edu
FAFSA School Code 003632

Please visit our website for the most current information on programs and any associated deadlines at financialaid.tamu.edu.

Tuition and Required Fees

All rates are the most current available at the time of printing and are subject to change.

Tuition—Residents of Texas

A resident student pays \$226.55 per semester credit hour (includes state minimum and designated tuition).

Tuition—Nonresident and International

A non-resident and international student pays \$539.55 per semester credit hour (includes state minimum and designated tuition).

Nonresident Tuition Exemption

If you have any questions concerning your eligibility for exemption from non-resident tuition, you may contact the Student Business Services at (979) 847-3337 or your department.

Advising Services Fee

This \$9.10 per semester credit hour fee is a University-wide fee assessed to provide advising services not provided to students by members of the faculty. Please refer to sbs.tamu.edu for the latest tuition and fee information.

Bursar Services Fee

This \$0.55 per semester credit hour fee is assessed to provide effective and efficient support services for the assessment and collection of student tuition and fees, cashiering services, student long-term and short-term loan management, and student financial debt management.

Bush School Graduate Program Fee

This fee is \$1,000 per semester.

Career Center Fee

This \$6.75 per semester fee (\$3.38 per summer 5-week term and \$6.75 for a 10-week summer semester) is required for all students to support the services of the Career Center, including career advising, career-related programs, and computer technologies. This fee entitles all students to the many services available, including on-campus interviewing.

Computer Access/Instructional Technology Fee

The computer access/instructional technology fee is charged at the rate of \$26.13 per semester credit hour not to exceed \$376.95 to support equipment and services for student access to computing, networking and instructional technology at the University. The fee will be used to keep the classroom instructional multimedia equipment near state-of-the-art and to support faculty in utilizing instructional technology.

Distance Education Tuition & Fees

A student registering for distance education courses will be assessed Distance Education Differential Tuition per hour based on the course(s) being taken. Each course has a different Distance Education Differential Tuition based on the fees associated with that program. An administrative fee of \$30 per hour and a Distance Education Teaching Fee of \$539.55 per hour are assessed for those non-resident students taking distance education courses outside the State of Texas.

Energy Fee

This \$60 per semester fee (\$30 per summer 5-week term) is required of all students to cover rising utility costs for Educational and General facilities on the Texas A&M University Campus.

Environmental Service Fee

This \$3 per semester fee is required of all students and provides environmental improvements at the institution through services related to recycling, energy efficiency and renewable energy, transportation, employment, product purchasing, planning and maintenance, or irrigation. The fee may also provide matching funds for grants to obtain environmental improvements.

Field Trip Fees

Field trip fees are assessed to cover the cost of providing trips and vary depending on the course taken and expected expenses.

Health Center Fee

This \$72.50 per semester fee (\$25 for a 5-week summer term) is required of all students for the purpose of operating, maintaining and equipping the University Health Center and entitles the student to its services. These services do not include surgical operations or charges for consultations with outside physicians requested by parents.

Identification Card (Aggie Card) Fee

Every student is required to have a student ID card. An ID card is permanent and a student is responsible for maintaining a working ID throughout his/her career at the University. The Aggie Card is used for residence hall access, registration, fee collection, financial aid disbursement, dining halls, athletic event and recreational sports admittance and library privileges. The charge is \$3 per semester. Replacement ID cards are \$12.

A student who loses his/her IDs should report the loss immediately online at myaggiecard.tamu.edu and deactivate the card or contact:

Student Business Services

Aggie Card Office

General Services Complex

(979) 845-4661

24 hours a day, seven days a week

or

The Network Availability Center (NAC)

(979) 862-4884

8 a.m.–5 p.m., Monday through Friday

Instructional Enhancement/Equipment Access Fees

The instructional enhancement/equipment access fee, not to exceed \$200, is charged to a student enrolled in certain courses. The fee is used for the purchase and maintenance of equipment, visual aids, other supplemental materials and educational supplies to provide students with a rich learning environment.

International Education Fee

This \$4 per semester fee is assessed to all students to support student scholarships for international education and related activities.

International Student Fee

This \$46 fee is required of all students who are not U.S. citizens or who are not U.S. lawful permanent residents to offset the cost of specialized services International Student Services provides to these students, such as immigration advising, certificate of eligibility document issuance (I-20/DS-2019), verification and monitoring of legal status, status changes, extensions of social/academic adjustment, administration of special scholarships and programs for these students.

International Orientation Fee

This \$35 fee is a one-time charge to all students who are not U.S. citizens or who are not U.S. lawful permanent residents to offset the cost of orientation programming. Designed especially for international students, this orientation does not duplicate other graduate student orientation programs.

Laboratory Fees

The University is required to assess and collect a laboratory fee not to exceed \$30 for each laboratory course to cover in general the cost of laboratory materials and supplies used by a student.

Late Penalties

A student who fails to pay fees and installments when due is assessed a \$25 late payment fee for each payment or installment paid late.

Late Registration/Add Penalties

- A student who registers on or after the first day of classes, but before the 13th day of classes is assessed a \$100 late registration fee.
- A student who registers after the 12th class day is assessed a \$200 late registration penalty.
- A student who adds classes after the 12th class day that result in a net increase in hours enrolled is assessed a \$50 late add fee.

Library Access Fee

All students pay this fee at the rate of \$26.45 per hour not to exceed \$396.75. These funds are used to provide new acquisitions, materials, etc. for campus libraries.

Reinstatement Fee

A student who fails to pay all fees by the last day of the semester will be administratively withdrawn from the University and charged a \$50 reinstatement fee.

Software Licensing Fee

This \$1.25 per semester credit hour fee (\$0.63 for summer term) is assessed to provide campus-wide software site licenses for students and the associated administrative costs of managing these licenses.

Student Center Complex Fee

This \$100 fee (\$50 for a 5-week summer term and \$100 for a 10-week summer semester) is required of all students for operating, maintaining, improving and equipping the Student Center Complex.

Student Recreation Center Fee

This \$101.92 per semester fee (\$50.96 for a 5-week summer term and \$101.92 for a 10-week summer semester) is assessed to all students attending the University for use of the recreational sports center.

Student Services Fee

All students pay this fee at the rate of \$14.97 per semester credit hour not to exceed \$179.64 per semester. It entitles the student to receive The Battalion newspaper, reduced admission to many Memorial Student Center (MSC) programs and the services of the Student Legal Advisor, MSC, Student Counseling Service, Student Activities Office and Recreational Sports.

Transportation Fee

This \$70 per semester fee (\$35 for a 5-week summer term and \$70 for a 10-week summer semester) is assessed to provide unlimited fare-free access to all students to on-campus and off-campus services, and expanded service and revenue for a long-term bus replacement plan. In addition, revenue will pay for operating expenses and the enhancement of bus facilities on campus. Fee subject to change.

University Writing Fee

This \$10 per semester fee (\$5 per summer 5-week term) is assessed to provide support for the administrative and tutorial costs of the University Writing Center. The Center was established to enhance students' writing and public speaking skills and to incorporate "communication-across-the-curriculum" approaches to instruction.

Optional Campus Services

Installment Payment Option

A student who chooses to pay using the four-payment installment plan pays a \$15 installment payment service charge. This charge is non-refundable once a payment has been made. You may add the installment plan by selecting the installment option through the online registration system at howdy.tamu.edu.

Aggie Bucks Unlimited

Show your Aggie Pride with the NEW Aggie Bucks Unlimited Gold debit card, designed just for the Texas A&M University community. Cardholders can make purchases everywhere Visa® debit cards are accepted—on campus and worldwide—and access their cash for free at more than 6,900 Wells Fargo® ATMs, including 15 in Bryan-College Station. Plus, students can use the Aggie Bucks Unlimited Gold debit card for the fastest available access to their financial aid or other refunds from the University when they sign up for Direct Deposit to a Wells Fargo checking or savings account. To get the card, speak to a Wells Fargo Banker at your New Student Conference or visit any of the six banking locations in Bryan-College Station, including the Wells Fargo Service Center in the General Services Complex on campus.

Athletic Events

Football

Student tickets for home football games (fall only) \$200

All Sports (with football)

Student tickets for all fall and spring home sports..... \$325

All Sports (without football)

Student tickets for all fall and spring home sports..... \$175

For more information, please go to mysportspass.tamu.edu.

Bus Service

Fare-free off-campus shuttle bus service is provided to all students that present a valid student ID. Fare-free on-campus shuttle bus service is also provided to all students. For more information about routes, visit the Transportation Services website at transport.tamu.edu.

Campus Dining Options/Dining Plans

Campus Dining

Texas A&M University Dining serves students in fulfilling their daily nutritional needs. With convenient locations near residence halls and class rooms, there are many options available in a variety of formats—from all-you-can-eat dining centers, to food courts, snack bars, coffee shops and convenience stores. We are happy to cater to students special needs—whether for health and nutrition information, organic or vegetarian options, even kosher and gluten-free meals. Contact us at (979) 845-3005 for any questions or special requests.

Dining Plans

Whether living on or off campus, University Dining’s plans offer flexibility and value for on-campus dining. Dining plans consist of “Dining Dollars”, which are credits in your account and act like a debit card. They can be used to purchase a meal at our dining centers for a discounted rate or as “cash” in other venues, where you will receive a 10% discount on your purchases. Other forms of payment (cash or credit card) do not receive a discount. Plans are valid from the first day of move-in (as designated by the Department of Residence Life) and end after finals. All plan pricing listed includes 8.25% sales tax.

\$2,200 Dining Dollars	\$2,382 semester/\$4,763 academic year
\$1,800 Dining Dollars	\$1,949 semester/\$3,897 academic year
\$1,400 Dining Dollars	\$1,516 semester/\$3,031 academic year
\$1,200 Dining Dollars	\$1,299 semester/\$2,598 academic year
\$800 Dining Dollars	\$866 semester/\$1,732 academic year

A \$1,200 Dining Dollar Plan (\$2,400 Dining Dollars for the academic year) dining plan is required for all freshmen classified as U1 (with less than 30 hours) living in university housing on campus. All other students, U2 and above, whether living on or off-campus, are not required to purchase a dining plan. Dining plans are purchased for the academic year, or by the semester. Dining Dollars can be used at any time for the purchase of food and beverage items only. Additional Dining Dollars may be added to a plan at anytime throughout the semester.

Additional Dollars

Dining Dollars may be added at any time during the semester to an existing dining plan. Any purchases made following the published University payment deadlines, are payable immediately.

\$25 Dining Dollars.....	\$27.06
\$100 Dining Dollars	\$108.25

For All Dining Plans

Dining Dollars can be carried over each semester, with the purchase of another dining plan. No Dining Dollars will be carried over after the end of the Summer Sessions in August (Summer Session II and 10 week Session). There is no maximum for roll over.

The students University Identification Card (Aggie Card) must be presented to dining facility cashiers for Dining Dollar participation. According to University policy, no one is permitted to use or borrow another student's identification card; therefore, dining plan use is not transferable between students.

To purchase a dining plan, students may select the plan of their preference through the official university registration site under "Optional Services" or visit the University Dining website dining.tamu.edu. All dining plans will be added to your university student account and are payable according to Student Business Services information under "Tuition and Fees" as published by Texas A&M University. Any purchases added following the published financial deadlines, including additional Dining Dollars, are payable immediately. Changes or drops/cancels to a dining plan require an email request to dining@tamu.edu and are permitted only through the fourth week of classes according to the University's schedule for tuition and fee adjustments

For questions and assistance, please email dining@tamu.edu (include name, UIN and instructions if dining plan related) or contact our office at (979) 845-3005. Additional information on University Dining and dining plans can be found on the website dining.tamu.edu.

Golf Memberships

Membership allows the holder to play when tee times or twilight times are available, including weekends and holidays. Memberships are non-transferable and may be used only by the holder of the membership. Golf carts, range balls, and clubs are available for rent at the pro shop and are NOT included in the price of the memberships. Each golfer must have a set of clubs and must register in the pro shop before beginning play. Other rules governing play are available at the Texas A&M Golf Course pro shop. Tee times may be reserved up to 7 days in advance and are recommended. To reserve a tee time or for more information, please contact the Texas A&M Golf Course at (979) 845-1723.

- **Semester memberships** are \$299 and are divided as follows:

Fall semester – September 1 through December 31

Spring semester – January 1 through May 31

Summer semester – June 1 through August 31

- **Annual memberships** are \$799 and run three consecutive semesters. For example: An annual membership purchased beginning in spring would be valid from January 1 through the following December 31.

- **Semester cart memberships** are \$299 and are also available. Cart membership allows the holder to ride at any time as long as carts are available. Cart memberships are non-transferable and may be used only by the holder of the membership. Any golfer playing with a cart membership holder must pay the appropriate fee to cover his or her portion of the cart.

Housing

Housing in residence halls is not available for graduate students except during summer school. Summer school housing information is normally available in early March. Graduate housing is available in the University Apartments.

For more information please contact: For summer school housing please contact:

University Apartments
 Department of Residence Life
 Texas A&M University
 3365 TAMU
 College Station, TX 77843-3365
 (979) 845-2261
 Fax (979) 862-2605
university-apartments@tamu.edu
reslife.tamu.edu

Housing Assignments Office
 Department of Residence Life
 Texas A&M University
 1258 TAMU
 College Station, TX 77843-1258
 (979) 862-4744 or 1-888-451-3896
 Fax (979) 862-3122
housing@tamu.edu
reslife.tamu.edu

MSC OPAS Tickets

This exciting optional fee enables a Texas A&M student to purchase six vouchers for tickets to MSC OPAS programs. This option is only available during fall registration but allows a student to attend any six programs during the season. A limited number of students will be able to purchase this option due to seating capacity. For more information, please contact MSC OPAS at (979) 845-1661.

Parking Permit

All vehicles parked on the Texas A&M University campus are required to have a parking permit, unless they are parked in a pay visitor area. Permits may be requested online at transport.tamu.edu. Costs of permits are currently as follows, but are subject to change. For more information, visit the Transportation Services website at transport.tamu.edu.

Student Parking Permit including	
West Campus Garage (12-month permit).....	\$275
Night Permit	\$88
Garage Non-Reserved Space	\$444
Motorcycle Permit including mopeds and scooters	\$88
University Apartments	\$225

Student Directory

The cost is \$3.25 and includes sales tax.

Yearbook

The cost is \$64.90 including shipping and sales tax.

Fees for Other Special Items or Services

Application Fees

Graduate: \$50; Undergraduate: \$75; International: \$90.

Cooperative Education Fee

A fee of \$75 is charged to all students participating in domestic or international Cooperative Education programs.

Diploma Fee

A non-refundable fee per degree sought is assessed the semester a student applies for graduation. This fee is payable each time a student applies for graduation. A late fee of \$50, in addition to the diploma fee, is charged to those who apply for graduation after the set deadline.

Independent International Study Fee

The \$100 fee covers services provided by Study Abroad Programs associated with students who elect to go abroad and transfer credit back to Texas A&M. Such services include advising students and departments on key issues and procedures before, during and after programs abroad; overseeing transfer credit paperwork; maintaining library and computer resources for those who want to pursue independent opportunities abroad; and overseeing issues related to affiliated programs abroad and emergency services to assist students as needed.

International Student Health Insurance

International students (students who are not U.S. citizens or Lawful Permanent Residents of the United States) enrolled at Texas A&M are required to have health insurance. International students will be automatically enrolled in and charged for the System Student Health Insurance Plan (SSHIP) unless they apply for, and are granted, a waiver. Individually purchased plans from vendors other than the Texas A&M University System provider will not be eligible for a waiver of automatic enrollment in the SSHIP. This is to ensure that medical treatment will be available in the event of injury or illness during enrollment at the University. This requirement includes students enrolled in extensive English language programs. Full-time English Language Institute (ELI) students should contact ELI for information about this requirement. All other International students can receive more detailed information about this requirement by visiting the website at iss.tamu.edu/insurance/insurance.asp. Specific questions may be directed to International Student Services by emailing healthinsurance@tamu.edu.

Master of Real Estate Program Fee

This fee is \$1,000 per semester.

Master of Real Estate Program Fee (formerly Master of Land Economics and Real Estate)

The fee structure is \$2,000 per semester for each fall and spring semester beginning with students who enter Fall 2008 and later. It will be used to further enhance the MRE program through the support of career services, student advising, curriculum development, and enrichment experiences.

Mays MBA Program Fee

The structure is \$5,000 per semester for each of the three semesters of the Mays MBA Program beginning with those students who enter Fall 2008 and later. The fee is used to support the MBA Program Office, Graduate Business Career Services, and the various activities of the Mays MBA Program.

Mays Masters' Program Fee

The fee structure is \$700 for each fall and spring semester and \$200 for each summer session beginning with those students who enter Fall 2008 and later. The fee supports the Graduate Business Career Services office and other placement and admission resources for Mays Masters students.

New Graduate Student Fee

A non-refundable new graduate student fee of \$50 is charged to all new graduate students. This fee is assessed the first semester the student is registered.

Professional Program in Biotechnology Program Fee

This fee is \$530 per semester.

Sponsored International Students

An administrative fee not to exceed \$500 per semester or summer term (all or part thereof) will be required to support international sponsored students whose programs are coordinated through the Sponsored Student Programs Office, unless these fees are waived as part of negotiated contractual agreements.

Teacher Education Admission Fee

A fee of \$200 is charged to all students entering the teacher education program.

Thesis/Dissertation/Record of Study Fee (Processing Fee)

This fee includes the review, processing and archiving of each thesis/dissertation/record of study. Archival formats include microfilm or digital storage. The fee does not include binding of personal copies. Information on binding personal copies is available at the Thesis Office or on the website thesis.tamu.edu.

Masters fee: \$110, Doctoral fee: \$170

Distance Education and Other Nontraditional Course Offerings

- DE Distance Education Instruction:** This group includes technology mediated instruction, with the exception of web-based courses offered to on-campus students. Traditional off-campus face-to-face courses may be considered distance education.
- IA *In Absentia*:** The traditional student who is performing individual research or completing degree requirements that do not require classroom instruction.
- CE Cooperative Registration:** Students participating in the Cooperative Education Program at Texas A&M University.
- GG Texas A&M University Graduate Students–Galveston:** Texas A&M graduate students who enrolled at College Station, but who are taking courses exclusively at Galveston.
- SA Study Abroad:** Students participating in the Texas A&M University Study Abroad Program.

Required Tuition and Fees	DE	IA	CE	GG	SA
Tuition	Yes	Yes	Yes	Yes	Yes
Advising Services Fee	Yes	Yes	Yes	Yes	Yes
Bursar Services Fee	Yes	Yes	Yes	Yes	Yes
Computer Access Fee	Yes	Yes	Yes	Yes	Yes
Cooperative Education Fee	No	No	Yes	No	No
Distance Education Tuition & Fees	Yes	No	No	No	No
Energy Fee	Yes	Yes	Yes	Yes	Yes
Equipment Access Fees	Yes	Yes	Yes	Yes	Yes
Field Trip Fees	Yes	Yes	Yes	Yes	Yes
Health Center Fee	No	No	No	No	No
ID Maintenance Fee	Yes	Yes	Yes	Yes	Yes
International Education Fee	Yes	Yes	Yes	Yes	Yes
International Student Services Fees	Yes	Yes	Yes	Yes	Yes
Laboratory Fees	Yes	Yes	Yes	Yes	Yes
Library Access Fee	Yes	Yes	Yes	Yes	Yes
Property Deposit	Yes	Yes	Yes	Yes	Yes
Recreational Sports Fee	No	No	No	No	No
Software Licensing Fee	Yes	Yes	Yes	Yes	Yes
Sponsored International Student Fee	Yes	Yes	Yes	Yes	Yes
Student Services Fee	Yes	No	No	Yes	Yes
Transportation Fee	No	No	No	No	No
University Center Complex Fee	No	No	No	Yes	No
Writing Center Fee	No	No	No	N/A	No

Deposits

General Deposit

Every student must make a \$100 deposit to protect the University from damage to or loss of University property. Failure to pay promptly will cause the student to be barred from re-admission and receiving an official transcript from the University. This deposit, less outstanding charges, will be returned upon the student graduating or withdrawing from school. Students leaving the University without graduating or withdrawing are subject to forfeiture of their property deposit refund if a request for the refund has not been received by Student Business Services. Deposits not refunded within four years from date of last attendance will be forfeited into a student deposit scholarship account.

Room Deposit

A deposit of \$300 and a nonrefundable \$25 application fee are required to apply for a room in a residence hall. The deposit will be retained to offset charges for damages or late cancellation, or to keep the application on an active waiting list. A reservation may be canceled and the deposit refunded upon request prior to signing a housing contract. After a housing contract has been signed for the next academic year, deposit refunds are made according to the following proposed schedule: On or before May 1 for \$300 (100 percent); May 15 for \$75 (25 percent); after May 15 no refund. The amount of the room deposit and the deposit refund schedule are subject to change per University administration approval. Cancellations after July 15 are subject to additional charges.

College of Business Administration Masters Enrollment Deposit

The College of Business Administration requires a Masters enrollment deposit of \$500, which is applied to first semester registration charges for students who complete enrollment. Deposit is forfeited for students who fail to enroll for classes.

Refund Policy

Fee Adjustments for Courses Added and Dropped

A student may drop courses during the first four days of a fall or spring semester. Students also may drop classes with special permission of the dean between the 5th and 12th class days. Full refunds will be given for courses dropped during these periods. Refunds will not be issued for classes dropped after the 12th class day. As of the first day of the semester, a student may not drop all of his/her courses through the drop/add process, but instead must go to the office of his/her dean to officially withdraw. A student may add courses during the first five days of a fall or spring semester.

Withdrawal from the University

The federal government mandates that a student who officially and unofficially withdraws from all classes may only keep the financial assistance they have “earned” up to the time of withdrawal. Documentation for a student who unofficially withdraws from the University may be required. Title IV funds that were disbursed in excess of the earned amount must be returned by the University and/or the student financial aid programs. This situation could result in the student owing funds to the University, government or both. Scholarships & Financial Aid will also calculate a return of funds for state programs.

To determine the amount of aid the student has earned up to the time of withdrawal, Scholarships & Financial Aid will divide the number of calendar days the student attended classes by the total number of calendar days in the semester (less any scheduled breaks of five days or more). The resulting percentage is then multiplied by the total federal funds that were disbursed (either to the student's University account or to the student directly by check or direct deposit) for the semester. This calculation determines the amount of aid earned by the student, which he or she may keep (for example, if the student attended 25 percent of the term, the student will have earned 25 percent of the aid disbursed). The unearned amount (total aid disbursed less the earned amount) must be returned. Scholarships & Financial Aid will notify and provide instructions to students who are required to return funds to the government. In most cases, students who complete 60 percent of the semester are eligible for all of the financial aid disbursed to them.

Allocating Returned Title IV (Federal Aid)

Funds that are returned to the federal government are used to reduce the outstanding balances in individual federal programs.

Financial aid returned (by the University and/or the student or parent) must be allocated in the following order:

1. Unsubsidized Federal Direct Loan
2. Subsidized Federal Direct Loan
3. Federal Perkins Loan
4. Direct Graduate Plus (Student) Loan
5. Federal Direct PLUS (Parent) Loan
6. Federal Pell Grant
7. Federal Supplemental Educational Opportunity Grant (FSEOG)
8. Other federal loan or grant assistance
9. Other state or institutional financial aid programs

Additionally, students who do not successfully complete any courses for the semester may be considered unofficially withdrawn and may be subject to a return calculation if attendance cannot be documented.

A student whose circumstances require that he/she withdraws from all classes is strongly encouraged to speak with a financial aid counselor and his/her academic advisor before doing so.

A student athlete should see his/her academic advisor in the Athletic Department before initiating the withdrawal process.

Refund Preference Selection

Texas A&M and Wells Fargo Bank have joined forces to deliver financial aid and other refunds to students faster through the University's refund delivery process. You will receive information from Wells Fargo and the University at your new student conference and in your official University email account, which will explain the process for providing your refund delivery preference.

Unclaimed Refunds

According to federal law, the university is required to return Title IV funds that have not been claimed (i.e., refund check that has not been cashed) within 240 days of issue. These funds will be returned to the appropriate federal financial aid program.

Tuition and Fee Adjustments

Tuition and fee adjustments shall be made to a student officially withdrawing from the University for charges listed below according to the following refund schedule: Tuition and Required Fees, Residence Hall Rent and Meal Plans.

1. If the student withdraws during a fall or spring semester or a summer term of 10 weeks or longer:

Prior to the first class day	100%
During the first five class days	80%
During the second five class days	70%
During the third five class days	50%
During the fourth five class days	25%
After the fourth five class days	None

2. If the student withdraws during a term or session of more than five weeks but less than 10 weeks:

Prior to the first class day	100%
During the first, second, or third class day	80%
During the fourth, fifth, or sixth class day	50%
Seventh day of class and thereafter	None

3. If the student withdraws from a term or session of five weeks or less:

Prior to the first class day	100%
During the first class day	80%
During the second class day	50%
During the third class day and thereafter	None

Residence Hall Rent/Deposit

If a student withdraws, moves off campus or in any other way terminates the housing contract, a refund of residence hall rent may be made according to the housing contract. Any changes to the rent refund schedule will be detailed in the housing contract. If a student cancels the academic year housing contract during the contract period, the \$300 deposit is subject to forfeiture and a surcharge (per the housing contract). The academic year contract period is from the time the contract is signed to the end of the fourth week of classes in the spring semester. Exceptions to this policy may be made for students who cancel their contract for the following reasons: Texas A&M University co-op or student teaching assignment, academic restriction, graduation and medical withdrawal.

Department of University Dining Dining Plans Add/Change/Drop Policies

Texas A&M University's dining plans and options listed are based on information available at time of printing and are subject to change. University Dining follows the University's refund schedule for Tuition and Fee Adjustments. Refunds are given on the percentage basis listed for students dropping fee options or officially withdrawing from the University.

Students may purchase a dining plan, change to a larger plan or add on to a plan during registration for classes or at any time through University Dining. Changes to a smaller dining plan or requests to cancel/drop are permitted only through the fourth week of classes. The appropriate fee is to be paid to the Office of Student Business Services or by using Touchnet.

Dining plans are valid for one semester starting with the first day of campus move-in (as designated by the Department of Residence Life) and end after finals. Check with Dining for posted dates for dining plan access. Location hours may vary during class breaks and meal availability may exclude official University holidays.

Following University policy, no one is authorized to use or borrow a student's identification card (Aggie Card); therefore, dining plans are not transferable between students. The Aggie Card must be presented to dining cashiers for dining plan participation. If an Aggie Card becomes lost, report it immediately using the 24-hour hotline at (979) 862-4884 or contact the Aggie Card Office.

For questions and assistance, please email dining@tamu.edu (include name, UIN and instructions if dining plan related) or contact our office at (979) 845-3005. Additional information on University Dining and dining plans can be found on the website dining.tamu.edu or in this catalog under Campus Dining Options.

Identification Card Fee

No refund available for this fee.

Yearbook

Yearbook charges are refundable in full during the semester in which payment is made. Thereafter, no refunds will be made on canceled orders. Yearbooks must be picked up during the academic year in which they are published. Students who will not be on campus when the yearbooks are published must pay a mailing and handling fee. Yearbooks will not be held, nor will they be mailed, without payment of the mailing and handling fee. Refunds will not be made on books not picked up within one semester of the publication date. Refunds will not be made before 21 days from the date of payment. Refund policies contained herein reflect policies in effect at the time of publication and are subject to change.

Reductions in Rates for Late Entry to the University

No reduction will be made in the charge of room rent and board in case of entrance within 10 days after the opening of a semester or summer term, nor will a refund be made in case of withdrawal during the last 10 days of a semester or summer term, or the last days for which payment is made.

Tuition and Required Fee Estimates

Graduate Tuition and Fees (estimated)

No. of Hours	Resident Student	Nonresident Student	International Student
3	\$1,344.17	\$2,283.17	\$2,329.17
6	\$2,259.17	\$4,137.17	\$4,363.17
9	\$3,174.17	\$5,991.17	\$6,037.17
12	\$4,089.17	\$7,845.17	\$7,891.17

Special Notes: "Residence" refers to whether you were a Texas resident at the time you enrolled in the University or a resident of another state or a foreign country. Rates used are the most current available at the time of printing and are subject to change. Please see information about equipment access fees and lab fees which may affect a student's total charges. Actual fees may vary. This estimate does not include program fees.

Housing

Adult, Graduate and Off Campus Student Services

studentlife.tamu.edu/agoss

- AggieSearch (aggiesearch.tamu.edu) provides students access 24/7 to apartment listings and roommate search options.
- The *Off Campus Survival Manual* introduces students to the community and covers leases, transportation, security deposits, cost estimates, eating arrangements, and more.

Department of Residence Life

reslife.tamu.edu

- Responsibility for the operation of on-campus residence halls and University Apartments. Only undergraduate students may apply to live in on-campus residence halls and The Gardens 2 Apartments during the fall and spring semesters. Summer occupancy of on-campus residence halls is open to undergraduate and graduate students.
- University Apartment units (reslife.tamu.edu/ua) are available for graduate students, single-parent families, veterans, international students, married students or single undergraduate students without children who are sophomores, juniors, seniors or non-traditional freshmen (The Gardens).

Orientation

Aggie Honor System Office

aggiehonor.tamu.edu

- All Texas A&M students, graduate and undergraduate, part-time or full-time, in residence or in distance education, are expected to follow the guiding rule of the Aggie Honor Code: “An Aggie does not lie, cheat, or steal or tolerate those who do.”
- Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Aggie Honor System Office (see aggiehonor.tamu.edu). Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the Texas A&M community from the requirements or the processes of the Aggie Honor System Office.

New Graduate Student Orientation

ogs.tamu.edu/incoming-students/new-student-orientation

- A university wide New Graduate Student Orientation takes place at the start of the fall and spring semester of each academic year. This orientation acquaints new graduate students with Texas A&M University’s personnel, services, resources, policies and procedures. Graduate students admitted for the summer semester are expected to attend the fall orientation.
- New Graduate Student Orientation consists of presentations given and organized by the Office of Graduate Studies highlighting an overview of graduate education and other areas pertinent to new graduate students. Policies, procedures and timelines are discussed, and information on financial aid, campus police, writing services and additional campus services is provided. To close the morning session, a panel of current graduate students discuss their experiences at Texas A&M and answer questions presented to them from the audience of new graduate students. After these presentations, new graduate students are given the opportunity to walk through resources tables from other offices around the Texas A&M campus who serve graduate students. Lunch is provided as a time for students to meet one another and network with staff.
- Orientation covers the what, why and how of graduate degree requirements for new graduate students. Distance Education graduate students should complete the online orientation on the ogs.tamu.edu website.
- For further information about New Graduate Student Orientation, please contact The Office of Graduate Studies at 302 Jack K. Williams Administration Building, Texas A&M University, 1113 TAMU, College Station, TX 77843-3111, (979) 845-3631 or email ogs@tamu.edu.

Prospective Student Centers

Texas A&M University has eight Prospective Student Centers throughout the state. You can meet one-on-one with an admissions counselor or a financial aid advisor and learn more about academic programs, admissions, financial aid and scholarships, housing, and student services at Texas A&M University. Call the Prospective Student Center (PSC) nearest you to set up an appointment to learn more about your future at Texas A&M.

Aggieland Prospective Student Center

Texas A&M University*
109 John J. Koldus Building
1265 TAMU
College Station, TX 77843-1265
(979) 458-0950
admissions@tamu.edu

Brazos Valley

Contact Information*
217 John J. Koldus Building
1265 TAMU
College Station, TX 77843-1265
(979) 458-0966

Corpus Christi Regional Prospective Student Center*

5262 South Staples, Suite 115
Corpus Christi, TX 78411
(361) 289-7905

Dallas/Fort Worth Regional Prospective Student Center*

3900 Arlington Highlands Blvd., Suite 273
Arlington, TX 76018
(817) 375-0960

Houston Regional Prospective Student Center*

1225 North Loop West, Suite 200
Houston, TX 77008
(713) 454-1990

Laredo Regional Prospective Student Center*

107 Calle Del Norte, Suite 102
Laredo, TX 78041
(956) 795-0412

Rio Grande Valley Regional Prospective Student Center*

5277 North 23rd St.
McAllen, TX 78504
(956) 683-8647

San Antonio Regional Prospective Student Center*

40 NE Loop 410, Suite 605
San Antonio, TX 78216
(210) 212-7016

Central Texas Regional Prospective Student Center*

Visit admissions.tamu.edu/psc for contact information.

admissions.tamu.edu

* Se habla español

Resources for Students

Alcohol and Drug Education Programs (ADEP)

studentlife.tamu.edu/adep

- Provide educational information regarding alcohol and other drugs
- Presentations may be requested for student groups
- Resource tables or interactive programming available for student events
- Responsible Aggie Decisions (RAD) Peer Education Group
Students may apply to be part of this recognized student organization

Becky Gates Children's Center

childrens-center.tamu.edu

- Texas A&M University opened the Children's Center, an on-campus childcare center, at the beginning of the 1998 fall semester. It is conveniently located behind University Apartments. The Center serves up to 162 children full-time. The hours of operations are 7:30 a.m. to 5:30 p.m. Monday through Friday. The Center follows the Texas A&M University staff holiday calendar (with the exception of 5½ staff development days). Enrollment at the Center is open to children age 12 months to 5 years, whose parents are students, faculty or staff of Texas A&M. The Center seeks to enroll children representing diverse cultural, ethnic, socioeconomic and linguistic backgrounds. The Children's Center is dedicated to providing quality care and an individualized, developmentally appropriate early childhood experience for the children. The staff establishes positive interaction, nurturing each child's growth and education in a stimulating, secure and caring learning environment. Variety is vital for a child's development. A balance of indoor and outdoor, individualized and group, quiet and active experiences are planned for each day. Individual colleges and departments are encouraged to utilize the children's center as a place to partner their classroom learning experiences with real-world, hands-on learning in the field.
- The Center is also a demonstration site for many undergraduate and graduate students at Texas A&M, including those in education, business, marketing, horticulture, architecture, parks and recreation, and construction science. These students are placed at the Center for various observation and community outreach experiences in an effort to enhance their academic development and connect student learning.
- The Center is a mostly self-supporting program. Funding is derived from childcare tuition and fees, student service fees and donations. The university provides additional facility support. A student childcare tuition rate is available for families who qualify. This rate is subsidized by student service fees. In addition, 40% of all childcare slots are reserved for children of Texas A&M students. Wait list applications are available year-round and may be obtained on the website or by calling (979) 458-5437.

Corps of Cadets, Office of the Commandant

corps.tamu.edu

- The Office of the Commandant is responsible for the development and execution of all programs affiliated with the Texas A&M Corps of Cadets. The Army, Navy/Marine and Air Force ROTC program offices are also facilitated within the Office of the Commandant.
- The Office of the Commandant is located in Room 102 of the Military Sciences Building (Trigon) on campus; phone (979) 845-2811.

Department of Multicultural Services

dms.tamu.edu

- Home to several student organizations and learning experiences fostering environments for student engagement, development and learning. Our student organizations include Aggies 2 Aggies; Asian Presidents' Council (APC); Black Student Alliance Council (BSAC); Hispanic Presidents' Council (HPC); Excellence uniting Culture, Education, and Leadership (ExCEL); Maximizing Educational Development through Academic and Leadership Skills (MEDALS); and Southwestern Black Student Leadership Conference (SBSLC).
- Outside of student organizations, we offer additional developmental opportunities including African American Student Leadership Institute (AASLI), Community Conversations, Cultural Day Trips, Cultural Leadership Understanding and Exploration for Sophomore (CLUES), Diversity Training Institute (DTI) and Institute for the Development and Education of Asian American Leaders (IDEAAL). Our department is also home to a free tutorial service providing consistent one-on-one and small group tutoring in specific courses.

Disability Services

disability.tamu.edu

- Reviews student disability documentation
- Determines appropriate accommodations
- Facilitates exam accommodations
- Provides sign language interpreting and transcription services
- Obtains course materials in alternative formats
- Consults on disability-related issues

Gay, Lesbian, Bisexual, Transgender (GLBT) Resource Center glbt.tamu.edu

Resource and Referral Center:

- Books
- Periodicals
- Brochures
- Films

Annual events include:

- Coming Out Week
- GLBT Awareness Week
- The Coming Out Monologues
- Evening of the Arts

George Bush Presidential Library and Museum bushlibrary.tamu.edu

- Presidential Museum
- Government Archives/Research
- Education Programs
- Public Programs
- Special Events
- Foundation

International Student Services iss.tamu.edu

Support Services for International Students:

- Online Orientation
- International Student Conference
- International Student Employment Information
- Cross-Cultural Programming
- Personal Advising
- Administration of Scholarships and Loans
- Community Involvement Activities
- Liaison between Student and Faculty and between Student and Community.
- Certificates of Eligibility (Forms I-20 and DS-2019)

Memorial Student Center (MSC) msc.tamu.edu

- Most of the 300+ MSC programs produced each year are open to students.
- Some of the more notable programs include Fall Leadership Conference, MSC Open House, the MSC OPAS season performances, the art collection and exhibits at the MSC Forsyth Center Galleries, Wiley Lecture, MLK Breakfast, Battle of the Bands, the MSC Variety Show, Aggie Nights, Month of Giving, Arts Awareness Week, and many more leadership conferences, trips and service projects.

- Finally, the MSC Box Office provides students and organizations with convenient and affordable ticketing, cash handling, and sales services. The Box Office makes selling easier by eliminating the worry and risk of cash handling by providing online sales and by providing extensive reporting capabilities that take the hassle out of accounting tracking sales and cash flow.

Oak Ridge Associated Universities (ORAU)

www.orau.org

- Since 1950, students and faculty of Texas A&M University have benefited from its membership in Oak Ridge Associated Universities (ORAU). ORAU is a consortium of 105 colleges and universities and a contractor for the U.S. Department of Energy (DOE) located in Oak Ridge, Tennessee. ORAU works with its member institutions to help their students and faculty gain access to federal research facilities throughout the country; to keep its members informed about opportunities for fellowship, scholarship and research appointments; and to organize research alliances among its members.
- Through the Oak Ridge Institute for Science and Education (ORISE), the DOE facility that ORAU operates, undergraduates, graduates, postgraduates, as well as faculty enjoy access to a multitude of opportunities for study and research. Students can participate in programs covering a wide variety of disciplines including business, earth sciences, epidemiology, engineering, physics, geological sciences, pharmacology, ocean sciences, biomedical sciences, nuclear chemistry and mathematics. Appointment and program length range from one month to four years. Many of these programs are especially designed to increase the numbers of underrepresented minority students pursuing degrees in science- and engineering-related disciplines. A comprehensive listing of these programs and other opportunities, their disciplines, and details on locations and benefits can be found in the *ORISE Catalog of Education and Training Programs*, which is available at see.orau.org or by calling the contact below.
- ORAU's Office of Partnership Development seeks opportunities for partnerships and alliances among ORAU's members, private industry, and major federal facilities. Activities include faculty development programs, such as the Ralph E. Powe Junior Faculty Enhancement Awards, the Visiting Industrial Scholars Program, consortium research funding initiatives, faculty research and support programs as well as services to chief research officers.
- For more information about ORAU and its programs, visit www.orau.org or contact:

Jeffrey R. Seemann
 Vice President for Research
 ORAU Councilor for Texas A&M University
 (979) 845-8585

Recreational Sports

recsports.tamu.edu

- Most Texas A&M students are automatically Rec Members. All you need is your student ID to utilize the Student Recreation Center (Rec Center). We invite persons with disabilities to contact Member Services to inquire about accommodations.
- Drop-in recreation encompasses the use of recreational facilities such as swimming/diving pools, walking/jogging track, handball/racquetball courts, indoor soccer, basketball, volleyball and badminton courts located in the Rec Center. The Rec Center also features a bouldering wall, an indoor rock climbing facility, outdoor basketball courts, outdoor sand volleyball courts, a 14,000 square foot weight and fitness room, a natatorium with three indoor pools with an Olympic venue and spring and platform diving, and an outdoor free-form and lap pool. Facilities may be used on a drop-in basis except when reserved for classes or university functions. Daily guest passes are available for visitors.
- Rec Sports also offers the Walk of Champions, aquatics classes, group exercise classes, personal training, the Healthy Living Lecture series, specialty classes, massage therapy, intramurals, the Texas A&M Sport Clubs program, Outdoor Adventures and the Texas A&M Golf Course, pro shop and driving range.

Rudder Theatre Complex (RTC)

rtc.tamu.edu

- Rudder Theatre Complex (RTC) includes a 2,500-seat auditorium, a 750-seat theater, a 250-seat forum and an exhibit hall. These facilities are available to any campus-affiliated group. The highly skilled RTC staff arranges event set ups; provides and operates audio/visual equipment, electricity, lighting and event staging; and assists with many of the other support details that are essential to a successful event.

Sponsored Student Programs

ssp.tamu.edu

Support Services for International Sponsored Students:

- Admissions
- Academic Program Development
- Contractual Agreements between the Students and Sponsors
- Student Billing and Accounts
- Academic and Personal Counseling
- Liaison between Academic Departments, Student and Sponsors

Student Assistance Services

studentaffairs.tamu.edu/SAS

Referrals/Resource Connections:

- Personal
- Academic
- Community

Student Absence Notification

Sexual Violence Response

Assistance in Coordinating Family Needs, in the Event of an Emergency

Transition Issues

General Consultation:

- University Rules
- Process
- Faculty Concerns

Student Conflict Resolution Services

studentlife.tamu.edu/scrs

- Student Conduct Services
- Student Legal Services
- Student Mediation Services

Student Counseling Service

scs.tamu.edu

- P.A.S.S.+ Academic Program
- Career Counseling Programs
- Personal Counseling
- HelpLine
- Crisis Intervention

Student Health Services

(Accredited by Accreditation Association for Ambulatory Health Care)

shs.tamu.edu

Clinics:

- Medical Clinic
- Preventive Medicine
- Women's Clinic
- Specialty Clinics

Ancillary:

- Medical Laboratory
- Radiology Services

Additional Services:

- Ambulance Service/EMS
- Dial-A-Nurse
- Dietitian
- Health Education
- Pharmacy
- Physical Therapy
- Insurance - tamuinsurance.com
- Appointments - Monday - Friday, 8 a.m. - 5 p.m.

Student Life

studentlife.tamu.edu

- The Offices of the Dean of Student Life sponsors a number of programs and events for students throughout the year: National Collegiate Alcohol Awareness Week (NCAAW), Safe Spring Break, Aggieland Market, Housing Fair and New Student Conferences.
- Additionally, the department sponsors and/or advises the following student organizations: Aggie Orientation Leader Program (AOLP), Aggies With Kids, Graduate Student Council (GSC), Off Campus Aggies (OCA), and Responsible Aggie Decisions (RAD).
- Specific services and programs offered include:
 - Adult, Graduate and Off Campus Student Services
 - Alcohol and Drug Education Programs
 - Family Programs
 - GLBT Resource Center
 - New Student Programs
 - Student Conflict Resolution Services (Student Conduct Services, Student Legal Services and Student Mediation Services)
 - Student Media (*The Battalion*, *Aggieland* yearbook, *Campus Directory*)

Student Life Studies

studentlifestudies.tamu.edu

- Facilitates assessment and evaluation of services and programs in the Division of Student Affairs and assists in expanding the knowledge base about Texas A&M students and their co-curricular experiences. Department staff can assist with the development of assessment instruments and the collection and analysis of data including web-based programs.
- Student Organization Assessment Center - serves as a resource to recognized student organizations interested in evaluation of their programs and services as well as in the development of missions, goals and strategic plans.

Technology Resources

IT.tamu.edu

- Internet Access
- Campus Wireless
- Texas A&M Email
- 24-Hour Technical Support (hdc.tamu.edu)
- Campus Computer Labs
- Discounted Software
- Supercomputing
- Learning Management System (eLearning)

University Center Complex (UCEN)

uc.tamu.edu

- The University Center Complex (UCEN) is comprised of four buildings that include the Memorial Student Center; Rudder Conference and Events Center, also known as Rudder Tower; John J. Koldus Student Services building and All Faiths Chapel. For a complete list of the units and departments that occupy the University Center buildings, please visit uc.tamu.edu. UCEN also encompasses the outdoor plazas at the Koldus Building and Rudder Tower, and the department also manages the reservations for Sbisa Dining Hall Plaza, Sul Ross Plaza and West Campus Plaza.
- When it comes to planning events on campus, visit the UCEN Hospitality & Event Services (HES) office on the 2nd floor of Rudder Tower. The HES office can assist you with reservations in any of the UCEN facilities as well as help in all aspects of planning meetings, socials or conferences. The HES office also provides a full range of coordination, registration and support services for conferences and short courses.

University Libraries

library.tamu.edu

- Sterling C. Evans Library
- West Campus Library - wcl.library.tamu.edu
- Medical Sciences Library (MSL) - msl.library.tamu.edu
- Policy Sciences & Economics Library - psel.library.tamu.edu
- Cushing Library - cushing.library.tamu.edu
- Digital Library - digital.library.tamu.edu

Veterans' Services

veterans.tamu.edu

- Assist eligible students and eligible dependents in securing the benefits and services provided by the Veterans Administration

Vice President for Student Affairs

studentaffairs.tamu.edu

- The role of Student Affairs at Texas A&M is to maximize the quality and breadth of opportunities for student engagement in the campus community, while maintaining the integration and balance between in- and out-of-class experiences.

Vocational Rehabilitation

veterans.tamu.edu/Federal_Benefits/Chapter_31.aspx

- Helps people with disabilities prepare for, find and keep jobs
- Work-related services are individualized toward a person's needs
- Helps identify, find or provide work-related services that are required to achieve employment outcomes
- Eligibility required

Women's Resource Center

wrc.tamu.edu

We offer development, education and programming in the following areas:

- Leadership Development
- Relationship and Sexual Assault Education
- Self-Esteem and Body Image Programs
- Student Organization Work and Meeting Space
- Internships

International Opportunities for Students

A large, modern fountain with multiple water jets of varying heights, set in a park-like environment with trees and a building in the background. The water is clear and blue, and the sky is bright with some clouds. Two people are walking on a path to the left of the fountain.

International Opportunities for Students

Student Options Abroad

Study Abroad Programs Office (SAPO)

studyabroad.tamu.edu

As the world is becoming more globally interconnected, there exists an increasing need for qualified individuals who have first-hand knowledge of intercultural experience and understanding. Many graduates pursue careers in academic, managerial or administrative positions that are benefited if the student has conducted research, attended conferences, worked, lived or studied abroad.

Regardless of the type or length of activity abroad, the Study Abroad Programs Office (SAPO) can assist graduate students in pre-trip logistics, health insurance, obtaining passports, crisis management abroad, scholarships, and many other related matters. Faculty members who are interested in learning more about arranging such possibilities for graduate students, should contact SAPO.

Academic Programs Abroad

Many graduate students use study abroad programs as means of enhancing their foreign language and research skills. When considering study abroad, it is important for a graduate student to know that limitations may exist for transferring graduate credits, and the student should consult with his/her committee chair early during the study abroad decision process.

Conducting Research Abroad

In some cases, graduate students are employed as part of a research project, and in others, they register for research hours at Texas A&M and go abroad independently. In all such cases, students should register their research experiences with the Study Abroad Programs Office to ensure emergency and crisis assistance while abroad.

- Research at Texas A&M University
www.tamu.edu/research

Faculty-Led Programs

To find the most recent Texas A&M graduate program offerings, in addition to other graduate opportunities, consult the study abroad website. Also, the Study Abroad Programs Office has a library that houses books and brochures on a variety of different opportunities abroad, including those for graduate students.

Internships/Work Abroad Options

- MSC L.T. Jordan Institute for International Awareness
ltjordan.tamu.edu/fellows
- Public Policy Internship Program
ppip.tamu.edu
- Texas A&M Career Center
careercenter.tamu.edu

Reciprocal Educational Exchange Programs (REEPs)

These programs give students the opportunity to enroll and pay tuition at Texas A&M but “switch places” with counterparts at foreign institutions. A complete listing of current exchanges are listed below.

- List of Departmental/College Exchange Programs
studyabroad.tamu.edu – Click on Programs and search for exchange programs
- List of University Wide Exchange Programs
studyabroad.tamu.edu – Click on Programs and search for exchange programs

“Non-Degree” Status at a Foreign Institution

Many foreign universities will accept non-degree-seeking students to study for a semester or year. In some cases, your faculty advisor or academic department may have an existing collaboration with a foreign university. If you wish to enroll directly at a foreign institution without seeking a degree, write directly to the school or schools of choice, asking for admission as a non-degree student. You may be able to receive credit for some of your coursework; it will depend on whether Texas A&M, the department, and your graduate advisory committee will accept the credit you earn overseas as transfer credit into your Texas A&M degree.

Degrees from Foreign Universities

Occasionally, a student may wish to receive an advanced degree from an international university. Of particular interest to many is the opportunity to receive a master’s degree in 12 months from the British University system or the Erasmus Mundus program, the European Union “Fulbright” for graduate students. While the experience would certainly be worthwhile, the student should be aware that a terminal degree is usually most valuable in the country from which it was granted. If you decide to pursue a degree in a foreign university, investigate whether they accept foreign students into their degree programs, and how that degree will fit into your long-term academic or career plans. You would then follow the foreign university’s application guidelines. Generally, approximately a 12-month lead time is necessary.

Funding to Go Abroad

Federal and other financial aid may be adjusted to accommodate for extra costs associated with research or study abroad. Students interested in this should discuss it with your academic department, Office of Graduate Studies, and Student Financial Aid for additional funding opportunities to go abroad.

- Fulbright Scholarship Programs for U.S. Students
www.iie.org/fulbright
- Marshall Scholarships
www.marshallscholarship.org
- National Security Education Program (NSEP)
www.nsep.gov
- Rotary Foundation Ambassadorial Scholarship
www.rotary.org – Click on Students and Youth
- Texas A&M University Scholarships
studyabroad.tamu.edu – Click on Financial Resources and Scholarships
- The Rhodes Scholarships
www.rhodesscholar.org

University Locations Abroad

Many Texas A&M partner organizations offer international opportunities to students. Students can check the Study Abroad Programs Office search engine to locate such experiences or contact their academic departments about programs and locations they recommend. In addition, Texas A&M has a center in Costa Rica.

The Soltis Center for Research and Education in Costa Rica

soltiscentercostarica.tamu.edu

The Soltis Center was established as a result of the vision and generous donation of Texas A&M University former student Mr. Charles William “Bill” Soltis, a graduate of the class of 1955, and his wife, Wanda. The Center is located in San Isidro de Peñas Blancas in San Ramon, Costa Rica. It is comprised of 250 acres adjoining the Bosque Eterno de los Niños Reserve and Zona Protectora Arenal-Monteverde and provides a unique natural setting for research and education. This facility provides dormitories, classrooms and computer labs, among other modern amenities to support research, education and outreach activities in a tropical rainforest setting. Classes on tropical ecology, hydrology, and sustainability are featured at this center.

On Campus Engagement in International Opportunities

You don't have to go abroad to take advantage of international opportunities offered by Texas A&M. Students who remain on campus are encouraged to participate in many options available including the following:

- Academic certificates and minors with an international focus
studyabroad.tamu.edu
- Engineers without Borders-U.S.A.
ewb.tamu.edu
- Global Business Brigades
gbb.tamu.edu
- MSC L.T. Jordan Institute for International Awareness
ltjordan.tamu.edu
- Student Organizations
studentactivities.tamu.edu/app/organization
(To find internationally focused student organizations, please visit studentactivities.tamu.edu/app/search/index and search international.)



Texas A&M University at Galveston

Texas A&M University at Galveston

Administrative Officers

President and CEO	Robert Smith III, RADM USN (RET)
Associate Provost and Senior Vice President and Chief Academic Officer	William A. Seitz, B.A., Ph.D.
Vice President for Academic Affairs	Donna C. Lang, B.S., M.A., Ed.D.
Superintendent, Texas Maritime Academy.....	William W. Pickavance, Jr., RADM USN (RET), M.S., M.A.
Vice President for Finance	Susan Hernandez Lee, B.B.A., M.B.A.
Associate Vice President for Administration.....	W. Brad McGonagle, B.B.A., M.S., Ph.D.
Associate Vice President for Student Affairs and Auxiliary Services.....	Grant Shallenberger, B.B.A., M.A.
Associate Vice President for Research and Graduate Studies.....	Tammy L. Holliday, B.A, Ph.D.
Associate Vice President for Research Development	Antonietta Quigg
Director of Information Services.....	Steven M. Conway, B.S., M.S., M.P.P.M.

Board of Visitors

Steven P. Valerius (Chair).....	Houston, Texas
Dennis Murphree (Chair Elect).....	Houston, Texas
Robert A. Fry, Jr. (Vice Chair Elect)	Pasadena, Texas
Wade Battles	Houston, Texas
Greg Binion.....	Houston, Texas
Christopher S. Cahill	Galveston, Texas
James C. Card.....	Houston, Texas
Michaele Cokinos.....	Houston, Texas
Thomas E. Farmer	Galveston, Texas
G. Allen Flynt	Houston, Texas
Frans Gillebaard	Kemah, Texas
Paul Hill	League City, Texas
Randolph W. House	College Station, Texas
Peter D. Huddleston	Houston, Texas
Charlie Jenkins.....	Houston, Texas
William E. Jenkins	Houston, Texas
John W. Lyons, Jr. (Emeritus Member).....	Texas City, Texas
Mark Lyons.....	Texas City, Texas
Ross D. Margraves, Jr.	Houston, Texas
Betty Massey.....	Galveston, Texas
Keith McFatrige, Jr.	Galveston, Texas
James P. McGregor	Houston, Texas
Phyllis Milstein	Galveston, Texas
B. Greg Mitchell	La Jolla, California
George P. Mitchell (Emeritus Member)	The Woodlands, Texas
Frank M. Muller, Jr.	Houston, Texas
L.C. Neely	San Antonio, Texas

Bruce Nichols.....	Austin, Texas
Chris Orth.....	Houston, Texas
Victor R. Pierson.....	Jamaica Beach, Texas
James E. Pozzi.....	Galveston, Texas
Wayne H. Prescott.....	Austin, Texas
Terry Ray.....	Brownsville, Texas
William G. Schubert.....	Pinehurst, Texas
Albert P. Shannon.....	Galveston, Texas
Kelly Teichman.....	Galveston, Texas
Kris Anne Vogelpohl.....	Galveston, Texas
Jonathan Whitworth.....	North Vancouver, British Columbia

General Statement

Texas A&M University at Galveston, a branch campus of Texas A&M University, offers ocean-oriented graduate studies with a Master of Marine Resources Management (MMR) degree, Master of Science (M.S.) in Marine Biology, Doctor of Philosophy (Ph.D.) in Marine Biology and Master of Maritime Administration and Logistics. The Master of Marine Resources Management and Master of Maritime Administration and Logistics degrees are professional degrees offered on the Texas A&M University at Galveston campuses. The Master of Science and Doctor of Philosophy degrees in Marine Biology are offered as part of the Marine Biology Interdisciplinary program through the collaboration of the Texas A&M University, Texas A&M University at Galveston, and Texas A&M University–Corpus Christi campuses. Texas A&M University at Galveston is located on the shore of Galveston Bay with close access to the Gulf of Mexico. The University has facilities at three separate campus locations in Galveston. Most instructional programs are taught at the 130-acre Mitchell campus on Pelican Island.

General Program Information

Graduate Admissions

A formal application is required from a person seeking admission or readmission to graduate studies. A statewide Apply Texas application can be used to apply to any public university in the state of Texas and can be accessed at www.applytexas.org.

An application fee of \$50 for U.S. citizens and permanent residents or \$90 for international applicants is required to process an application for admission. Application fees are nonrefundable. Checks or money orders (U.S. currency) should be made payable to Texas A&M. All financial dealings with Texas A&M may be done by check or money order provided it displays an agency bank in the U.S. and has magnetic ink character recognition (MICR) routing numbers at the bottom of the check. The \$50 fee required of U.S. citizens or permanent residents may be waived, but only in exceptional cases, for low-income applicants. In such cases, an applicant should include with the application for admission a letter from his/her financial aid officer or other knowledgeable officer verifying the need for a waiver. Waiver of the \$90 international application fee is not available.

With the approval from the degree granting unit providing admission, admission to graduate studies normally remains valid for one year from the term of acceptance with one \$50 or \$90 (as appropriate) application fee. An extension to the one-year time limit may be granted, if requested by the applicant in writing and approved by the degree granting unit.

The normal requirement for admission to graduate studies is a scholastic record which, over at least the last two years of full-time academic study in a degree program, gives evidence of the applicant's ability to do successful graduate level work.

An applicant whose academic record is not satisfactory, or who is changing fields of study, may be required to take additional work in preparation for graduate study. Such work will normally be arranged in conference with the graduate advisor or the head of the student's major department. Before accepting a student for graduate study, a department may require that the student pass a comprehensive examination covering the basic undergraduate work in that field.

To allow time for processing, application forms should be filed at least six weeks prior to the opening of the semester (international applicants should refer to the deadlines under that heading). Admission to graduate studies cannot be completed until all the credentials requested in the application form have been received and evaluated.

In addition to the records sent to the Office of Admissions and Records, a student should have in his/her possession a copy of his/her record for use in conferences with the graduate advisor or graduate faculty in his/her department. An applicant, otherwise qualified for admission to graduate studies, may not be approved in instances where the facilities and staff available in the particular field are not adequate to take care of the needs of the student.

Students interested in applying for admission to this program should visit the website www.applytexas.org to obtain an online graduate admission application for Texas A&M University at Galveston. Students interested in receiving additional information on these programs should mail requests to:

Coordinator of Graduate Programs
Research and Graduate Studies Office
Texas A&M University at Galveston
P.O. Box 1675
Galveston, TX 77553-1675

Or email gradstudies@tamug.edu.

Residence

In partial fulfillment of the residence requirement for all Texas A&M University at Galveston degrees, the student must complete 9 resident credit hours during one regular semester, one 10-week summer semester or in combination during the two five-week summer sessions (e.g., 3 hours first session, 6 hours second session). Upon recommendation of the student's advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. However, such a petition must be approved prior to the student's registration for the final 9 credit hours of required coursework. Full-time staff members of the University or of closely affiliated organizations stationed at the campus at Galveston or College Station may fulfill total residence requirements by completion of less-than-full course loads. Specific authorization for such programs must be granted in advance by the employing agency. Employees should submit verification of their employment at the time they submit their degree plan.

Student's Advisory Committee

After being granted admission to graduate study and prior to enrollment in coursework, the student will meet with the departmental graduate advisor regarding the selection of a committee chair and the development of the student's advisory committee. The student's advisory committee for the master's degree will consist of no fewer than three members and no more than five members of the graduate faculty representative of the student's fields of study and research. Two members must be members of the graduate faculty of Texas A&M Galveston, one of whom should be the chair of the student's advisory committee. At least one of the members must be from another department in Galveston or College Station. The chair, in consultation with the student, will select the remainder of the student's advisory committee. The chair will then notify the tentative members of the advisory committee, giving the student's name and field of study, and request that they consider serving on this student's advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate faculty members may serve as chair of a student's advisory committee. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable.

If the chair of the student's advisory committee is unavailable for an extended time during any academic period during which the student is involved in activities relating to an internship or professional study and is registered for 684 or 693 courses, the student may request in writing that the program chair appoint an alternate advisory committee chair during the interim period. The duties of the student's advisory committee include responsibility for the proposed degree plan.

In addition, the committee as a group, and as individual members, is responsible for counseling the student on academic matters, and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies. The committee members' signatures on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a student's advisory committee cannot resign en masse.

Other specific requirements of the student's advisory committee (SAC) for students in the Marine Biology Interdisciplinary program are detailed in the Marine Biology (MARB-IDP) section to follow.

Degree Plan

Each graduate student must submit an official degree plan to the Office of Graduate Studies (OGS) for approval. The degree plan formally declares your degree objective, the membership of your advisory committee, and the specific courses that you will be required to complete as part of your degree program. You will develop your proposed degree plan in consultation with your advisory committee. The degree plan must be approved by your advisory committee members, your department head and, if applicable, your intercollegiate faculty chairperson.

Completed degree plans must be submitted to OGS according to the following regulation with the student meeting whichever of these deadlines falls earliest:

- Following the deadline imposed by the student's college or interdisciplinary degree program.
- No later than 90 days prior to the date of the final oral examination or thesis defense for master's students or 90 days prior to the date of the preliminary examination for doctoral students.
- According to deadlines published in the OGS calendar each semester for graduation that semester.

The calendar may be found at ogs.tamu.edu/current-students/dates-and-deadlines/.

Specific rules and limitations on coursework and committee membership can be found in the Texas A&M University *Graduate Catalog*. Once a degree plan is approved by OGS, changes in coursework or committee membership may be requested by petition to OGS. "Petition Forms" may be downloaded from the OGS homepage. Changes of major, degree or department must be requested by submitting a petition and/or a new degree plan/coursework petition.

Credit Requirement for Masters Level Programs

There is a credit requirement of a minimum of 36 credit hours of courses, as approved on the degree plan. Students may elect to pursue either a thesis or a non-thesis degree in Marine Resources Management, Marine Biology or Master of Maritime Administration and Logistics. Student pursuing a course of study in Marine Biology will create their degree plan with the supervision of their faculty advisor. Students pursuing the thesis option master's degree in Marine Biology will have a requirement of a minimum of 32 credit hours of courses, as approved on their degree plan.

Limitations on the Use of Transfer, Extension and Certain Other Courses

Some departments may have more restrictive requirements for transfer work. If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The total of any combination of A and B below may not exceed the greater of either 12 hours or one-third (1/3) of the total hours on the degree plan. The following restrictions apply.
 - Courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for students in degree-seeking status at the host institution. Courses previously used for another degree are not acceptable for degree plan credit.
 - A maximum of 12 credit hours of 489 and/or 689 (Special Topics).
2. A maximum of 8 hours of 691 (Research), 4 hours of 684 (Professional Internship), or 9 hours of 485 and/or 685 (Directed Studies), and up to 3 hours of 690 (Theory of Research) or 695 (Frontiers in Research)-any combination of 684, 685, 690, 691 and

695 may not exceed one-fourth (1/4) of the total credit hour requirement shown on the individual degree plan.

3. A maximum of 2 hours of Seminar (481/681).
4. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
5. No credit may be obtained by correspondence study.
6. For graduate courses of three weeks' duration or less, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
7. Continuing education courses may not be used for graduate credit.
8. Extension courses are not acceptable for credit.

Exceptions will only be permitted in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Transfer of Credit

Courses for which transfer credits are sought must have been completed with a grade of B or greater and must be approved by the student's advisory committee and the Office of Graduate Studies. These courses must not have been used previously for another degree. Except for officially approved cooperative doctoral programs, credit for thesis or dissertation research or the equivalent is not transferable. Credit for "internship" coursework in any form is not transferable. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or greater might be considered for transfer credit if the courses would be accepted for credit toward a similar degree for a student in degree-seeking status at the host institution. Credit for coursework taken by extension is not transferable. Coursework in which no formal grades are given or in which grades other than letter grades (A or B) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit. Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours, or equated to semester credit hours. Grades for courses completed at other institutions, except for the Texas A&M University System Health Science Center, are not included in computing the GPR. An official transcript from the university at which transfer courses are taken must be sent directly to the Office of Admissions. Masters students may transfer a maximum of 12 hours of courses or one-third of the total hours of the degree plan, whichever number is greater, from an approved institution upon the advice of their advisory committee.

Scholarship

Graduate students must maintain a grade point ratio (GPR) of 3.000 (B average based on a 4.000 scale) for all courses which are listed on the degree plan and for all graded graduate and advanced undergraduate coursework (300- and 400-level) completed at Texas A&M University at College Station and/or Texas A&M University at Galveston and eligible to be applied toward a graduate degree. Graduate students will not receive graduate degree credit for undergraduate courses taken on a satisfactory/unsatisfactory (S/U) basis. Graduate students may not receive grades other than satisfactory (S) or unsatisfactory (U) in graduate courses bearing the numbers 681, 684, 690, 691, 692, 693 and 695. Any other graduate course taken on an S/U basis may not be used on a graduate

degree plan. Graduate courses not on the degree plan may be taken on an S/U basis. Only grades of A, B, C and S are acceptable for graduate credit. Grades of D, F or Unsatisfactory (U) for courses on the degree plan must be absolved by repeating the courses at Texas A&M University at College Station and/or Texas A&M University at Galveston and achieving grades of C or above or Satisfactory (S). A course in which the final grade is C or lower may be repeated for a higher grade. The original grade will remain on the student's permanent record, and the most recent grade will be used in computing the cumulative and degree plan GPRs. The cumulative GPR for a graduate student is computed by using all graded graduate (600-level) and advanced undergraduate (300- and 400-level) coursework completed at Texas A&M University at College Station and/or Texas A&M University at Galveston and eligible to be applied toward a graduate degree. Semester credit hours to which grades of Withdraw Failing (WF) are assigned shall be included in computing the GPR. Those involving grades of Withdraw Passing (WP), Satisfactory (S), Unsatisfactory (U) and Q-drop (Q) shall be excluded. If either of a student's cumulative GPR or the GPR for courses listed on the degree plan falls below the minimum of 3.000, he or she will be considered to be scholastically deficient. If the minimum cumulative GPR is not attained in a reasonable length of time, the student may be dropped from graduate studies. The procedures for dismissal are explained in the Texas A&M University Student Rules. Departments or colleges may adopt specific guidelines pertaining to scholastic deficiency or dismissal.

Continuous Registration

A student in a graduate degree program requiring a thesis, dissertation, internship or record of study, who has completed all coursework on his/her degree plans other than 691 (Research), 684 (Internship) or 692 (Professional Study) is required to be in continuous registration until all requirements for the degree has been completed. The continuous registration requirement may be satisfied by registering either *In Absentia* or In Residence.

Foreign Language

There are no specific language requirements for the Master of Marine Resources Management, Master of Science, Doctor of Philosophy in Marine Biology, or the Master of Maritime Administration and Logistics degrees.

Thesis/Dissertation Proposal

For the thesis-option masters degree or doctoral degree, the student must prepare a thesis/dissertation proposal for approval by the advisory committee and the head of the major department. This proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the submission of the request for the final examination.

There are compliance issues that must be addressed if graduate students are performing research involving human subjects, animals, infectious biohazards and recombinant DNA. Students involved in these types of research must check with the Office of Research Compliance, Office of the Vice President for Research at (979) 845-8585 to ensure that they have met all compliance responsibilities.

Time Limit

All degree requirements for a master's degree must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old may not be used to satisfy degree requirements.

All requirements for doctoral degrees must be completed within a period of 10 consecutive calendar years for the degree to be granted. A course will be considered valid until 10 years after the end of the semester in which it is taken. Graduate credit for coursework more than 10 calendar years old at the time of the final oral examination may not be used to satisfy degree requirements.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. Candidates for advanced degrees who expect to complete their work at the end of a given semester must apply for graduation by submitting the electronic application for a degree to the Admissions and Records Office and by paying the required graduation fee at Financial Management Services no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. The electronic application for degree can be accessed via the website graduation.tamu.edu/applica.html.

Thesis/Dissertation Defense/Final Examination

The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. To be eligible to take the final examination, a student's GPR must be at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and there must be no unabsolved grades of D, F or U for any course listed on the degree plan.

To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. An approved thesis proposal must be on file in the Office of Graduate Studies according to published deadlines.

The final examination covers the thesis/dissertation and all work taken on the degree plan and, at the option of the committee, may be written, oral or both. The final examination may not be administered before the thesis/dissertation is available to all members of the student's advisory committee in substantially final form and all members have had adequate time to review the document. The examination is conducted by the student's advisory committee as finally constituted. Thesis option masters and doctoral students must be registered in the University in the semester or summer term in which the final examination is taken. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate

committee with at most one dissension is required to pass a student on his or her exam. A department, or interdisciplinary degree program, may have a stricter requirement provided there is consistency within all degree programs within a department or interdisciplinary program.

A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a minimum of 10 working days in advance of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded).

Thesis option masters and doctoral candidates may petition to be exempt from their final examination provided their degree plan GPR is 3.500 or greater and they have the approval of the advisory committee, the head of the student's major department, or intercollegiate faculty, if appropriate, and the Office of Graduate Studies. It is recommended that the petition for exemption be submitted the same semester the student intends to submit the thesis. Non-thesis option students cannot be exempted from their final examination.

The Degree of Master of Marine Resources Management (MARM)

The Master of Marine Resources Management (MARM) provides students with a broad understanding of coastal and ocean policy and management. The demand for graduates from this program in industry, government, academia and non-governmental organizations (NGO's) has never been stronger. Federal agencies employing graduates include the U.S. Coast Guard, the U.S. Army Corps of Engineers, and the Environmental Protection Agency. State agencies include the Texas General Land Office and the Texas Commission on Environmental Quality. Industries employing graduates include oil and natural gas, environmental consulting companies, ports, and tourism. These organizations have identified the need for a degree which focuses on national and international ocean resource law and policy; coastal zone management; physical and geochemical marine resources management strategies; and fisheries management. This degree program views marine natural resources management and policy development from both an ecological and policy perspective.

The degree may be viewed as a degree comparable to an MBA as an alternative terminal degree for people working in marine/ocean/coastal organizations. In addition, the degree program may address the needs of some public school science teachers seeking a degree outside the field of education.

Non-Thesis Option

A thesis is not required for the Master of Marine Resources Management degree for students who select the non-thesis option program. Students pursuing the non-thesis option are not allowed to enroll in 691 (Research) for any reason and 691 may not be used for credit toward a non-thesis option Master of Marine Resources Management degree.

For the non-thesis degree in Masters of Marine Resources Management, of the total 36 hours of curriculum, 24 are required courses of study. The required courses include 6

hours of science, 8 hours of management, 2 hours of Geographic Information Systems (GIS) and 8 hours of law/policy courses. The student in the non-thesis option will choose electives for the remaining 12 credit hours, 3 hours of which will be additional science, and 3 hours of which will be additional law/policy/management. The remaining 6 hours can be in an appropriate supporting field, if desired. Additional flexibility to replace required courses with courses targeted to their area of research is available to thesis option students upon recommendation and approval by their committee and the department.

Curriculum in Master of Marine Resources Management

Required Courses (24 hours required)

- MARS 625 GIS Based Modeling for Coastal Resources
- MARS 615 Physical and Geochemical Marine Resources
- MARS 635 Environmental Impact Statements and NRDA
- MARS 676 Environmental Policy
- MARA 604 Marine Natural Resource Economics
- MARB 620 Marine Biological Resources
- MARS 675 Environmental Management Strategies for Scientists
- MARS 680 Integrative Analyses in Marine Resources
- MARS 652 Sustainable Management of Coastal Margins

Thesis Option

The MARM thesis option is designed to allow the student to demonstrate research capabilities through developing an independent and thorough investigation of a particular problem of interest. This would also prepare the student for further graduate studies.

An acceptable thesis is required for the Master of Marine Resources Management degree for students who select the thesis option program. The finished work must reflect a comprehensive understanding of the pertinent literature and express in clear English, the problem(s) for study, the method, significance and results of the student's original research. Guidelines for the preparation of the thesis are available in the Thesis Manual which is available online at thesis.tamu.edu.

After successful defense (or exemption from) and approval by the student's advisory committee and the head of the student's major department, students must submit their thesis to the Thesis Office. Students must submit their thesis in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website thesis.tamu.edu. Additionally, a signed approval page must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval page are required by the deadline day.

Deadline dates for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement).

Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at Financial Management Services. After commencement, theses are digitally stored and made available through the Texas A&M Libraries.

A thesis that, because of excessive corrections, is deemed unacceptable by the Thesis Office, will be returned to the student's department head. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All

original submittal deadlines must be met during the resubmittal process in order to graduate that semester.

No credit hours of 684 (Professional Internship) may be used for the thesis option Master of Marine Resources Management degree. A maximum of 8 credit hours of 691 (Research) or 485 and/or 685 (Directed Studies), and up to 3 credit hours of 690 (Theory of Research) or 695 (Frontiers in Research) may be used toward the thesis option Master of Marine Resources Management degree. In addition, any combination of 685, 690, 691 and 695 may not exceed 12 credit hours.

The 36-hour thesis-option curriculum is structured with 22 hours of required courses and 14 hours of optional elective courses. Additional flexibility to replace required courses targeted to their area of research is available to thesis-option students upon recommendation and approval by their committees and the department.

The Degree of Master of Science in Marine Biology and Doctor of Philosophy in Marine Biology: Marine Biology Interdisciplinary Degree Program (MARB-IDP)

The M.S. and Ph.D. degrees in Marine Biology are taught by marine biologists within the Texas A&M University System (TAMUS). The program is interdisciplinary, involving courses and linking faculty from the Texas A&M Colleges of Science (SCI), Agriculture and Life Sciences (COALS), Geosciences (GEOS), TAMU at Galveston (TAMUG) and TAMU-Corpus Christi (TAMUCC).

The goal of the Marine Biology Interdisciplinary graduate program is to attract high-quality students interested in one or a combination of the sub-disciplines of marine biology who wish to pursue careers in higher education, government, or private industry. The structure of the education provided by the program will ensure that highly qualified individuals will be sent into the job market or on to further education. Employment of graduates will be related to environmental and living resource regulation and management within all levels of government; industries related to or affected by resource utilization and management; and within all levels of academia, including teaching and conducting both basic and applied research.

The degree program will focus on independently supervised research complemented by formal coursework. Essential components of the program include the following:

- a highly diverse curriculum available on all three campuses;
- original, supervised scholarly research, to be written and formally defended as a paper, thesis or dissertation;
- efficiencies obtained by sharing the diversity of courses already offered at the three participating entities facilitated by distance learning technologies;
- all students will benefit from distance technologies by having access to various courses offered at the alternative campuses and the ability to interact with members of their committees and others from whom they are separated by distance.

Students will earn one of the following degrees:

- Master of Science, non-thesis option, with 36 total semester credit hours;
- Master of Science, thesis option, with 32 total semester credit hours including thesis; or

- Doctor of Philosophy, with a minimum of 64 total semester hours beyond the M.S. degree or a minimum of 96 total semester hours beyond the B.S. degree, including dissertation.

Degree Requirements

Credit Hours Required for Master of Science Degree

	Thesis	Non-Thesis
Courses	22	34
Seminar	2	2
Research hours	8	0
Total	32	36

Credit Hours Required for Doctor of Philosophy Degree

	With M.S.	Without M.S.
Courses	17-23	39-55
Seminar	2	2
Research hours	39-45	39-55
Total	64	96

Residence

1. For the M.S. degree:

M.S. students, both thesis and non-thesis option, are expected to devote most of their time and energy to graduate studies under the direction of the students' major professors and the advisory committees. Although there is no specific requirement that the student be in residence on any of the three campuses, a student's chair and committee will be the ultimate arbiter of the time in residence at any one of the participating facilities. In addition, students enrolled through the Texas A&M or TAMUG campuses will have to meet the degree residency requirements as stated in the *Texas A&M Graduate Catalog* and students enrolled through the TAMUCC campus will have to meet the graduate degree residency requirements as stated in the TAMUCC Graduate Catalog.

2. For the Ph.D. degree:

Students entering the program with a baccalaureate degree must spend two academic years in residence at one or a combination of the three campus facilities. Students entering with a M.S. degree must spend at least 1 year in residence. The residency requirement may be met at any of the three participating locations, or any combination of months on all campuses, totaling either one or two years, as required. Registration on-campus for 9 credit hours per long-term shall satisfy the technical requirement for residency. The student's committee chair, along with the committee, will be the ultimate arbiter of the amount of time to be spent working in the mentor's facility or otherwise working closely with the mentor.

Student's Advisory Committee (SAC)

1. For the M.S. degree:

The Committee consists of at least three members, each of whom must have a graduate faculty appointment at TAMUCC or Texas A&M or TAMUS Participating Graduate Faculty. The Chair of the Committee must be a faculty member in one of the participating departments and be a formal member of the MARB IDPs PGF. At least one member must be from a different academic department than those departments participating in the program.

2. For the Ph.D. degree:

The Committee consists of at least four members, each of whom must have a graduate faculty appointment at TAMUCC or Texas A&M. The Chair (or co-Chair) of the Committee must be a faculty member of one of the participating departments and be a formal member of the MARB IDPs PGF. At least one member must be from a different academic department other than the participating departments.

3. External Committee Members:

Committee members outside the University, e.g., qualified scientists at other academic institutions, governmental agencies, or industries, will be authorized as Associate Adjunct or special appointment Graduate Faculty, for both M.S. and Ph.D. committee service, if they have expertise beneficial to the guidance and/or completion of the student's research. The external member may not constitute one of the three (M.S.) or four (Ph.D.) required committee members. The OGS, Texas A&M, must approve all external committee members before they may serve on a committee. Categories and requirements of graduate faculty members are described in the *Texas A&M Graduate Catalog*.

The Degree Plan

Students, in conjunction with their committee chairs and committee members, will choose courses in the degree plan. The limitations on certain courses are described in the Texas A&M or TAMUCC Graduate Catalogs. Guidelines for the use of transfer and certain other courses in the Ph.D. program can be found in *Texas A&M Graduate Catalog*.

Time Limit

All degree requirements for the M.S. and Ph.D. must be completed within 7 and 10 years, respectively, of entering the degree program, in accordance with provisions contained in the *Texas A&M Graduate Catalog*.

Applications and Deadlines

All applications and deadlines will be in accordance with provisions of the OGS, Texas A&M and the TAMUCC OGS.

Examinations

1. For the M.S. degree:

A final examination will be required of both thesis option and non-thesis option students. The examination will cover all fields of general biology, as well as the

specific research topic in the case of thesis option students. Thesis option students may schedule the final examination after completion of all coursework and after at least the first draft of the thesis has been submitted to their committee for review. Non-thesis option students may schedule the final examination after completion of all coursework. Both thesis option and non-thesis option students must have a GPR of 3.0 or higher for courses on the degree plan completed within the participating colleges, and there must be no unresolved grades of D, F or U for any course listed on the degree plan.

2. For the Ph.D. degree:

A preliminary examination, written and oral, is required, and shall be administered in accordance with the rules outlined in the Graduate Catalog of the respective institution. It will be given no earlier than a date at which the student is within approximately 6 credit hours of completion of the formal coursework on the degree plan, or no later than the end of the semester following completion of the formal coursework on the degree plan. The written portion of the exam shall cover all fields of study included in the student's degree plan. The written examinations must be completed and reported as satisfactory before the oral portion of the examination may be held. Upon successful completion of the examination, the student will be admitted to candidacy.

Students enrolled through Texas A&M or TAMUG must pass the final examination/dissertation defense by deadline dates published in the Texas A&M OGS calendar and students enrolled through TAMUCC must pass the final examination/dissertation defense by deadline dates published in the TAMUCC OGS calendar. No student may be given a final examination unless their GPR is 3.0 or above, they have been admitted to candidacy, and there are no grades of D, F or U for any course listed on the degree plan.

Special Requirements for the Program

1. For the M.S. degree:

The M.S. student will be encouraged to teach undergraduate laboratory courses for at least one semester, especially if the student has not already had teaching experience as a graduate student or teaching professional. All teaching assistants will comply with Southern Association of Colleges and Schools (SACS) requirements that they have either 18 graduate credit hours in the subject matter or will be under the direct supervision of a faculty member.

2. For the Ph.D. degree:

The Ph.D. student will be encouraged to teach undergraduate laboratory courses for at least two semesters, especially if the student has not already had teaching experience as a graduate student or teaching professional. All GATs will comply with SACS requirements that they have either 18 graduate credit hours in the subject matter or will be under the direct supervision of a faculty member.

The Degree of Master of Maritime Administration and Logistics

The Master of Maritime Administration and Logistics is a professional graduate management degree that helps the student develop an integrated understanding of the centrality of ports and interconnected transportation systems to the international and domestic commerce of the United States and to the general global trading system. Coursework in international trade, economics, finance, marketing, management, logistics, port management and environmental science will prepare graduates for senior management positions in a wide variety of industries associated with logistics and, most specifically, waterborne commerce.

Southeast Texas, from the Louisiana border to Freeport, contains the important ports of Beaumont-Port Arthur, Galveston, Houston and Freeport, an important segment of the Gulf Intracoastal Waterway (GIWW), and a significant portion of the oil refining capacity of the United States. This maritime complex contains a rich diversity of cargo handling facilities which connect to the main east-west and north-south rail and road arteries of the nation. Port activity in the region is steadily expanding as world trade and the general globalization of business increases. The opening of the new locks of the Panama Canal in 2014 will dramatically increase regional port and logistics activity and the associated need for professionals with advanced degrees. Additionally, increased energy exploration and recovery activities in the Gulf of Mexico are expected to stimulate 2-3 trillion dollars of economic investment in the coastal zone of Texas in the next few decades. This investment will sustain continued economic growth for the foreseeable future. The combination of these two circumstances—the general increase in world trade and the expanding energy industry in the Gulf of Mexico—will provide exciting and challenging opportunities throughout the energy, maritime and all other transportation industries.

The graduate program in Maritime Administration and Logistics will attract dynamic and forward looking students who understand the implications of expanding regional and international trade. Some students will want to complete the thesis option, which requires preparation of a graduate thesis involving original research. This is strongly recommended for students who intend to continue their education at the doctoral level. (See below.) The non-thesis option does not preclude future work toward a doctorate but is most appropriate for students who see this graduate program as their final professional degree. Thesis students will be supervised by a graduate advisory committee that is responsible for development of their final degree plan.

Graduate programs in business typically are delivered by both full time and part-time/adjunct faculty who are active researchers and practitioners in their fields. Proximity to the Houston-Galveston port complex allows ready access to extremely well qualified faculty, to research opportunities, and to challenging and exciting professional career opportunities following graduation. The websites of the Department of Maritime Administration and the Department of Marine Sciences contain biographical summaries of all faculty who will teach in this program and their research interests.

Degree Requirements for the Master of Maritime Administration and Logistics**Credit Hours Required for Master of
Maritime Administration and Logistics Degree**

	Thesis	Non-Thesis
Courses	30	36
Research hours	6	0
Total	36	36

It is recognized that students will come to this program from a variety of academic backgrounds. While there are no specific undergraduate courses or programmatic pre-requisites, it is strongly recommended that students have a background in basic business principles and practices that are academically represented by the following, as described in the current online catalog of Texas A&M University at Galveston at www.tamug.edu/catalog:

INFO 303 – Statistical Methods
 ECON 202 – Principles of Microeconomics
 MARA 363 – The Management Process (Organizational Behavior)
 ACCT 229 and ACCT 230 – Financial and Managerial Accounting Principles
 MARA 250 – Management Information Systems

Further, students will normally not be admitted to the program unless they have had a minimum of two years of experience in a managerial role, following completion of their undergraduate degree. This need not be in maritime or other transportation-related industries.

Required Coursework

All students will complete seven (7) courses (21 credits) in the management of a maritime enterprise: MARA 610 – International Strategic Planning and Implementation

MARA 623 – Economic Issues in Shipping
 MARA 624 – Intermodal Transportation Operations
 MARA 627 – Marketing of Transportation Services
 MARA 636 – Managerial Decision Making
 MARA 641 – Financial Management in Marine Transportation
 MARA 664 – Production, Operations and Logistics Management

Elective Coursework

To complete the remaining 15 credits, students will select from two sets of elective courses that define modules in Shipping and Port Management and Maritime Policy and Law:

For the module in Shipping and Port Management, choose five (5) of the following:

MARA 616 – Management of Port Facilities and Infrastructure
 MARA 640 – Global Logistics
 MARA 650 – Distribution Logistics

MARA 652 – Marine Transportation System Design and Policy
MARA 658 – Port Design, Planning and Security
MARA 660 – Risk Assessment and Marine Insurance

For the module in Maritime Policy and Law, choose five (5) of the following:

MARA 604 – Marine Natural Resources Economics
MARA 670 – Coastal and Inland Waterways Transportation
MARA 672 – The Maritime Global Trading System
MARS 620 – International Environmental Business Transactions
MARS 635 – Environmental Impact Statements and NRDA
MARS 640 – Environmental Administrative Law
MARS 660 – Environmental Alternative Dispute Resolution
MARS 676 – Environmental Policy

Students choosing the thesis option to the degree will take 6 credits of MARA 691 – Research in Maritime Administration and will take three (3) additional courses in one of the identified modules.

Thesis Option

The thesis option is designed to allow the student to demonstrate research capabilities through developing an independent and thorough investigation of a particular problem of interest. This would also prepare the student for further graduate studies. An acceptable thesis is required for the Master of Maritime Administration and Logistics degree for students who select the thesis option program. The finished work must reflect a comprehensive understanding of the pertinent literature and express in clear English, the problem(s) for study, the method, and the significance and results of the student's original research. Guidelines for the preparation of the thesis are available in the Thesis Manual which is available online at thesis.tamu.edu.

After successful defense (or exemption from) and approval by the student's advisory committee and the Head of the Department of Maritime Administration, students must submit their thesis to the Thesis Office of Texas A&M University. Students must submit their thesis in electronic format as a single PDF file. The PDF file must be uploaded to the Thesis Office website thesis.tamu.edu. Additionally, a signed approval page must be brought or mailed to the Thesis Office. Both the PDF file and the signed approval page are required by the deadline day. Deadline dates for submitting are announced each semester or summer term in the Office of Graduate Studies Calendar (see Time Limit statement in the Graduate Studies section of this catalog). Before a student can be "cleared" by the Thesis Office, a processing fee must be paid at Financial Management Services. After commencement, theses are digitally stored and made available through the Texas A&M Libraries.

A thesis that, because of excessive corrections, is deemed unacceptable by the Thesis Office, will be returned to the Head of the Department of Maritime Administration. The manuscript must be resubmitted as a new document, and the entire review process must begin anew. All original submittal deadlines must be met during the resubmittal process in order to graduate that semester.

No credit hours of 684 (Professional Internship) may be used for the thesis option for the Master of Maritime Administration and Logistics degree. A maximum of 8 credit hours of 691 (Research) or 485 and/or 685 (Directed Studies), and up to 3 credit hours of 690 (Theory of Research) or 695 (Frontiers in Research) may be used toward the thesis option of the Master of Maritime Administration and Logistics degree. In addition, any combination of 685, 690, 691 and 695 may not exceed 12 credit hours.

The 36-hour thesis-option curriculum is structured with 21 hours of required courses and 15 hours of optional elective courses of which at least 6 hours are in 691 courses. Additional flexibility to replace required courses targeted to their area of research is available to thesis-option students upon recommendation and approval by their committees and the Head of the Department of Maritime Administration.

Residence

In partial fulfillment of the University residence requirement for the degree of Master of Maritime Administration and Logistics, the student must complete 9 resident credit hours during the regular semester, one 10-week summer semester, or in combination during the two five-week summer sessions. Upon recommendation of the student's advisory committee, or advisor for non-thesis students, and with the approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. Such a petition, however, must be approved prior to the student's registration for the final 9 credit hours of required coursework. Full-time staff members of the University or of closely affiliated organizations stationed at the campus in Galveston or College Station may fulfill total residence requirements by completion of less-than-full course loads. Specific authorization for such programs must be granted by the employing agency. An employee should submit verification of his/her employment at the time he/she submits a degree plan.

Student's Advisory Committee

All MMAL non-thesis students' advisory committees will consist of the departmental graduate advisor for the MMAL program or the department head for the Maritime Administration department. The departmental graduate advisor or the department head has the responsibility of approving the proposed degree plan for all non-thesis MMAL students. When necessary, recommendations in cases of academic deficiency will be made to the Office of Graduate Studies. After being granted admission to graduate study and prior to enrollment in course work, all thesis-option MMAL students will meet with the departmental graduate advisor regarding the selection of a committee chair and the development of the student's advisory committee. The student's advisory committee for the master's degree will consist of no fewer than three members and no more than five members of the graduate faculty representative of the student's fields of study and research. Two members must be members of the graduate faculty of Texas A&M at Galveston, one of whom should be the chair of the student's advisory committee. At least one of the members must be from another department in Galveston or College Station. The chair, in consultation with the student, will select the remainder of the student's advisory committee. The chair will then notify the tentative members of the advisory committee, giving the student's name and field of study, and request that they consider serving on this student's advisory committee. The student will interview each prospective committee member to determine whether he or she is willing to serve. Only graduate

faculty members may serve as chair of a student's advisory committee. The chair of the committee, who usually has immediate supervision of the student's degree program, has the responsibility for calling required meetings of the committee, and for calling meetings at any other time considered desirable. If the chair of the student's advisory committee is unavailable for an extended time during any academic period during which the student is involved in activities relating to an internship or professional study and is registered for 684 or 693 courses, the student may request in writing that the program chair appoint an alternate advisory committee chair during the interim period. The duties of the student's advisory committee include responsibility for the proposed degree plan. In addition, the committee as a group, and as individual members, is responsible for counseling the student on academic matters and, in the case of academic deficiency, initiating recommendations to the Office of Graduate Studies. The committee members' signatures on the degree plan indicate their willingness to accept the responsibility for guiding and directing the entire academic program of the student and for initiating all academic actions concerning the student. Although individual committee members may be replaced by petition for valid reasons, a student's advisory committee cannot resign en masse.

Degree Plan

Each graduate student must submit an official degree plan to the Office of Graduate Studies (OGS) for approval. The degree plan formally declares his/her degree objective, the membership of the advisory committee, and the specific courses that she/he will be required to complete as part of the degree program. She/he will develop their proposed degree plan in consultation with their designated advisory committee. The Head of the Department of Maritime Administration must approve all degree plans. Completed degree plans must be submitted to OGS according to the following regulation with the student meeting which ever of these deadlines falls earliest:

- Following the deadline imposed by the student's college or interdisciplinary degree program.
- No later than 90 days prior to the date of the final oral examination or thesis defense – thesis students only.
- According to deadlines published in the OGS calendar each semester for graduation that semester. The calendar may be found at ogs.tamu.edu/current-students/dates-and-deadlines/.

Specific rules and limitations on coursework and committee membership can be found in the Texas A&M University Graduate Catalog. Once a degree plan is approved by OGS, changes in coursework or committee membership may be requested by petition to OGS. "Petition Forms" may be downloaded from the OGS home page. Changes of major, degree or department must be requested by submitting a petition and/or a new degree plan/coursework petition. Additional flexibility to replace required courses with courses targeted to their area of research is available to thesis option students upon recommendation and approval by their committee and the department head.

Limitations on the Use of Transfer, Extension and Certain Other Courses

If otherwise acceptable, certain courses may be used toward meeting credit-hour requirements for the master's degree under the following limitations.

1. The total of any combination of A and B below may not exceed the greater of either 12 hours or one third (1/3) of the total hours on the degree plan. The following restrictions apply:
 - A. Courses taken in residence at an accredited U.S. institution, or approved international institution with a final grade of B or greater, will be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University, or the student was in degree-seeking status at the institution at which the courses were taken; and if the courses would be accepted for credit toward a similar degree for students in degree-seeking status at the host institution. Courses previously used for another degree are not acceptable for degree plan credit.
 - B. A maximum of 12 credit hours of 489 and/or 689 (Special Topics).
2. A maximum of 8 hours of 691 (Research), 4 hours of 684 (Professional Internship), or 9 hours of 485 and/or 685 (Directed Studies), and up to 3 hours of 690 (Theory of Research) or 695 (Frontiers in Research). Any combination of 684, 685, 690, 691 and 695 may not exceed one-fourth (1/4) of the total credit hour requirement shown on the individual degree plan.
3. A maximum of 2 hours of Seminar (481/681).
4. A maximum of 9 hours of advanced undergraduate courses (300- or 400-level).
5. No credit may be obtained by correspondence study. (Courses in the student's degree plan which may be delivered in whole or in part by electronic means are not considered "correspondence study.")
6. For graduate courses of three weeks' duration or less, up to 1 hour of credit may be obtained for each five-day week of coursework. Each week of coursework must include at least 15 contact hours.
7. Continuing education courses may not be used for graduate credit.
8. Extension courses are not acceptable for credit.

Exceptions will only be permitted in unusual cases and when petitioned by the student's advisory committee and approved by the Office of Graduate Studies.

Transfer of Credit

Students may transfer a maximum of 12 hours of courses or one-third of the total hours of the degree plan, whichever number is greater, from an approved institution upon the advice of their advisory committee. Courses taken in residence at an accredited U.S. institution or approved international institution with a final grade of B or better might be considered for transfer credit if, at the time the courses were completed, the student was in degree-seeking status at Texas A&M University at Galveston or at the institution at which the courses were taken, and if the courses would be accepted for credit toward a similar degree for students in degree-seeking status at the host institution.

Coursework in which no formal grades are given or in which grades other than letter grades (A, B, C, etc.) are given (for example, CR, P, S, U, H, etc.) is not accepted for transfer credit. Courses appearing on the degree plan with grades of D, F or U may not be absolved by transfer work. Credit for thesis research or the equivalent is not transferable.

Credit for coursework submitted for transfer from any college or university must be shown in semester credit hours or equated to semester credit hours. Students must have an official transcript sent directly from the university in which the transfer coursework was taken to the Texas A&M at Galveston Office of Admissions and Records. Courses completed at other institutions are not included in computing the GPR.

Scholarship

Graduate students must maintain a grade point ratio (GPR) of 3.000 (B average based on a 4.000 scale) for all courses which are listed on the degree plan and for all graded graduate and advanced undergraduate coursework (300- and 400-level) completed at Texas A&M University at College Station and/or Texas A&M University at Galveston and eligible to be applied toward a graduate degree. Graduate students will not receive graduate degree credit for undergraduate courses taken on a satisfactory/unsatisfactory (S/U) basis. Graduate students may not receive grades other than satisfactory (S) or unsatisfactory (U) in graduate courses bearing the numbers 681, 684, 690, 691, 692, 693 and 695. Any other graduate course taken on an S/U basis may not be used on a graduate degree plan. Graduate courses not on the degree plan may be taken on an S/U basis. Only grades of A, B, C and S are acceptable for graduate credit. Grades of D, F or Unsatisfactory (U) for courses on the degree plan must be absolved by repeating the courses at Texas A&M University at College Station and/or Texas A&M University at Galveston and achieving grades of C or above or Satisfactory (S). A course in which the final grade is C or lower may be repeated for a higher grade. The original grade will remain on the student's permanent record, and the most recent grade will be used in computing the cumulative and degree plan GPRs. The cumulative GPR for a graduate student is computed by using all graded graduate (600-level) and advanced undergraduate (300- and 400-level) coursework completed at Texas A&M University at College Station and/or Texas A&M University at Galveston and eligible to be applied toward a graduate degree. Semester credit hours to which grades of Withdraw Failing (WF) are assigned shall be included in computing the GPR. Those involving grades of Withdraw Passing (WP), Satisfactory (S), Unsatisfactory (U) and Q-drop (Q) shall be excluded. If either of a student's cumulative GPR or the GPR for courses listed on the degree plan falls below the minimum of 3.000, he or she will be considered to be scholastically deficient. If the minimum cumulative GPR is not attained in a reasonable length of time, the student may be dropped from graduate studies. The procedures for dismissal are explained in the Texas A&M University Student Rules. Departments or colleges may adopt specific guidelines pertaining to scholastic deficiency or dismissal.

Continuous Registration

Students in the thesis option of the Master of Maritime Administration and Logistics program who have completed all coursework on their degree plans other than 691 (Research) are required to be in continuous registration until all requirements for the degree have been completed. See Continuous Registration Requirements on [page 202](#).

Foreign Language

There are no specific language requirements for the degree Master of Maritime Administration and Logistics.

Thesis Proposal

For the thesis option, the student must prepare a thesis proposal for approval by the advisory committee and the head of the Department of Maritime Administration. This proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the submission of the request for the final examination. There are compliance issues that must be addressed if graduate students are performing research involving human subjects, animals, infectious biohazards and recombinant DNA. Students involved in these types of research must check with the Office of Research Compliance, Office of the Vice President for Research at (979) 845-8585 to ensure that they have met all compliance responsibilities. .

Time Limit

All degree requirements for a master's degree must be completed within a period of seven consecutive years for the degree to be granted. A course will be considered valid until seven years after the end of the semester in which it is taken. Graduate credit for coursework which is more than seven calendar years old may not be used to satisfy degree requirements.

Application for Degree

Graduate degrees are conferred at the close of each regular semester and 10-week summer semester. Candidates for advanced degrees who expect to complete their work at the end of a given semester must apply for graduation by submitting the electronic application for a degree to the Admissions and Records Office and by paying the required graduation fee at Financial Management Services no later than the Friday of the second week of the fall or spring semester or the Friday of the first week of the first summer term. The electronic application for degree can be accessed via the website howdy.tamu.edu.

Thesis Defense/Final Examination

This section applies to thesis students only. The candidate must pass a final examination by dates announced each semester or summer term in the Office of Graduate Studies Calendar. To be eligible to take the final examination, a student's GPR must be at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M which are eligible to be applied to a graduate degree, and there must be no unabsolved grades of D, F or U for any course listed on the degree plan. To absolve a deficient grade, the student must have repeated the course at Texas A&M University and have achieved a grade of C or better. All coursework on the degree plan must have been completed with the exception of those hours for which the student is registered. Additionally, all English Language Proficiency requirements must be satisfied prior to scheduling the examination. An approved thesis proposal must be on file in the Office of Graduate Studies according to published deadlines. The final examination covers the thesis and all work taken on the degree plan and, at the option of the committee, may be written or oral or both. The final examination may not be administered before the thesis is available to all members of the student's advisory committee in substantially final form, and all members have had adequate time to review the document. The examination is conducted by the student's advisory committee as finally constituted. Thesis option students must be registered in the University in the semester or summer term in which

the final examination is to be taken. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, attend final examinations for advanced degrees. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings. A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam. A department, or interdisciplinary degree program, may have a stricter requirement provided there is consistency within all degree programs within a department or interdisciplinary program. A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies a minimum of 10 working days in advance of the scheduled date for the examination. Examinations which are not completed and reported as satisfactory to the Office of Graduate Studies within 10 working days of the scheduled examination date will be recorded as failures. A student may be given only one opportunity to repeat the final examination for the master's degree and that must be within a time period that does not extend beyond the end of the next regular semester (summer terms are excluded). Thesis option candidates may petition to be exempt from their final examination provided their degree plan GPR is 3.500 or greater and they have the approval of the advisory committee, the head of the student's major department, or intercollegiate faculty, if appropriate, and the Office of Graduate Studies. It is recommended that the petition for exemption be submitted the same semester the student intends to submit the thesis. Non-thesis option students cannot be exempted from their final examination.

Admissions

To apply for graduate school, you will need to submit: (1) A web-based application (www.applytexas.org), including the application fee and essay questions; (2) Official Graduate Management Admissions Test (GMAT) scores – see www.gmat.org for test information; (3) Two official transcripts from EACH college/university you have attended; (4) Two letters of recommendation submitted either electronically or by surface mail; (5) Your professional resume; and (6) TOEFL or IELTS scores, if applicable, for international students (see below).

Note that copies of transcripts may be submitted for preliminary review, but official transcripts are required before an application is regarded as complete. International students should consult the TAMUG website (www.TAMUG.edu) under “Prospective Students” for additional requirements.

The following information will be helpful as you prepare your application:

1. If you are currently a graduate student enrolled at Texas A&M University at Galveston, and wish to change from your current enrollment in another graduate program, DO NOT use the ApplyTexas application system. Contact the Maritime Administration department office for internal application instructions.
2. DO NOT submit documents not required in the application process, such as certificates, awards, visas/passports, writing/publication samples and so on.
3. Modifications cannot be made to an online application. Make sure that your application and documents are in the final and desired format before they are submitted electronically.
4. Information on the status of a submitted application is not available. Applicants will be contacted by the Maritime Administration Department if information is needed.

5. All applications are reviewed online; paper credentials are not assessed. Do not mail supplemental materials by surface mail. (Note that letters of reference from others may be submitted by surface mail, as noted above.) They will not be reviewed and will not be returned.
6. All uploaded materials are to be scanned and sent in PDF format. Do not use any other format.
7. Watch spelling errors and use appropriate UPPER/lower case characters. Do not submit documents that are all UPPER CASE or all lower case.
8. Your professional resume should detail your academic background, professional work experience, and managerial responsibilities.
9. Your letters of recommendation should be written by individuals who can address your responsibilities and skills, professional potential, motivation and the impact on this degree on the development of your career. If they are sent by surface mail, they should be addressed to the address below.
10. Official GMAT scores are ultimately required. Unofficial scores are accepted and strongly encouraged for the initial review. They can be sent in PDF format.
11. The following applies to transcripts: (a) Scan student copies of your transcript(s) as PDF files and upload to your application; (2) Preview these copies to be sure they are legible — low resolution copies may improve legibility; (3) Students of TAMUG can upload an official transcript; (4) Transcripts may be missing final grades if applying in a current semester. Do not send it later; it is not needed; (5) Do not mail official transcripts to Graduate Admissions at Texas A&M University at Galveston. If you are admitted, you will be contacted and asked to submit official copies.
12. International students should enter their name on the application as it appears on their passport to avoid immigration and processing problems.
13. You may type your TOEFL or IELTS scores on your application. Mailed official score sheets are not needed. Scores must be within two years of the date of the exam. The minimum requirements of the University are a minimum of 6.0 on the International English Testing System (IELTS) and the following on the TOEFL: 600 (paper), 250 (computer), 100 (Internet-based).
14. Foreign students who have received a baccalaureate degree with all four years of attendance at a U.S. college or university OR students who have received a score of 22 or better on the verbal portion of the GMAT may have their TOEFL/IELTS requirement waived.

Questions regarding admissions and the program itself can be sent to MMAL@tamug.edu. Materials that are mailed should be sent to:

Chair, Graduate Admissions Committee
Department of Maritime Administration
Texas A&M University at Galveston
P. O. Box 1675
Galveston, Texas 77553

Texas A&M University at Galveston Course Descriptions

Maritime Administration (MARA)

- 604. Marine Natural Resource Economics. (3-0). Credit 3.** Critical evaluation of policies and procedures in the development and use of natural resources relevant to marine and maritime markets; identification of problems in resource exploration, development, and transportation; the political/economic decision-making processes; analytical tools used to make economic decisions in resource markets. Prerequisite: ECON 322 or equivalent.
- 610. International Strategic Planning and Implementation. (3-0). Credit 3.** An introduction to the strategic management process, with an emphasis on the maritime industry in the domestic and international context. The formulation of strategy in the context of environmental opportunities and threats, how to analyze industry competition, and how to implement strategies and build competitive advantage. Students will select a company engaged in domestic or international waterborne commerce and analyze the strategic planning processes of the firm using the standard techniques such as SWOT analysis, the Five Forces model and the Value Chain analysis.
- 616. Management of Port Facilities and Infrastructure. (3-0). Credit 3.** Problems associated with the management of buildings, piers, bulkheads and associated structures and connecting waterways focusing on corrosion, adverse affects of climate, tide and current affects, dredging cycles and related facilities access issues associated with structures in the coastal zone. Particular attention is paid to the requirements of state and federal agencies regarding equipment and facilities used in the safe loading, discharge, and storage of cargoes, including hazardous materials.
- 623. Economic Issues in Shipping. (3-0). Credit 3.** The role of domestic and international shipping in the American economy; discussion of the economic characteristics of waterborne transportation, including the nature of transport demand and cost functions; economic dimension of transport service; transport market structures; and transport pricing theory and practice. Emphasis on managerial implications of transport economic principles for domestic and international shipping.
- 624. Intermodal Transportation Operations. (3-0). Credit 3.** Survey of economic and operational characteristics of intermodal transportation - rail, trucking, air, shipping, and pipelines. Emphasis on the interface of surface transportation with the marine industry; pricing strategies, cost structures, and regulatory issues.
- 627. Marketing of Transportation Services. (3-0). Credit 3.** Marketing planning and analysis applicable to the service firm; assessment of customer needs; quality control; competitive strategies; applications of marketing principles and practices to the maritime industry.
- 636. Managerial Decision Making. (3-0). Credit 3.** Construction of mathematical models of business environments; linear programming techniques; planning, analysis and control of operations in complex organizations through mathematical techniques.
- 640. Global Logistics. (3-0). Credit 3.** Transportation and logistic activities of multinational firm with an emphasis on transportation, customer service, inventory control facility location, global sourcing, customs documentation, and the role of government in importing and exporting. Attention is given to current events and their effects on the marketing and logistics activities of U.S. based organizations.
- 641. Financial Management in Marine Transportation. (3-0) Credit 3.** Management of the corporation's sources and uses of funds with emphasis on risk and return, investment valuation, the selection of risky investment projects, capital structure, dividend policy, and methods of raising long term capital; applications to the maritime industry are made where appropriate.
- 650. Distribution Logistics. (3-0). Credit 3.** Distribution logistics and the basic management of businesses; systems engineering techniques used to optimize profit and quality customer service; transportation modes, intermodal connections, inventory policies, warehousing, order processing, network design and facility management.
- 652. Marine Transportation System Design and Policy. (3-0). Credit 3.** Interaction between shipping policy and design of marine transportation and port systems; effects of market structure on economics and finance; port performance and performance measures.

- 658. Port Design, Planning and Security. (3-0). Credit 3.** Ground-level issues, tasks, and responsibilities that must be managed by the security manager in concert with the port director and federal and local law enforcement agencies; multiuse port facilities for recreation, hospitality, and external business and commercial interests; design of marine structures for the berthing, mooring, and repair of vessels.
- 660. Risk Assessment and Marine Insurance. (3-0). Credit 3.** Theory, techniques, participants and background of risk management with emphasis given to contemporary issues in marine insurance law; marine liability coverage, cause of loss, additional perils, exclusions, warranties, duration of risk, adjustment clauses, operating clauses, civil commotions, war insurance, and project risk management techniques.
- 664. Production, Operations, and Logistics Management. (3-0). Credit 3.** Types of decisions to be made at varying levels and where appropriate; quantitative models and techniques that can be used in decision making areas of the firm; analysis of how the operations function fits in with other functional areas of the firm; interrelationships with the firms' strategies.
- 670. Coastal and Inland Waterways Transportation- Policy, Strategy, and Management. (3-0). Credit 3.** Port and terminal development, competition with other modes of transportation, manpower, rates, environmental concerns and the impact of waterway systems on regional economies and national economic development; commercial aspects of the inland waterways with emphasis on operations, freight rate structures and applied cash flow methods.
- 672. The Maritime Global Trading System. (3-0). Credit 3.** Introduction to the theory of international waterborne trade; provides a basis for examining American foreign trade policy, and regional and world trade institutions such as the WTO, ASEAN, the EU, GATT, and NAFTA. Topics include: International trade theory and policy, open-economy macroeconomic policy, tariffs, non-tariff barriers and enhancements, multinational enterprises and foreign direct investment, global competition and integration.
- 689. Special Topics In... Credit 1-4.** Selected topics in an identified area of maritime administration. Prerequisite: Graduate standing; approval of instructor.
- 691. Research. (4-0). Credit 1-4.** For thesis or dissertation.

Marine Biology (MARB)

- 603. Cetacean Behavior and Behavioral Ecology. (3-3). Credit 4.** Consists of lectures, readings, and discussion sessions on the social, calf rearing, foraging, and migrating strategies of whales, dolphins, and porpoises. Emphasis is on the recent literature of animals in nature, although results from aquaria are also presented with comparisons to social strategies in the wild.
- 606. Advanced Concepts in Marine Population Biology. (3-0). Credit 3.** Lectures examine novel approaches and concepts employed studying factors affecting recruitment, determining trophic relationships (e.g., stable isotopes), and the consequences, at various levels, of changes in abundance of marine populations, including ecological (community), population (Allee effects) and genetic (effective populations size.) Inference of population connectivity determined through the use of electronic tags and molecular techniques is also examined. Prerequisite: B.S. Marine Biology or Marine Science or instructor approval.
- 616. Introduction to Methods in Scientific Diving. (2-3). Credit 3.** Prepares students to use SCUBA as a research tool for the marine sciences in compliance with University, American Academy of Underwater Sciences, and Federal OSHA standards. Practical work in pool and open waters will complement academic experience and provide training towards scientific diver status. Prerequisite: Advanced SCUBA Certification.
- 617. Research Diving Methods. (0-6). Credit 2.** Field experience in a wide range of diving environments stressing dive planning and safety, buoyancy control, equipment configuration and scientific methodology in biological, physical, chemical, archaeological and geological sciences. Students will design, supervise and conduct independently developed scientific diving projects. Prerequisite: MARB 616 or equivalent.

- 620. Marine Biological Resources. (3-0). Credit 3.** An introduction to biological resources which can be recovered from marine environment to provide food, biomass and materials, recreation, and employment to the coastal United States and other regions, with emphasis on fisheries and hatcheries, in Oceanic Resources, Coastal and Estuarine Resources, and Mariculture. Natural and societal limitations to resource recovery are investigated, and environmental impacts are analyzed. Prerequisites: (at least 3 of these) CHEM 102, BIOL 114, GEOL 104, and/or OCNG 251.
- 651. Shore and Estuarine Fishes of the Gulf of Mexico. (2-6). Credit 4.** Taxonomy, ecology and zoogeography of fishes inhabiting estuarine and marine ecosystems of the northwestern Gulf of Mexico. Particular emphasis on community structure and factors affecting spatial and temporal abundance of fishes found along the Texas coast. Prerequisites: MARB 311 or equivalent; approval of instructor.
- 654. Coastal Plant Ecology. (3-3). Credit 4.** Study of estuarine, coastal, and dune plant communities and associated environmental factors affecting plants including the identification, distribution, ecological importance, and management techniques of vascular plants in these communities. Prerequisites: Graduate classification; approval of instructor.
- 655. Wetlands Ecology, Monitoring and Delineation. (2-3). Credit 4.** Study of the characteristics and importance of wetlands, and methods of delineating, monitoring, and evaluations of wetlands. Students will learn wetland plants. Soils, hydrology, ecology of wetlands, animals inhabiting wetlands, delineations techniques, laws pertaining to wetlands, permits required for impacts, mitigation and management techniques for wetlands. Prerequisite: Graduate classification.
- 656. Tropical Marine Ecology. (1-6). Credit 3.** Field-oriented experience in coral reef, mangrove, sea grass, cave and other tropical marine ecosystems. Special emphasis will be placed on biodiversity, ecology and conservation issues specific to the Yucatan Peninsula of Mexico. This course will involve one week coursework in Galveston and a two-week field trip to Akumal on the Caribbean coast of Yucatan. Prerequisite: Scuba certification.
- 662. Biology of Mollusca* (3-3). Credit 3.** Survey of mollusks including their morphology, ecology, physiology and reproduction. Emphasis on marine species of ecological and commercial importance. Prerequisites: MARB 435 or 665 or equivalent.
- 665. Biology of Invertebrates (3-3). Credit 4.** Morphology, biology and phylogeny of invertebrates. Topics may be either detailed discussions/dissections of specific organisms or comparative information on a process. Prerequisites: MARB 435 or ZOOL 335 or equivalent; approval of instructor.
- 667. Biology of Marine Annelida. (3-3). Credit 4.** Survey of Marine Annelids including their behavior, organ systems physiology, and reproduction. Emphasis on morphology and taxonomy of polychaetous annelids to enable students to move more rapidly and accurately analyze benthic assemblage data. Prerequisites: MARB 435 or ZOOL 335 or equivalent; approval of instructor.
- 668. Marine Evolutionary Biology. (3-0). Credit 3.** Lecture, readings, and discussions on advanced evolutionary topics including history of evolutionary thought, organic evolution, evolutionary methods, and modern applications to organismal evolutionary questions. Students will lead and participate in journal club style discussion of selected recent literature. Prerequisite: Graduate classification.
- 681. Seminar in Marine Biology. (1-0). Credit 1.** Detailed reports on specific topics within the field of marine biology. Students may register in no more than two sections of this course in a given semester. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1-9.** On the job training in the field of marine biology. Prerequisites: Graduate classification; approval of instructor.
- 685. Directed Studies. Credit 1-6.** Limited investigations in fields other than those chosen for the thesis or dissertation topic. May be repeated for credit. Prerequisite: Graduate classification; approval of instructor.
- 689. Special Topics In...Credit 1-4.** Selected topics in an identified area of marine biology. Prerequisite: Graduate classification; approval of instructor.
- 691. Research for Thesis or Dissertation. Credit 1-9.** This course is the designated field and/or laboratory research leading to the M.S. or Ph.D. degree. May be offered by any Marine Biology faculty member as many times as necessary in a given semester and repeated for credit by a student. Prerequisites: Graduate classification; approval of instructor.

Marine Sciences (MARS)

- 602. Environmental Economics and Oceanography. (3-0). Credit 3.** An introductory fundamentals course for Marine Resources Management students; primary concepts of economics and oceanography with an emphasis on their applications to physical and living resources. Writing assignments and case studies.
- 610. Environmental Law. (3-0). Credit 3.** This course is designed to provide a broad overview of basic environmental laws including statutes, regulations, and cases. This course also focuses on both economic and ethical issues within the context of environmental law and policy. Prerequisite: Approval of instructor.
- 615. Physical and Geochemical Marine Resources. (3-0). Credit 3.** Location, identification, extraction and exploitation of non-fisheries marine resources, including: water, salt, hydrocarbons, minerals, energy from the thermal, wave, tidal, current and wind fields, chemical compounds, pharmaceuticals, and construction materials in estuarine, coastal and open ocean areas. Prerequisites*: CHEM 102, GEOL 104, OCNG 251 or equivalents; graduate classification; or approval of instructor.
- 620. International Environmental Business Ethics. (3-0). Credit 3.** Introduction to ethics in international environmental business transactions. Sources of morality (ethical traditions, theories, ethical decision-making models) applicable to business and management, critical ethical issues, dilemmas, and challenges business operations (e.g., gene cloning). Utilizes research and critical thinking strategies through a web-based process, class interaction, and self evaluation. Prerequisite: Approval of instructor.
- 625. GIS Based Modeling for Coastal Resources. (1-3). Credit 2.** Basic concepts of design, planning, and implementation of Geographical Information Systems; computer hardware and software evaluation; practical experience in data entry, analysis and update of spatial and characteristic data; use of maps and remotely sensed data as data. Prerequisite: Any computer science course or equivalent.
- 635. Environmental Impact Statements and Natural Resource Damage Assessment. (3-0). Credit 3.** The course presents an overview of: a) environmental impact statements (EIS) under the National Environmental Policy Act (NEPA); and b) natural resource damage assessment (NRDA) under the Oil Pollution Act of 1990 (OPA 90) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). It is designed to cover requirements for a wide variety of EISs. NRDA hypothetical cases will be presented in which students are asked to calculate assessments. Prerequisite: Approval of instructor.
- 638. Avian Diversity and Habitats as Coastal Resources. (2-3). Credit 3.** The lecture and readings will emphasize field identification, habitat requirements for native and migrant species and birds as bioindicators of habitat health and environment stress. The study of bird diversity to environmental monitoring of coastal ecosystems and migrant stopover habitats will be applied. Labs will be conducted primarily in the field. Prerequisites: BIOL 112; MARB 315 or WFSC 302 or ZOO 318; or approval of instructor and graduate status.
- 640. Environmental Administrative Law. (3-0). Credit 3.** Environmental law is governed, in large part, by administrative law. This course covers the processes involved in administrative environmental law. The primary focus of this course will be on: the Environmental Protection Agency, the U.S. Coast Guard, the Corps of Engineers and NOAA. A review of international administrative bodies will also be included. Prerequisite: Approval of instructor.
- 645. Wildlife Law and Ethics. (3-0). Credit 3.** This course provides an overview of the basic wildlife laws including international regimes, bilateral and multilateral treaties, conventions, and cases dealing with conservation, preservation, and management of non-Homo sapien species; federal law, regulations, and cases; and a sampling of state law. It also focuses on the ethical issues of species management. Prerequisite: Approval of instructor.
- 648. Invasive Species. (3-0). Credit 3.** The science and management of biological invasions, history and success rates including vectors and theories with positive and negative biological, ecological, economical and societal impacts. Invasive species as threats to natural areas and communities. Management theories and regulatory strategies and their effectiveness. Emphasis on marine invasive species. Prerequisite: graduate standing.

- 650. Geochemical Marine Resources Management. (3-0). Credit 3.** The purpose of this course is to provide an overview of the issues involved in geochemical marine resources management. This course explores the management of exploration, production, and protection of the geochemical marine resources of the earth and the interface of the many players. Prerequisite: Approval of instructor.
- 652. Sustainable Management of Coastal Margins. (3-0). Credit 3.** The class will study federal, state, and local laws, regulations, ordinances and programs pertaining to management of coastal margins, visit the Texas General Land Office and attend meetings of the Coastal Coordinating Council, the Texas Legislature when a coastal-related bill is being debated, Galveston County Commissioner's Court or Galveston City Council when a coastal ordinance is being considered. Prerequisite: Approval of instructor.
- 655. Wetlands Management. (3-3). Credit 4.** This course surveys the interrelationship of chemistry, physics, geology and biology of coastal wetland systems and explores and defines the context of wetlands sustainability and management. Field exercises are an integral component providing students "hands on" experience. Guest lectures, seminars and field trips lead by agency personnel who are experts in these fields of research are included. Prerequisite: Background in chemistry, physics, geology, and biology.
- 660. Environmental Alternative Dispute Resolution. (3-0). Credit 3.** Because environmental issues and law were born and raised in the arena of adversarial combat, the traditional adversarial litigative process is far from ideal. This course first explores the traditional method of settling disputes: the court system. It then reviews the increasingly visible dispute resolution alternatives. Finally, it provides certification in mediation. Prerequisite: Approval of instructor.
- 670. Eco-Environmental Modeling. (3-0). Credit 3.** Biological organisms are surrounded by chemical and physical environments which are influenced by the bio-system and flows of energy, water and chemical species. Coupling atmospheric, aquatic, and terrestrial systems is important. Modeling entails both mathematical tools and the underlying science. This course focuses on scientific models, from the simplest to more elaborate. Prerequisites: BIOL 113, 114; CHEM 101, 102; MATH 151, 166; graduate status or special approval.
- 675. Environmental Management Strategies for Scientists. (2-0).* Credit 2.*** It is designed to provide a scientist with EMS strategies' skills. This includes knowing what environmental laws may be triggered by activities, the fundamental structure of an EMS, EMS alternatives, concepts in an audit, Alternative Dispute Resolution, and how an effective EMS can reduce costs and increase profits. Prerequisite: Approval of instructor.
- 676. Environmental Policy. (3-0). Credit 3.** This course will provide a general introduction to the basic concepts and mechanisms of international and U.S. federal environmental law and policy. It will survey the field and its development as well as focus on case studies that illustrate the basic types of environmental problems. Prerequisite: Approval of instructor.
- 680. Integrative Analysis in Marine Sciences. (2-0). Credit 2.** Review of public policy change mechanisms in marine resources management, including Congressional testimony, agency recommendations and structure, and NGO reports. Students propose and defend a public policy change with detailed documentation and an oral presentation demonstrating a professional understanding of marine resources issues within the context of current law. Prerequisite(s): 24 hours of MARM course credits completed or in concurrent enrollment; approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Presentation of recent research by students, faculty and visiting faculty.
- 683. Field Practicum in Marine Sciences. Credit 1 to 4.** An overview of marine sciences in remote locations varying by instructor and selected topics. Lectures on recent scientific papers, methods, and concepts related to field area. Individual projects and data collection including data analysis and presentation of results in a formal seminar and paper based on the research and findings. Prerequisite: enrollment in graduate program.
- 684. Internship of Marine Resources Management. Credit 1-9.** This is a faculty-supervised study with an agency or other position within or outside the Texas A&M University System. Student involvement consists of real-life learning of marine resources management issues. It is a full-immersion course that provides students with hands-on experience in marine resources management. Prerequisite: Approval of faculty sponsor.

- 685. Directed Studies. Credit 1-6.** Selected topics in an identified area of science, law policy or management of marine natural resources not covered in any other courses in the curriculum. Prerequisite: Approval of instructor.
- 689. Special Topics in Marine Resources Management. Credit 1-3.** Selected topics in an identified area of marine resources management. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1-12.** Research for thesis or dissertation. Prerequisite: Approval of instructor.

* Pending approval by the Texas Higher Education Coordinating Board.

Texas A&M University at Galveston Graduate Faculty

The faculty and administrative positions are current as of Spring 2012. Figures in parentheses indicate date of first appointment at the University and date of appointment to present positions, respectively. An asterisk indicates that the faculty member holds a graduate appointment.

- Acero-Schertzer, Carmen**, Lecturer in General Academics, Mathematics (2008). B.S., U.N.M. San Marcos, Lima, Peru, 1973; M.S., Drexel University, 1984; M.S., University of Miami, 1990; Ph.D., University of Miami, 1996.
- Adams, Kcelee Rena**, Lecturer in General Academics, Physical Education (2012). B.B.A., McMurry University, Abilene, TX., 2009.
- Alexander, Erin M.**, Lecturer in Maritime Administration (2004). B.A., University of St. Thomas, 1977; B.A., University of St. Thomas, 1977; M.B.A., Southern Methodist University, 1978.
- Alexander, Steve**, Lecturer in Marine Sciences (2008). B.S., University of Houston, 1972; M.S. Louisiana State University, 1973; Ph. D., Louisiana State University, 1976.
- Alexander, William B.**, Lecturer in Maritime Administration* (2003). B.A., University of St. Thomas, 1976; M.A., University of Notre Dame, 1977.
- Alvarado-Bremer, Jaime R.**, Associate Professor of Marine Biology,* Wildlife and Fisheries Sciences* and Marine Sciences* (1999, 2006). B.S., Universidad, Autonoma Metropolitana, Mexico, 1985; M.S., University of Toronto, 1988; Ph.D., University of Toronto, 1994.
- Amon, Rainer**, Associate Professor of Marine Sciences* and Oceanography* (2003, 2007). B.S., University of Vienna, Austria, 1986; M.S., University of Vienna, Austria, 1990; Ph.D., University of Texas, 1995.
- Anis, Ayal**, Associate Professor of Marine Sciences* and Oceanography* (2000, 2007). Joint faculty, Maritime Systems Department (2008). B.S., Tel-Aviv University, 1982; M.S., Hebrew University, 1984; Ph.D., Oregon State University, 1993.
- Armitage Chan, Anna R.**, Assistant Professor of Marine Biology*, Marine Sciences* and EcoSystem Science and Management* (2006) (2007). B.S., University of California, Los Angeles, 1995; Ph.D., University of California, Los Angeles, 2003.
- Baca, David R.**, Lecturer and Public Services Librarian (2010). B.S., Mechanical Engineering Technology, Texas A&M University, 1980; M.L.I.S., University of Texas, 1993; Ph.D., Texas A&M University, 2006.
- Baker, Robert K.**, Lecturer in Maritime Administration (1983) (2002). B.S., Texas A&M University, 1977; M.B.A., University of Houston, 1983. Chief Mate Steam and Motor Vessels Any Gross Tons Upon Oceans, Master of Steam and Motor Vessels of Not More Than 1600 Gross Tons Upon Oceans.
- Balaban, Alexandru**, Professor of Marine Sciences* (2000). Diploma, Radiochemist, Ph.D., Polytecnic University, Bucharest, Romania, 1953, 1957, 1959.
- Baldwin, Janetta**, Senior Lecturer in General Academics (Kinesiology) (1980, 1994). B.S., University of Texas, 1969; M.S., Texas A&M University, 1980.
- Beach, Matthew D.**, Lab Instructor in Maritime Systems Engineering (2010). B.S., University of Hawaii, 2009.
- Bell, Janice S.**, Lecturer in General Academics (Spanish) (2002). B.A., University of Houston, 1970; M.A., University of Northern Iowa, 1995.
- Bodson, Bruce**, Lecturer in Marine Sciences* (2002). B.S., University of Arizona, 1980; M.S., University of Texas at Dallas, 1987; J.D., South Texas College of Law, 1993.

- Boudreaux, Tiffany M.**, Lecturer in General Academics (English) (2008). B.A., Southeastern Louisiana University, 1995; M.A., Southeastern Louisiana University, 1998.
- Boudreaux, Lowell A.**, Lecturer in Maritime Administration (2003). B.B.A., Lamar University, 1993; M.B.A., Lamar University, 1996.
- Brinkmeyer, Robin L.**, Assistant Professor of Marine Sciences* (2003, 2006). B.S., University of Texas, 1988; B.S., University of Texas, 1988; M.A., University of Texas, 1993; Ph.D., University of Bremen, Germany, 2003.
- Brody, Samuel D.**, Professor of Marine Sciences* (2009). B.A., Bowdoin College 1992; Graduate Diploma, University of Adelaide, Australia, 1994; M.S., University of Michigan, 1996; Ph. D., University of North Carolina, 2002.
- Brown, Philip R.**, Associate Professor of General Academics, (Mathematics) (2001, 2007). B.S., University of Witwatersrand, Johannesburg, South Africa, 1991; M.S., University of Witwatersrand, Johannesburg, South Africa, 1993; Ph.D., Texas A&M University, 2000.
- Bumbaugh, Fred R.**, Lecturer in Marine Sciences (2002). B.S., Shippensburg University, 1972; M.S., University of Houston at Clear Lake, 1978.
- Buch, Kevin**, Lecturer in General Academics (Scuba Diving) (2005). B.S., University of Texas at Arlington, 1998; M.S., University of Texas at Arlington, 2000.
- Bunch Davis, Carol A.**, Assistant Professor of General Academics (English) (2003). B.A., Trinity University, 1990; M.A., University of Houston at Clear Lake, 1998. Ph.D., University of Southern California, 2007.
- Butler, Christine Courteau.**, Lecturer in General Academics (2012). B.S., Stephen F. Austin State University, 2009; M.A., Stephen F. Austin State University, 2011.
- Carhart, John W.**, Senior Lecturer in General Academics (Political Science) and Assistant Department Head (1988) (2002). B.A., Southwest Texas State University, 1981; M.A., Southwest Texas State University, 1988.
- Carroll, Matthew C.**, Assistant Professor of Marine Engineering Technology (2009). B.S., Lafayette College, 1974; M.S., University of Illinois at Urbana-Champaign, 1982; Ph.D., University of Illinois at Urbana-Champaign, 1986.
- Ciminello, Jr., Vito J.**, C.P.A., Senior Lecturer in Maritime Administration (1994). B.A., Brown University, 1977; M.S., Northwestern University, 1979.
- Cleary, James P.**, Lecturer in Marine Transportation (2008). B.S., Texas A&M University, 1980; Master of Steam or Motor Vessels of Any Gross Tons upon Oceans.
- Cole, Collier M.**, Lecturer in General Academics (Psychology) (1983). B.A., University of California at Los Angeles, 1971; M.A., University of Houston, 1973; Ph.D., University of Houston, 1976.
- Coleman Jr., Charles H.**, Senior Lecturer in Marine Sciences and Director of the Geology Laboratory (1981, 1992). B.S., Texas A&M University, 1975; M.S., University of Houston at Clear Lake, 1986.
- Coleman, Cheryl L.**, Lecturer in General Academics (Kinesiology) (1997). B.S., United States Naval Academy, 1984; J.D., Northwestern University, 1993.
- Coleman, Gerard T.**, P.E., Senior Lecturer in Marine Engineering Technology (1996). B.S., U.S. Naval Academy, 1980; M.S., George Washington University, 1996.
- Conway, Steven M.**, Senior Lecturer in Maritime Administration (2007). B.S., U.S. Coast Guard Academy, 1975; M.S., University of Bridgeport, 1980; M.P.P.M., Yale School of Management, 1982.
- Curley, Stephen J.**, Regents Professor of General Academics (English) (1973, 1996). B.A., Fordham University, 1968; Ph.D., Rice University, 1974.
- Curtis, Timothy D.**, Lieutenant U.S. Navy, Officer-in-Charge, Department Head, Lecturer, Department of Naval Science (2010). B.S. University of Florida, 2002.
- Davis, Randall W.**, Professor of Marine Biology* and Wildlife and Fisheries Sciences* (1990, 1994). B.S., University of California, Riverside, 1974; Ph.D., University of California, San Diego, 1980.
- Davison, Don F.**, C.P.A., Lecturer in Maritime Administration (2002). B.S., Southern Methodist University, 1974; M.A., University of Texas. 1979; M.B.A., Southern Methodist University, 1980.
- Davison, Janine.**, Lecturer in General Academics (2011). B.A., Texas A&M University, 1996; M.A., University of Houston, 2004.
- Dellapenna, Timothy M.**, Associate Professor of Marine Sciences* and Oceanography* (Geology) (1999). B.S., Michigan State University, 1986; M.S. Western Michigan University, 1993; Ph.D., College of William and Mary, 1999.
- Desrosiers, Robert A.**, Assistant Professor of Maritime Administration* (2010). B.S., U.S. Merchant Marine Academy (1990); M.M.A., University of Rhode Island (1998); Ph.D. Korea Maritime University (2008).

- Ditty, James**, Lecturer in Marine Biology* (2009). B.S., Marshall University, 1977; M.S., Louisiana State University, 1981; Ph.D., Louisiana State University, 2002.
- Domsky, Darren**, Assistant Professor of General Academics (Philosophy) (2007). B.A., University of Alberta, 1996; M.A., University of Alberta, 1998; Ph.D., York University, 2006.
- Donelan, Michael B.**, Lecturer in Maritime Administration (2010). B.A., Brown University (1972). M.B.A., Tulane University (1981).
- Estes III, Ernest L.**, Professor of Marine Sciences* (1976, 1987, 2006). B.S., Lawrence University, 1965; M.A., Duke University, 1967; Ph.D., University of North Carolina, 1971.
- Fieglein, J. Michael**, Lecturer in Maritime Administration (1999). B.S.M.E., University of Houston, 1970; J.D., Villanova School of Law, 1974.
- Figlus, Jens**, Assistant Professor of Maritime Systems Engineering (2012). Dipl.-Ing., University of Karlsruhe, Germany, 2005; M.C.E. University of Delaware, 2007; Ph.D., University of Delaware, 2010.
- Fitzhugh III, Thomas C.**, Lecturer in Maritime Administration (1996). B.S., Texas A&M University, 1971; J.D., University of Texas, 1976.
- Flanagan, Mary Kate**, Lecturer in Maritime Administration (2012). B.S., Texas A&M University, 2005; B.S., Lamar University, 2007; M.B.A., Tulane University, 2009.
- Fleming, Kevin**, Lecturer in General Academics, English (2002, 2009). B.A. English, Southwest Texas State University, 1976; M.A., University of Texas, 1984; Ph.D., University of Houston, 1999.
- Folden, Charles A.**, Lecturer in Marine Sciences (1980). B.S., California State University, Long Beach, 1975; M.A., Governors State University, 1979.
- Fredrickson, Henry W.**, Lecturer in Marine Engineering Technology (2005). B.S., Texas A&M University, 1968. Chief Engineer of Steam, Motor and Gas Turbine Vessels.
- Frentz, Gerald**, Lecturer in Maritime Administration (2009), B.S., U.S. Naval Academy 1977; M.E., Texas A & M University 1985.
- Galan, Jhenny**, Assistant Professor of Marine Sciences* (2012). B.S. University of Philippines, 1996; Ph.D., University of Connecticut, 2006.
- Glenn Jr., William P.**, Lecturer in Maritime Administration and Marine Transportation (1997). B.S., Texas A&M University, 1981; J.D., Franklin Pierce Law Center, 1992; MIP, Franklin Pierce Law Center 1998.
- Gonzales, Raquel**, Lecturer in General Academics (Spanish) (2004). B.S., University of Houston, 1968; M.A., University of Houston at Clear Lake, 1977.
- Gracia, Pete A.**, Lecturer in General Academics (Mathematics) (1993). B.S., Lamar University, 1959; M.S., University of Houston at Clear Lake, 1991.
- Griffin, Lawrence L.**, Professor of Marine Sciences* and Oceanography* (1976, 2007). B.A., University of Texas, 1962; M.S., University of Texas, 1965; Ph.D., University of Texas, 1972.
- Guillen, George J.**, Lecturer in Marine Biology (2005). B.S., Texas A&M University, 1979; M.S., Texas A&M University, 1983; Ph. D., University of Texas School of Public Health, 1996.
- Hall, Christopher P.**, Lecturer in Marine Biology (2006). B. A., University of North Carolina at Wilmington, 1997; Environmental Science and Biology. B. A., University of North Carolina at Wilmington, 1997; Geology. M. S. (Master of Marine Resource Management), Texas A&M University, 2003.
- Hark, John F.**, Lecturer in Maritime Administration (2002). B.S., Texas A&M University, 1989.
- Harper Jr., Donald E.**, Professor Emeritus of Marine Biology and Wildlife and Fisheries Sciences (1975, 1997). B.S., University of Miami, 1963; M.S., Texas A&M University, 1996; Ph. D., Texas A&M University, 1970.
- Haymes, William E.**, Lecturer in Marine Sciences and Director of the Physics Laboratory (1989, 1992). B.S., University of Missouri-Rolla, 1964; M.S., University of Missouri-Rolla, 1971; Ph.D., University of Manchester, England, 1976.
- Highfield, Wesley E.**, Assistant Professor of Marine Sciences* (2011). B.S., Texas A&M University, 2001; M.U.P., Texas A&M University, 2004; Ph.D., Texas A&M University, 2008.
- Hite, Gerald E.**, Professor of Marine Sciences* (1980, 1998). Joint faculty, Maritime Systems Engineering (1990). B.S., Case Western Reserve, 1962; M.S., University of Illinois, 1965; Ph.D., University of Illinois, 1967; Habilitation, Universitat Kaiserslautern, 1974.
- Hoffman, Norman**, Lecturer in Marine Engineering Technology (2011). B.S., Villanova University, 1985; M.S., Drexel University, 1990; Ph.D., University of Houston, 2010.

- Horrillo, Juan J.**, Assistant Professor of Maritime Systems Engineering (2008). B.S., University of Cartagena, Columbia, 1984; M.S., University of Rhode Island, 1997; Ph.D., University of Alaska-Fairbanks, 2006.
- Hufton, Amic J.**, Lecturer in General Academics (Kinesiology) (2006). B.S., Texas A&M University, 2002.
- Iliffe, Thomas M.**, Professor of Marine Biology,* Wildlife and Fisheries Sciences* and Oceanography* (1989, 1997). B.S., Penn State University, 1970; M.S., Florida State University, 1973; Ph.D., University of Texas Medical Branch, 1977.
- Ingole, Sudeep P.**, Assistant Professor of Marine Engineering Technology* (2005,2009). B.E., Nagpur University, Nagpur, India, 1999; M.E., Indian Institute of Science, Bangalore, India, 2001; Ph.D., Texas A&M University, 2005.
- Jansen, Jack T.**, Lecturer in Marine Transportation (2010). B.S., Texas A&M University, 1998. Master of Steam and Motor Vessels of Any Gross Tons Upon Oceans.
- Jin, Jun**, Assistant Professor of Maritime Systems Engineering and Civil Engineering (2003). B.S., Harbin Engineering University, Harbin, China, 1991; M.S., Tianjin University, Tianjin, China, 1994; Ph.D., University of Central Florida, 2002.
- Johnson, Thomas S.**, Associate Professor Emeritus of General Academics (English) (1974, 1981). B.A., Loyola University of Los Angeles, 1966; M.A., University of California at Los Angeles, 1968; Ph.D., University of Texas, 1973.
- Jones, Glenn A.**, Professor of Marine Sciences* and Oceanography* (1996). B.A., University of Rhode Island, 1977; M.S., Columbia University, 1979; Ph.D., Columbia University, 1983.
- Kaiser, Karl**, Assistant Professor of Marine Sciences (2012). M.S., Johannes Kepler University, Linz, Austria, 1997; Ph.D., University of South Carolina, 2009.
- Kang, Cong X.**, Assistant Professor of General Academics (Mathematics) (2004). B.S., Carnegie Mellon University, 1992; Ph.D., University of Texas, 1999.
- Kanz, James E.**, Associate Professor of Marine Biology* and Biology* (1978, 1985). B.A., University of Washington, 1966; Ph.D., Tufts University, 1973.
- Klein, Douglas J.**, Professor of Marine Sciences* and Oceanography* (1979, 1987). B.S., Oregon State University, 1965; M.A., University of Texas, 1967; Ph.D., University of Texas, 1969.
- Knock, Susan L.**, Senior Lecturer in Marine Sciences* and Director of Academic Enhancement (1996, 2003). B.A., Colorado State College, 1975; Ph.D., University of Texas Medical Branch, 1988.
- Knox, Kris J.**, C.P.A., Senior Lecturer in Maritime Administration* and Assistant Department Head (1984). B.B.A, University of Houston, 1979; M.B.A., University of Houston, 1984; Ph.D., University of Texas Health Science Center at Houston, 1992.
- Ko, Jae-Young**, Assistant Professor of Marine Sciences* (2005). B.A., Hankuk University, Seoul, Korea, 1983; M.A., Hankuk University, Seoul, Korea, 1987; M.A., Syracuse University, 1994; Ph.D., State University of New York, 2000.
- Landry Jr., André M.**, Professor of Marine Biology,* Wildlife and Fisheries Sciences* and Marine Sciences* (1977, 1991). B.S., Tulane University, 1968; M.S., Texas A&M University, 1971; Ph.D., Texas A&M University, 1977.
- Lang, Donna C.**, Associate Vice President for Enrollment Management and Educational Outreach (1996, 2011). B.S., Texas A&M University, 1988; M.A. University of Houston at Clear Lake, 1992; Ed.D., University of Houston, 2000.
- Lang Jr., Victor J.**, Lecturer in General Academics (Speech) (1997). B.A., University of Texas, 1960.
- Lawhon, David R.**, Lecturer in General Academics (History) and Director, Honors Program (2003,2007). B.A., University of Houston at Clear Lake, 1995; M.A., University of Houston at Clear Lake, 2000.
- Lesko, Melanie J.**, Senior Lecturer in Marine Sciences* (Chemistry) (1983, 1996). Associate Department Head (1996). B.S., Lamar University, 1972; Ph.D., University of Houston, 1977.
- Linton, Thomas L.**, Senior Lecturer in Marine Sciences* and Wildlife and Fisheries Sciences.* (1981, 1989) B.S., Lamar University, 1959; M.S., University of Oklahoma, 1961; Ph.D., University of Michigan, 1965.
- Louchouart, Patrick**, Professor and Department Head of Marine Sciences* (2006). B.S., McGill University, Montreal, Quebec, Canada, 1989; M.S., Université du Québec à Montréal, 1992; Ph.D., Université du Québec à Montréal, 1997.
- Luna, Amy.**, Lecturer in Maritime Transportation (2012). B.S., Texas A&M University, 2007.
- Luxemburg, Leon A.**, Associate Professor of General Academics (Mathematics) (1990, 2005). Ph.D., Texas A&M University, 1987.
- Maack, Pamela A.**, Lecturer in General Academics (Anthropology)(2008). B.A., University of Virginia, 1982; Ph.D., Northwestern University, 1992.

- Maceo, Debra A.**, Senior Lecturer in General Academics (Kinesiology) (1994, 2003). B.S., Lamar University, 1975; M.A., University of Houston, 1995.
- Maloney, Bridget**, Lecturer in General Academics (Kinesiology). B.S., University of Arizona, 2005; M.S., Texas A&M University, 2008.
- Mark, Samuel E.**, Professor of General Academics (Anthropology/Archeology) (2001, 2006). B.S., Ball State University, 1980; M.A., Texas A&M University, 1993; Ph.D., Texas A&M University, 2000.
- Marshall, Christopher D.**, Associate Professor of Marine Biology* and Wildlife and Fisheries Science* (2001, 2008). B.S., Virginia Polytechnic Institute and State University, 1990; M.S., Nova Southeast University Oceanographic Center, 1992; Ph.D., University of Florida, 1997.
- Martinez, Rudy D.**, P.E., Senior Lecturer in Marine Engineering Technology (2006). B.B.A., Sam Houston State University, 1972; B.S., Lamar University, 1984; M.S., University of South Carolina, 1996; Ph.D., University of South Carolina, 2004.
- McGonagle, W. Brad**, Lecturer in Maritime Administration (2001). B.B.A. Texas A&M University, 1990; B.B.A., Texas A&M University, 1992; M.S., Texas A&M University, 1993; Ph.D., Texas A&M University, 1996.
- Merrell, Jr.**, William J., Professor of Marine Sciences* (1987, 1992), B.S., Sam Houston State University, 1965; M.A., Sam Houston State University, 1967; Ph.D. Texas A&M University, 1971.
- Metz, Tasha L.**, Lecturer in Marine Biology (2006). B.S., Texas Christian University, 1995; M.S., Texas Christian University, 1997; Ph.D., Texas A&M University, 2004.
- Mileski, Joan P.**, C.P.A., Associate Professor of Maritime Administration* and Marine Sciences* (2004). B.B.A., University of Notre Dame, 1979; M.S., Pace University, 1983; Ph.D., University of Texas at Dallas, 2000.
- Miller, Martin C.**, Associate Professor of Maritime Systems Engineering and Department Head of Maritime Systems Engineering (2007). B.S., U.S. Coast Guard Academy, 1964; MALS, Wesleyan University, 1969; M.S., The George Washington University, 1970; Ph.D. Oregon State University, 1977.
- Mills, Cantrelle**, Lecturer and Technical Services Librarian (2009). B. S. University of New Orleans, 2001; M.L.S., Drexel University 2009.
- Mohr, Robert R.**, Lecturer in Marine Sciences (2001). B.S., University of Toledo, 1975; M.A., University of Toledo, 1977; M.S. University of Nevada at Reno, 1979; M.S., University of Houston at Clear Lake, 1981; Ph.D., Texas A&M University, 1994.
- Norris, Kevine**, Lecturer in General Academics, Kinesiology, (2010), B.S., McMurry University, 2009.
- Olivares, Saul**, Lecturer in General Academics (2011), B.A., Lee College, 1999; M.S., University of Houston, 2003.
- Orange, William R.**, Lecturer in Marine Transportation (2010). B.S., Texas A&M University, 1991.
- Oertling, Thomas J.**, Lecturer in General Academics (Nautical Archaeology) (2000). B.S., Tulane University, 1977; M.A., Texas A&M University, 1984.
- O’Neal, Clifford C.**, Lecturer in Marine Biology (2007). B.S., Texas A&M University, 1996; M.S., Louisiana State University, 2000; Ph.D., Southern Illinois University at Carbondale, 2005.
- Panchang, Vijaykumar G.**, Regents Professor of Maritime Systems Engineering.* (2002,2009). B.S., University of Poona, India, 1980; M.S., University of Maine, 1982; Ph.D., University of Maine, 1985.
- Pangemanan, Adelaide P.**, Lecturer in General Academics (Mathematics) (2007). B.S., University of Southern California, 1998; M.S., State University of New York at Stony Brook, 2002.
- Pearl, Frederic B.**, Associate Professor of General Academics and Marine Sciences* (Anthropology) (2000, 2007). B.A., San Diego State University, 1991; M.A., Texas A&M University, 1997; Ph.D., Texas A&M University, 2001.
- Penuel, Eddie**, Lecturer in Maritime Administration (2009). B.B.A., Sam Houston State Teachers College (1964).
- Penuel, Victor B.**, Lecturer in General Academics (English) (1994). B.A., University of Houston at Clear Lake, 1989; M.A., University of Houston at Clear Lake, 1994.
- Perrigo, James**, Lab Instructor in Marine Sciences (1996). B.S., Texas A&M University, 1981; M.S., Texas A&M University, 2004.
- Putty, David Schott Lee.**, Lecturer in Maritime Transportation (2012). B.S. Texas A&M University, 1979; Master Oceans Unlimited, 5th Issue License; STCW 95- Endorsements: Master, Vessel Security Officer, Medical PIC, GMDSS, 1995.
- Qiu, Lin**, Lecturer in General Academics (Mathematics) (2007), B.S., Tongji University, 2002; M.A., University of Alabama, Tuscaloosa, 2005.

- Quigg, Antonietta S.**, Associate Professor and Assistant Department Head of Marine Biology,* Oceanography* and Marine Sciences* (2003,2009). B.S., Chemistry, La Trobe University, Australia, 1989; B.S., Biochemistry, La Trobe University, Australia, 1990; Ph.D., Monash University, Australia, 2000.
- Ray, Sammy M.**, Professor Emeritus of Marine Biology* and Wildlife and Fisheries Sciences* (1959)(1990). B.S., Louisiana State University, 1942; M.S., Rice University, 1952; Ph.D., Rice University, 1954.
- Reich, Kimberly**, Assistant Research Scientist* (2011). B.S., Palm Beach Atlantic University, 1998; M.S., Texas A&M University, 2001; Ph.D., University of Florida, 2009.
- Rooker, Jay R.**, Professor of Marine Biology,* Wildlife and Fisheries Sciences* and Marine Sciences* (1998,2009). B.A., Gustavus Adolphus College, 1985; M.S., University of Puerto Rico, 1991; Ph.D., University of Texas, 1997.
- Roth, Augusta D.**, Lecturer in Marine Transportation (2000). MBA University of Phoenix, 2008. B.S., Texas A&M University, 1996. Master of Steam and Motor Vessels of Any Gross Tons Upon Oceans.
- Rowe, Gilbert T.**, Regents Professor of Marine Biology* and Oceanography* (2003, 2007). B.S., Texas A&M University, 1964; M.S., Texas A&M University, 1966; Ph.D., Duke University, 1968.
- Ryan, James G.**, Professor of General Academics (History) (1990, 1996). B.A., University of Delaware, 1970; M.A., University of Delaware, 1973; M.A., University of Notre Dame, 1975; Ph.D., University of Notre Dame, 1981.
- Santschi, Peter H.**, Professor of Marine Sciences* and Oceanography* (1988). B.S., Gymnasium Berne, Switzerland, Matura, 1963; M.S., University of Berne, 1971; Ph.D., University of Berne, 1975; Privatdozent, Switzerland Federal Institute of Technology, 1984.
- Schlemmer II, Frederick C.**, Associate Professor of Marine Sciences* and Oceanography* (1978, 1985). B.S., U.S. Naval Academy, 1965; M.A., University of South Florida, 1971; Ph.D., Texas A&M University, 1978.
- Schmalz, Thomas G.**, Professor Emeritus of Marine Sciences* and Oceanography* (1981, 1996). B.S., Montana State University, 1970; Ph.D., University of Illinois, 1975.
- Schulze, Anja**, Assistant Professor of Marine Biology* and Oceanography* (2006). Diplom, University of Bielefeld, Germany, 1995; Ph.D., University of Victoria, Canada, 2001.
- Schwarz, John R.**, Department Head and Professor of Marine Biology* and Oceanography* (1976, 1986). B.S., Rensselaer Polytechnic Institute, 1967; Ph.D., Rensselaer Polytechnic Institute, 1972.
- Seitz, William A.**, Regents Professor of Marine Sciences* and Oceanography* (1977, 2002), Associate Provost (TAMU) and Senior Vice President and Chief Academic Officer, TAMUG (2006, 2011). B.A., Rice University, 1970; Ph.D., University of Texas, 1973.
- Shodavaram, Bhaskar Raju**, Lecturer in Marine Sciences and General Academics (Mathematics) (2009). B.S., SriVenkateswara University, 1959; M.S., Andhra University, 1960; M.S., North Carolina State University, 1969; Ph.D., Texas A&M University, 1973.
- Slabaugh, Leticia A.**, Lecturer in General Academics (English) (2008). B.A., Texas A&M University-Corpus Christi, 1997; M.A., Texas A&M University-Corpus Christi, 2001.
- Slatton, Katie, J.**, Lecturer in General Academics (Kinesiology) (2003). B.S., University of Montevallo, 1999; M.A., University of Montevallo, 2003.
- Smith, Jack H.**, Senior Lecturer in Marine Transportation (2003). B.S., Texas A&M University, 1966. Master of Steam and Motor Vessels of Any Gross Tons Upon Oceans. First Class Pilot of Vessels of Any Gross Tons (Houston, Bolivar, Texas City).
- Suen, Ching Y.**, Professor of General Academics (Mathematics) (1984, 1998). M.S., Tsing Hua University, 1978; Ph.D., University of Houston, 1983.
- Sweetman, John A.**, P.E., Associate Professor of Maritime Systems Engineering* and Civil Engineering* (2003). B.S., University of Michigan, 1986; M.E., Texas A&M University, 1987; Ph.D., Stanford University, 2001.
- Szucs, Joseph M.**, Professor and Department Head of General Academics (Mathematics) (1980, 1991, 2006). M.S., Szeged University, 1965; Ph.D., Szeged University, 1967.
- Tafreshi, Alexander B.**, Lieutenant, U.S. Navy, Assistant Officer-in-Charge, Lecturer in Naval Science (2011), B.S., University of Texas at Austin, 2006.
- Talent, David**, Lecturer in Marine Sciences. Ph.D. Rice University, Houston, Texas, 1981; M.S., Rice University, 1979; B.S., Southwest Missouri State University, 1974.
- Theis, William D.**, Lecturer in General Academics (English) (2005). B.A., University of Texas, 1978; M.A., University of Houston, 1988.

- Townsend, Grace L.**, Senior Lecturer in Marine Sciences (2001). B.S., Texas A&M University, 1981; M.S., University of Houston at Clear Lake, 1983.
- Traber, Daniel S.**, Associate Professor of General Academics, (English) (2001, 2007). B.A., University of Texas, Austin, 1991; M.A., University of Texas, El Paso, 1995, Ph.D., University of Houston, 2000.
- Treglia, Vincent A.**, P.E., Lecturer in Marine Engineering Technology (2001). B.S., State University of New York Maritime College, 1966. First Assistant Engineer of (Steam Vessels of any horsepower).
- Udoetuk, Mayen**, Lecturer in Marine Sciences (2009). B.S., Norfolk State University, 2006.
- Von Zharen, Wyndlyn M.**, Professor of Maritime Administration,* Marine Sciences,* Wildlife and Fisheries Sciences* and Oceanography* (1990, 2000). B.A., University of Florida, 1970; M.Ed., University of Florida, 1971; Ed.D., University of Florida, 1976; J.D., University of South Carolina Law School, 1987; L.L.M., University of Texas, 1998.
- Waddell Jr., Mathis T.**, Lecturer in General Academics (Political Science) (1995). B.A., University of Texas, 1962; M.A., University of Texas, 1963.
- Walling, Herbert M.**, Lecturer in Marine Transportation (2010). B.S. of Nautical Science Maine Maritime Academy, 1971.M.S., Maine Maritime Academy, 1987. Second Mate of Steam and Motor Vessels of Any Gross Tons Upon Oceans and Master of Towing Upon Oceans.
- Wang, Wen-Yao “Grace”**, Assistant Professor of Maritime Administration* (2008). B.A., National Taipei University, 1999; M.A., National Taipei University, 2001; Ph.D., Texas A&M University, 2008.
- Wardle, William J.**, Lecturer in Marine Biology (1973, 2003). B.S., Lynchburg College, 1963; M.S., Texas A&M University, 1970; Ph.D., Texas A&M University, 1974.
- Weeks, Kelly O.**, Assistant Professor of Maritime Administration* (2008). B.B.A., Delta State University, 2001; M.B.A., Delta State University, 2003; Ph.D., Jackson State University, 2007.
- Wiest, Natalie H.**, Lecturer and Head Librarian (1982). B.A., Pennsylvania State University, 1971; M.S., Drexel University, 1973; M.S., University of Tennessee, 1980.
- Willett, Donald E.**, Professor of General Academics (History) (1985, 1993). B.A., St. Edward’s University, 1972; M.A., Stephen F. Austin University, 1976; Ph.D., Texas A&M University, 1985.
- Williams, Sara S.**, Lecturer in General Academics, Kinesiology, (2010). B.S., Texas A&M University, 2000.
- Wood, Amanda L.**, Lecturer in Maritime Systems Engineering (2010). B.S. University of Houston, 1997, M.S., University of Houston, 2000, Ph.D. University of Houston, 2010.
- Würsig, Bernd G.**, Regents Professor of Marine Biology* and Wildlife and Fisheries Sciences* (1989,2006). B.S., Ohio State University, 1971; Ph.D., State University of New York, Stony Brook, 1978.
- Yi, Eunjeong**, Associate Professor of General Academics (Mathematics) (2003, 2006). B.S., Pusan National University, Pusan, South Korea, 1995; M.S., University of Houston, 2000; Ph.D., University of Houston, 2003.



Texas A&M University at Qatar

GRADUATE CATALOG

Texas A&M University at Qatar

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Assistant Dean for Admissions and Student Affairs.....	Cynthia J. Howman Wood
Assistant Dean for Research and Graduate Studies	Eyad A. Masad
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General Statement

The Texas A&M branch campus in Qatar, part of the 2,500-acre multi-institutional campus known as “Education City,” is offering a graduate program in chemical engineering. Texas A&M’s engineering program is widely considered among the best in America, and the curricula offered at the Qatar campus are materially the same as those offered at the main campus located in College Station, Texas. Texas A&M University at Qatar is fully funded by the Qatar Foundation for Education, Science, and Community Development and provides a unique opportunity for the University to expand its international presence and to provide educational and research opportunities for faculty and students.

Programs of Study at Texas A&M University at Qatar

Texas A&M University’s Dwight Look College of Engineering strives to provide its students with a high-quality education that will prepare them for a wide range of careers at the forefront of the engineering field. The curriculum is designed to accomplish this by closely integrating cutting-edge basic and applied research with innovative classroom instruction. Texas A&M University’s engineering programs are routinely ranked among the best in the United States, and graduates are highly sought after to provide leadership and innovative solutions to global challenges.

Our faculty members maintain active research programs in a wide range of areas. In addition, our students participate in numerous co-op and internship programs, which give them the opportunity to apply their knowledge to real problems in a variety of settings.

Admission

The online application for graduate admission may be found at Journey2TAMUQ.com. Additional information may be obtained by calling +974 (4423-0196), or by visiting the Office of Research and Graduate Studies at the Engineering Building located in Education City, Doha, Qatar. To be considered a candidate for admission to Texas A&M University at Qatar, the prospective student must formally apply by submitting all of the required documents and test scores and meeting all of the admission requirements. Required documents may include the following:

1. Completed application
2. Passport copy (resident permit if required)
3. Official college/university transcripts
4. Official test scores (GRE, TOEFL or IELTS)
5. Statement of purpose
6. Resume/Curriculum Vitae
7. Letters of recommendation
8. Application fee

Facilities

The Texas A&M at Qatar Engineering Building is one of the most advanced facilities for engineering education in the world. Designed by the Mexican architect Ricardo Legoretta, the 55,000 square meter (592,000 square feet) facility combines modernist elements with traditional Islamic architectural motifs. The building is fully wireless and features high-tech classrooms, teaching laboratories and computer laboratories. The research annex provides additional research laboratories that give future Aggie engineers firsthand experience.

Texas A&M at Qatar's home in Education City also includes a library with a core professional collection of 10,000 engineering titles, 38 print journals in the liberal arts, humanities and basic sciences. Students also have access to books and journal articles from the libraries on the main campus, from collections that exceed 4 million volumes and 95,000 serial titles. Extensive online resources are available to students in the library and remotely, including more than 90,000 electronic journals and newspapers, over 1,300 databases, and over 550,000 electronic books.

In order to take full advantage of the electronic resources available to university students, all incoming students are provided a wireless-equipped laptop computer fully loaded with the software necessary to complete the engineering curriculum.

Chemical Engineering Program

The Chemical Engineering Program offers two graduate degrees: Master of Science (MS) and Master of Engineering (MEng). The MS degree program includes a significant research component in addition to graduate coursework. Information about specific program coursework and examinations is available upon request and on our website chen.qatar.tamu.edu.

Some research areas available within the program include: liquefied natural gas safety, water and environmental management, desalination, gas-to-liquid conversion, applied crystal catalysis, design and simulation of chemical reactors, energy efficiency, process integration and optimization, oil and gas processing, nonlinear modeling, and process dynamics and control. Modern equipment is available in numerous laboratories to perform research in these and other areas.

Texas A&M University at Qatar Course Descriptions

Chemical Engineering (CHEN)

601. **Chemical Engineering Laboratory Safety and Health. (1-0). Credit 1.** Control of hazards associated with chemical engineering research laboratories and the chemical process industry; causes and prevention of accidents, emergency procedures, safety codes, health effects of toxic substances and experimental design for safety. Prerequisite: Graduate classification.
604. **Chemical Engineering Process Analysis. (3-0). Credit 3.** Development and analysis of chemical process models that involve systems of algebraic equations, and partial differential equations. Prerequisite: MATH 308 or approval of instructor.
623. **Fundamentals and Applications of Thermodynamics to Chemical Engineers (3-0) Credit 3.** Application of thermodynamics to chemical engineering operations and processes. Prerequisite: CHEN 354 or approval of instructor.
624. **Chemical Engineering Kinetics and Reactor Design (3-0). Credit 3.** Rates and Mechanisms of chemical reactions. Thermal and Catalytic reactions both homogeneous and heterogeneous. Prerequisite: CHEN 464 or approval of instructor.
629. **Advanced Transport Phenomena (3-0). Credit 3.** Principles of transfer of momentum, energy and mass studied by application to advanced chemical engineering problems. Theoretical analogy of these three models of transfer. Prerequisite: CHEN 461 or approval of Instructor.
631. **Process Dynamics I (3-0). Credit 3.** Dynamics, simulation and control of linear models of fluid, thermal and mass transfer processes for chemical industries by means of transient and frequency response analysis and design methods. Prerequisite: CHEN 461 or approval of Instructor.
633. **Theory of Mixtures (3-0). Credit 3.** Basic relations of statistical thermodynamics. Intermolecular forces, liquid state, theory of mixtures, critical state, theory of conformal solutions, orientational effects, theorem of corresponding states and applications to distillation and extraction. Prerequisite: CHEN 623 or approval of instructor.
634. **Multiphase Reactors. (3 -0). Credit 3.** Laboratory reactors; mixing phenomena in multiphase reactors; tracer techniques in chemical reactor characterization; trickle bed reactors; two phase and three phase fluidized bed reactors; bubble columns; slurry reactors. Prerequisite: CHEN 624 or approval of instructor.
643. **Applied Statistical Mechanics of fluids. (3-0). Credit 3.** Application of molecular theories and computer simulation techniques to describe the thermodynamics and transport properties of fluids and fluid mixtures. Prerequisite: CHEN 623 or approval of instructor.
655. **Process Safety Engineering. (3-0). Credit 3.** Applications of engineering principles to process hazards analysis including source and dispersion modeling, emergency relief systems, fire and explosion prevention and mitigation, hazard identification, risk assessment, process safety management, etc. Prerequisite: Approval of instructor.
658. **Fundamentals of Environmental Remediation Processes. (3-0). Credit 3.** Fundamental approach to various remediation technologies, topics in environmental thermodynamics and mass transfer, adsorption, desorption, ion exchange, air stripping, extraction, chemical oxidation, biodegradation. Prerequisite: Graduate classification in engineering.
661. **Optimization of Chemical Engineering Processes. (3-0). Credit 3.** Methods of optimization applied to the design and control of chemical engineering processes. Prerequisite: Approval of instructor.
681. **Seminar. (1-0). Credit 1.** Graduate students will be required to attend discussions covering problems of current importance in chemical engineering research.
684. **Professional Internship. Credit 1 to 4 each semester.** Engineering research or design experience in industrial setting away from Texas A&M campus; projects supervised jointly by faculty and industrial representative. Prerequisite: Graduate classification.
685. **Directed Studies. Credit 1 to 12.** One or more of numerous problems in chemical engineering processes and operations. Prerequisite: Approval of program chair and instructor.

- 689. Special Topics in... Credit I to 4.** Selected topics in particular areas of chemical engineering. May be repeated for credit. Prerequisite: Approval of program chair and instructor.
- 691. Research. Credit 1 or more each semester.** Problems of unit operations and unit processes. For maximum credit. Comprehensive thesis must be prepared of sufficiently high calibre to permit publication in scientific and technical journals. Prerequisite: Approval of program chair.
- 695. Graduate Mentoring Seminar (1-0) Credit 1.** Develop student skills in assessment; expose students to education in classroom setting. Prerequisites: 4 chemical engineering core graduate courses; graduate advisor approval.

Industrial and Systems Engineering (ISEN)

- 667. Engineering Economy. (3-0). Credit 3.** Fundamental concepts and advanced techniques of engineering economic analysis; evaluation of alternative capital investments considering income taxes, depreciation and inflation; discounted cash flow analysis of competing projects, break-even analysis and determination of rate of return on investment. Risk and uncertainty in engineering analysis. Prerequisite: ISEN 303 or approval of instructor.

Texas A&M University at Qatar Graduate Faculty

- Abdel-Wahab, Ahmed I.A.,** Associate Professor of Chemical Engineering. (2000, 2009) B.S., Al-Minia University, 1990; M.S., Al-Minia University, 1995; Ph.D., Texas A&M University, 2003.
- Abu-Rub, Haitham A.,** Associate Professor of Electrical and Computer Engineering; and IEEE Senior Member. (2006) M.S., Gdynia Maritime University (Poland), 1990; Ph.D., Gdansk University of Technology (Poland), 1995; Ph.D., Gdansk University (Poland), 2004.
- Ahmed, Shehab,** Assistant Professor of Electrical and Computer Engineering. (2007) B.S., Alexandria University (Egypt), 1999; M.S.E.E., Texas A&M University, 2000; Ph.D., Texas A&M University, 2007.
- Alnuweiri, Hussein M.,** Professor of Electrical and Computer Engineering. (2007) B.S., King Fahd University of Petroleum & Minerals (Saudi Arabia), 1983; M.S., University of Petroleum & Minerals (Saudi Arabia), 1984; Ph.D., University of Southern California, 1989.
- Alouini, Mohamed-Slim,** Adjunct Professor of Electrical and Computer Engineering; and IEEE Fellow. (2005, 2009) Diplome d'Ingenieur, Ecole Nationale Supérieure des Télécommunications Paris (France), 1993; Diplome d'Etudes Approfondies (DEA) Degree, Université Pierre et Marie Curie (France), 1993; M.S.E.E., Georgia Institute of Technology, 1995; Ph.D., California Institute of Technology, 1998; Habilitation a Diriger des Recherches, Université Pierre et Marie Curie (France), 2003.
- Amani, Mahmood,** Associate Professor of Petroleum Engineering. (1989, 2006) B.S., Wichita State University, 1986; M.S., Texas A&M University-Kingsville, 1988; Ph.D., Texas A&M University, 1997.
- Boutros, Joseph J.,** Professor of Electrical and Computer Engineering. (2007) Diplôme d'Ingénieur, Ecole Nationale Supérieure des Télécommunications Paris (France), 1992; Ph.D., Ecole Nationale Supérieure des Télécommunications Paris (France), 1996.
- Bickham, Troy O.,** Associate Professor of History. (2003, 2009) B.A., William Jewell College, 1995; M.Phil., Oxford University, 1997; D.Phil., Oxford University, 2001.
- Bryant, John A.,** Associate Professor of Construction Science. (1998, 2003) B.S., New Mexico State University, Las Cruces, New Mexico, 1982; M.S., University of Texas at El Paso, 1987; Ph.D., Texas A&M University, 1995.
- Bukur, Dragomir B.,** Professor of Chemical Engineering; Senior TEES Fellow and Holder of the Joe M. Nesbitt Professorship in Chemical Engineering. (1981, 2006) Dipl. Ing., University of Belgrade, 1970; M.S., University of Minnesota, 1972; Ph.D., University of Minnesota, 1974.
- Castier, Marcelo,** Professor of Chemical Engineering. (2010) B.Sc., Federal University of Rio de Janeiro (Brazil), 1981; M.Sc., Federal University of Rio de Janeiro, 1985; Ph.D., Technical University of Denmark, 1988.
- Elbashir, Nimir O.,** Assistant Professor of Chemical Engineering. (2008) B.S., University of Khartoum, 1994; M.E., Universiti Teknologi Malaysia, 1998; Ph.D., Auburn University, 2004.
- Fahes, Mashhad M.,** Assistant Professor of Petroleum Engineering. (2006) B.S., The Lebanese University, 2002; Ph.D., Imperial College London, 2006.

- Gupta, Anuj, P.E.**, Associate Professor of Petroleum Engineering. (2008) B.E., University of Delhi, 1983; M.S., University of Texas at Austin, 1987; Ph.D., University of Texas at Austin, 1991.
- Hall, Kenneth R., P.E.**, Associate Dean for Research and Graduate Studies and Professor of Chemical Engineering; Associate Vice Chancellor for Engineering; Associate Director of TEES; TEES Senior Fellow; and Holder of the Jack E. and Frances Brown Chair in Engineering. (1974, 2011) B.S., University of Tulsa, 1962; M.S., University of California, 1964; Ph.D., University of Oklahoma, 1967.
- Karkoub, Mansour**, Professor of Mechanical Engineering. (2009) B.S., University of Minnesota, 1988; M.S., University of Minnesota, 1990; Ph.D., University of Minnesota, 1994.
- Kent, C. Todd**, Assistant Dean for Academic Affairs and Assistant Professor of Political Science. (2005, 2010) B.S., Utah State University, 1982; M.A., Regent University, 1990; Ph.D., Texas A&M University, 2005.
- Linke, Patrick**, Professor of Chemical Engineering. (2007) Dipl.-Ing., University of Applied Sciences Cologne, 1996; M.Sc., University of Manchester, 1997; Ph.D., University of Manchester, 2001.
- Masad, Eyad A.**, Assistant Dean for Research and Graduate Studies; Professor of Mechanical Engineering. (2003, 2011) B.S., University of Jordan, Amman, 1993; M.S., Washington State University, 1995; Ph.D., Washington State University, 1998.
- Nasrabadi, Hadi**, Assistant Professor of Petroleum Engineering. (2006) B.S., Sharif University of Technology, 2002; Ph.D., Imperial College London, 2006.
- Nounou, Hazem N.**, Associate Professor of Electrical and Computer Engineering; IEEE Senior Member. (2007, 2009) B.S., Texas A&M University, 1995; M.S., Ohio State University, 1997; Ph.D., Ohio State University, 2000.
- Nounou, Mohamed N.**, Associate Professor of Chemical Engineering. (2006, 2009) B.S., Texas A&M University, 1995; M.S., Ohio State University, 1997; Ph.D., Ohio State University, 2000.
- Ozalp, Nesrin**, Assistant Professor of Mechanical Engineering. (2007) B.S., Ege University, 1995; M.S., Ege University, 1998; M.S., Stanford University, 2002; Ph.D., University of Washington, 2005.
- Palmer, Bruce R.**, Professor of Chemical Engineering. (2009) B.S., Colorado School of Mines, 1968; Ph.D., University of Utah, 1972.
- Parsaei, Hamid R., P.E.**, Associate Dean for Academic Affairs and Professor of Mechanical Engineering. (2010) B.S., National University of Iran, 1978; M.S., Western Michigan University, 1980; Ph.D., The University of Texas at Arlington, 1984.
- Qaraq, Khalid A.**, Professor of Electrical and Computer Engineering; IEEE Senior Member and ASEE Member. (2004) B.S., University of Technology (Iraq), 1986; M.S., Jordan University (Jordan), 1989; Ph.D., Texas A&M University, 1997.
- Ruimi, Annie**, Assistant Professor of Mechanical Engineering. (2007) B.S., San Diego State University, 1993; M.S., San Diego State University, 1994; Ph.D., University of California at Santa Barbara, 2005.
- Sadr, Reza**, Assistant Professor of Mechanical Engineering. (2008) B.S., Iran University of Science and Technology (Iran), 1991; M.S., Carleton University (Canada), 1996; Ph.D., The University of Utah, 2002.
- Tafreshi, Reza**, Assistant Professor of Mechanical Engineering. (2006) B.S., K.N. Toosi University of Technology (Iran), 1991; M.S., K.N. Toosi University of Technology (Iran), 1995; Ph.D., The University of British Columbia, 2005.
- Véchet, Luc**, Assistant Professor of Chemical Engineering. (2010) M.S., University Claude Bernard Lyon 1, 2003; Ph.D., École Nationale Supérieure des Mines de Saint-Étienne, 2006.
- Weichold, Mark H., P.E.**, Dean/CEO Texas A&M University at Qatar and Regent's Professor of Electrical and Computer Engineering; and IEEE Senior Member. (1978, 2007) B.S., Texas A&M University, 1978; M.S., Texas A&M University, 1980; Ph.D., Texas A&M University, 1983.

Course Descriptions

A large, multi-tiered fountain is the central focus of the image. It features several vertical jets of water spraying upwards from a dark, rectangular platform. The water then cascades down the sides of the platform into a larger, shallow pool of water in the foreground. The background shows a campus setting with green trees, a paved walkway, and a brick building under a blue sky with scattered white clouds. Two people are visible walking on the path to the left of the fountain.

Course Descriptions

All graduate courses offered in the University are described on the following pages and are listed by subject, arranged alphabetically. Some of the new courses and changes in courses are included in this catalog pending their approval by the Texas Higher Education Coordinating Board. Figures in parentheses following the number of the courses indicate the clock hours per week devoted to theory and practice, respectively. Theory includes recitations and lectures; practice includes work done in the laboratory, shop, drawing room or field. The unit of credit is the semester hour, which involves one hour of theory, or from two to four hours of practice per week for one semester of 15 weeks. Any course may be withdrawn from the session offerings in case the number of registrations is too small to justify offering the course.

Department of Accounting

A. S. Ahmed, J. J. Benjamin (Head), S. B. Fiechtner, J. C. Flagg, G. A. Giroux, S. D. Grossman, M. R. Kinney*, D. R. Lassila, M. L. Loudder, M. L. McAnally, A. S. McGowan**, S. McGuire, C. J. Nixon, T. C. Omer, L. L. Rees, N. Sharp, M. K. Shaub, W. T. Shearon, Jr., M. K. Shelley, K. Sivaramakrishnan, J. R. Strawser, R. H. Strawser, E. P. Swanson, S. Tse, D. D. Wang, C. D. Weaver, M. S. Wilkins, C. J. Wolfe

* Doctoral Student Advisor

** Master's Student Advisor and Professional Program Advisor

The Department of Accounting offers graduate studies leading to the MS and PhD degrees, and coursework supporting the Mays Business School's MBA degree. The MS degree provides the necessary coursework for students who wish to enter public accounting, private industry or government service. The department also offers an integrated Professional Program that students enter in the junior year of the BBA program. Graduates receive a Bachelor of Business Administration degree and an MS degree. The PhD program is designed to prepare students for careers in teaching and research. Additional information, including specific departmental requirements, may be obtained by contacting the master's student advisor or the doctoral student advisor in the Department of Accounting.

Accounting (ACCT)

- 603. Energy Accounting. (3-0). Credit 3.** Overview of the oil and gas industry and specialized financial accounting procedures associated with the industry; emphasis on accounting for exploration, development, production, depletion and amortization as well as joint operations, asset impairment and retirement obligation; includes reserve accounting/disclosure related to the above topics. Prerequisites: ACCT 327 with C or better.
- 607. Seminar in Auditing. (3-0). Credit 3.** Current issues and research in auditing, attestation and financial disclosures. Classification 6 students may not enroll in this course. Prerequisite: ACCT 407 or equivalent.
- 610. Financial Accounting. Credit 1 to 3.** Develops a conceptual framework for understanding and using corporate financial statements. Oriented towards the user of financial accounting data (rather than the preparer) and emphasizes the reconstruction of economic events from published financial data. May be repeated for up to 3 hours credit. Classification 6 students may not enroll in this course. Prerequisite: Enrollment is limited to BUAD classification 7 graduate students.
- 611. Management of Taxation. (3-0). Credit 3.** Various income taxes on taxable entities. For business and other majors. Classification 6 students may not enroll in this course.
- 612. Partnership and Real Estate Taxation. (3-0). Credit 3.** Concepts and principles of partnerships and real estate taxation; use of partnerships and real estate for tax planning. Classification 6 students may not enroll in this course. Prerequisite: ACCT 405.
- 613. Estate Planning. (3-0). Credit 3.** Taxation of decedent's estates and lifetime gifts; valuation of property subject to estate and gift taxes; concepts and principles of estate and trust taxation; estate planning. Classification 6 students may not enroll in this course. Prerequisite: ACCT 405.
- 615. Contemporary Tax Topics. (3-0). Credit 3.** Explores business tax topics that provide current/future significant professional tax service opportunities such as specialized applications of business taxation. Intended for graduate students in the Tax Track in the Professional Program in Accounting. May be taken two times for credit. Prerequisite: ACCT 611.

- 620. Management Accounting and Control. Credit 1 to 3.** Applications of concepts useful to management, in the analysis of accounting data for the purposes of costing and income determination, decision making and control of various organizational activities. May be repeated for up to 3 hours credit. Classification 6 students may not enroll in this course. Prerequisite: ACCT 610 or equivalent. Enrollment is limited to BUAD classification 7 graduate students.
- 621. Corporate Taxation I. (3-0). Credit 3.** Formation and capital structures, partial liquidations, S corporations, accumulated earnings tax, personal holding companies and other topics. Classification 6 students may not enroll in this course. Prerequisite: ACCT 405 or equivalent.
- 628. Business Application Modeling. (3-0). Credit 3.** This course will focus on modeling application software that is commonly used in accounting and business; the primary emphasis will be Visual Basic for Applications in Microsoft Excel and Access; application exercises will deal with financial problem solving. Classification 6 students may not enroll in this course. Prerequisite: ACCT 427 or equivalent.
- 629. Controls and Audit Technology. (3-0). Credit 3.** This course focuses on internal controls and their importance with regards to financial reporting and arrangement. It covers topics such as process walk-through techniques, documentation, business processes, control frameworks, application controls, change management, operations management and security. Prerequisite: ACCT 407.
- 631. Corporate Taxation II. (3-0). Credit 3.** Taxation of corporations in business combinations and consolidations, divisions, recapitalizations and other special areas. Classification 6 students may not enroll in this course. Prerequisite: ACCT 621.
- 635. Certified Public Accountant—Problems. (3-0). Credit 3.** Current and emerging professional accounting issues facing audit, tax and system professionals in public accounting; emphasis on recent pronouncements of the FASB. Classification 6 students may not enroll in this course. Prerequisite: ACCT 642 or approval of instructor.
- 640. Accounting Concepts and Procedures I. (3-0). Credit 3.** Accounting concepts and relationships essential to administrative decisions; use of accounting statements and reports as policymaking and policy execution tools. Classification 6 students and non-business graduate students may enroll in this course. Prerequisite: Graduate classification.
- 641. Accounting Concepts and Procedures II. (3-0). Credit 3.** Financial accounting; conceptual aspects obtained through the problem approach. Classification 6 students may not enroll in this course. Prerequisites: Graduate classification; ACCT 610 or ACCT 640.
- 642. Accounting Concepts and Procedures III. (3-0). Credit 3.** Advanced financial accounting topics. Theoretical and problematical treatment of accounting in the corporate structure, debt and equity funding, and preparation and analysis of financial statements under conditions of changing economic environment. Classification 6 students may not enroll in this course. Prerequisites: Graduate classification; ACCT 641 or equivalent.
- 644. Control and Audit of Information Systems. (3-0). Credit 3.** This course focuses on the control, audit, and security of information systems; it is aimed at enhancing the ability of accounting professionals to deal with complex computer-based accounting systems as auditors of these systems; it covers topics such as general and application controls, audit software, and e-commerce security. Prerequisite: ACCT 427; graduate classification.
- 646. International Accounting. (3-0). Credit 3.** Introduction and examination of accounting issues unique to multinational enterprises and international business activity. Classification 6 students may not enroll in this course. Prerequisites: ACCT 328; FINC 341. Cross-listed with IBUS 646.
- 647. Financial Statement Analysis. (3-0). Credit 3.** Analytical approach to financial statements; application of finance and accounting principles relevant to the analysis of financial statements. Classification 6 students may not enroll in this course. Prerequisites: ACCT 610 or ACCT 640; FINC 612 or FINC 635. Cross-listed with FINC 647.
- 648. Accounting Information Systems. (3-0). Credit 3.** Design, implementation, operation, control and audit techniques of accounting information systems. Classification 6 students may not enroll in this course. Prerequisite: ACCT 427 or equivalent.
- 650. Accounting Ethics. (3-0). Credit 3.** Integration of ethical reasoning, objectivity, independence and other core values into the development of a professional accountant; critical analysis of the ethical lapses which have occurred in business and the accounting profession; explores ways to integrate ethical behavior into professional life. Prerequisite: Graduate classification.

- 651. Development of Accounting Thought. (3-0). Credit 3.** Examination of contemporary financial reporting issues in terms of institutional, ethical, and regulatory environment; framework for exercising judgment when literature provides no direct prescription about correct reporting. Tools used include unstructured cases and open-ended research assignments. Course not open to classification 6 students. Prerequisite: ACCT 642 or approval of instructor.
- 660. Accounting Information and Financial Markets. (3-0). Credit 3.** Financial accounting research with emphasis on financial markets; investigates major areas of financial accounting research, related statistical techniques and the progress of research in a historical perspective. Classification 6 students may not enroll in this course. Prerequisite: ACCT 665 or approval of instructor.
- 661. Interdisciplinary Interface of Accounting Thought. (3-0). Credit 3.** Implications for accountants of new developments in other disciplines and of changes in the technology and financing of particular industries. Classification 6 students may not enroll in this course. Prerequisite: ACCT 665.
- 665. Research Methodology I. (3-0). Credit 3.** Nature and evaluation of accounting research; includes preparation and evaluation of original research papers. Classification 6 students may not enroll in this course. Prerequisite: Doctoral classification.
- 671. Contemporary Accounting Topics. Credit 1 to 3.** Current issues and research in topical areas: financial data audit and control; international accounting; accounting for natural resources; tax planning, theory and structure of taxation. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 672. Accounting Field Project. (3-0). Credit 3.** This course focuses on strategic decision making and cost analysis in business firm operations. Prerequisite: Graduate classification.
- 675. Empirical and Computational Methods in Accounting Research. (3-0). Credit 3.** Practical aspects and performance of empirical research in accounting using recent programming environment; provide foundation for performing research related to PhD seminar project, academic research and scholarly papers. Not open to classification 6 students. May be repeated for credit. Prerequisite: Doctoral classification.
- 679. Managerial Accounting Analysis. (3-0). Credit 3.** Primary aspects of managerial accounting needs; planning, internal control, cash and inventory management, data systems and analysis, and mergers and acquisitions. Classification 6 students may not enroll in this course. Prerequisite: ACCT 620 or equivalent.
- 680. Tax Research and Policy. (3-0). Credit 3.** Methodology and sources of tax research; tax analysis research, policy implications, behavioral aspects and use of quantitative analysis. Classification 6 students may not enroll in this course. Prerequisite: ACCT 405 or ACCT 611.
- 684. Professional Internship. Credit 1 to 6 each semester.** A directed internship in an organization to provide students with on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. Classification 6 students may not enroll in this course. Prerequisites: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisites: Graduate classification and approval of instructor.
- 688. Doctoral Seminar. (3-0). Credit 3.** Historical development of the conceptual framework of accounting theory and practices; analysis of current research and controversial issues in the field. For doctoral students only. May be repeated for credit. Classification 6 students may not enroll in this course. Prerequisite or corequisite: ACCT 665.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of accounting. May be repeated for credit. Classification 6 students may not enroll in this course.
- 690. Theory of Research in Accounting. (3-0). Credit 3.** The design of research in the various subfields of accounting and the evaluation of research results using examples from the current research literature. May be repeated for credit. Classification 6 students may not enroll in this course. Prerequisite: ACCT 665.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Classification 6 students may not enroll in this course.

Department of Aerospace Engineering

K. T. Alfriend, A. A. Benzerga, R. Bhattacharya, R. D. W. Bowersox (Interim Head), J. G. Boyd, L. A. Carlson, S. Chakravorty, P. G. Cizmas, D. A. Donzis, S. Girimaji, W. E. Haisler, J. E. Hurtado, D. C. Hyland, J. L. Junkins, T. Kalmár-Nagy, A. N. Karpets, V. K. Kinra, D. C. Lagoudas, R. Langari, D. Mortari, M. Naraghi, T. C. Pollock, J. N. Reddy, O. K. Redinotis, H. L. Reed, J. D. Rogers, W. S. Saric, J. C. Slattery, T. W. Strganac, T. Strouboulis, R. R. Talreja, S. R. Vadali, J. L. Valasek, J. R. Walton, D. T. Ward, J. D. Whitcomb, E. B. White

The Department of Aerospace Engineering offers graduate work and research programs in aeronautical/aerospace engineering. Programs leading to the degrees of MEng, MS and PhD are available. The department also offers courses and faculty supervision for students pursuing the Doctor of Engineering degree. Major areas of interest are aero/fluid dynamics, computational fluid dynamics, fluid-structure interaction (aeroelasticity), flight mechanics, astrodynamics, spacecraft/aircraft dynamics and control, computational mechanics, solid mechanics, micromechanics, nanomechanics, composite materials, bio-nano materials, aging aircraft and structures. The department defined five cross-disciplinary research thrust areas that receive significant support and offer unique educational/research opportunities. The thrust areas are: (1) Autonomous Aerospace Vehicle Systems, (2) Aerospace Propulsion and Energy Systems, (3) Controlled Intelligent Materials and Structures, (4) Hypersonic Vehicle Systems, and (5) Space Exploration and Sensing Systems.

The aerodynamics and propulsion-related research within the department includes airfoil and wing analyses, boundary layer stability, turbulence, combustion, propulsion and flow-control for aircraft, land vehicles, wind turbines and other applications. A major focus within the department is viscous flows across the speed regimes ranging from incompressible subsonic to hypersonic. Fundamental transition research is performed within the NASA/AFOSR National Hypersonic Science Center in Laminar-Turbulent Transition, where experiments are conducted using world-class quiet-flow facilities that include the Klebanoff/Saric Low Disturbance Tunnel and the NASA Langley/TAMU Mach 6 Quiet Tunnel. Several research aircraft are available for full-scale flight research. The Texas A&M University National Aerothermochemistry (TAMU-NAL) Laboratory is a graduate research facility for conducting leading research in support of national interests in high-speed gasdynamics, unsteady flows and flows with thermal and chemical non-equilibrium effects. The Flight Research Laboratory houses several piloted aircraft for basic and applied research.

Research involving dynamics and control of autonomous intelligent vehicles, formation flying of spacecraft and other problems in astrodynamics is performed in the Center for Mechanics and Control. The Land, Air and Space Robotics (LASR) laboratory enables sensing and control research with emphasis on high fidelity emulation of close proximity motions of two or more vehicles. LASR is being utilized to research spacecraft on-orbit proximity operations, autonomous aerial refueling of UAVs and astronaut supervision of robots for surface operations on the Moon or Mars. Research related to satellite design, responsive space systems and autonomous rendezvous and docking is conducted by the AggieSat Lab Student Satellite Program. The department has a two-observatory facility on the grounds of the Physics Department's Astronomy Teaching Observatory, which is used for research on fine resolution interferometric imaging of space objects via photonic quantum correlations.

Investigations of materials and structural mechanics problems are undertaken in the Center for Mechanics of Composites. Research on nanomaterials, multifunctional material systems, multiscale modeling and integrated adaptive structures is coordinated by the Texas Institute for Intelligent Materials and Structures for Aerospace Vehicles (TiIMS). Research in the Electroactive Materials Characterization Laboratory focuses on processing-microstructure-property relationships in smart materials with the goal of developing new materials with unique combinations of mechanical, electrical and coupled properties for uses that range from advanced electronic devices and autonomous system concepts to the aerospace, automotive, medical and consumer industries.

Numerical simulations of complex fluid and solid mechanics problems are efficiently obtained with university and supporting departmental computational facilities.

Courses relating to structural mechanics and materials listed at the end of this section are contained within the Dwight Look College of Engineering listing. The mechanics and materials courses are administered by the Department of Aerospace Engineering and are taught by faculty from the Departments of Aerospace, Civil and Mechanical Engineering. A foreign language is not required for any of the aerospace degree programs.

Aerospace Engineering (AERO)

- 601. Principles of Fluid Motion. (4-0). Credit 4.** Formulation of equations of motion for fluid flow; theoretical and numerical solution methods for potential (ideal) flow; application to thin and thick airfoil and wing aerodynamics; complex variable methods for potential flow. Prerequisite: Approval of instructor.
- 602. The Theory of Fluid Mechanics. (3-3). Credit 4.** Entry-level graduate course on the theory of fluid mechanics, with emphasis on viscous subsonic flows; concepts of boundary layer theory, flow stability, transition and turbulence; laboratory includes elements of measurement techniques, numerical methods and physical modeling. Prerequisite: MATH 601 or registration therein.
- 603. Continuum Mechanics. (3-0). Credit 3.** Development of field equations for analysis of continua (solids as well as fluids); conservation laws; kinematics, constitutive behavior of solids and fluids; applications to aerospace engineering problems involving solids and fluids. Prerequisite: Graduate classification. Cross-listed with MEMA 602.
- 605. Theory of Elasticity. (3-0). Credit 3.** Analysis of stress and strain in two- and three-dimensions, equilibrium and compatibility equations, strain energy methods; torsion of noncircular sections; flexure, axially symmetric problems. Prerequisite: graduate or senior undergraduate standing. Cross-listed with MEMA 601 and MEEN 603.
- 606. Multifunctional Materials. (3-0). Credit 3.** This course will present an in-depth analysis of multifunctional materials and composites, and their novel applications. Prerequisites: Theory of elasticity or Continuum Mechanics MEMA 601 or MEMA 602/AERO 603, MSEN 601 or MEMA 609. Cross-listed with MEMA 606 and MSEN 606.
- 608. Nanomechanics. (3-0). Credit 3.** Application of mechanics concepts to nano-scale behavior of materials. Review of continuum mechanics; Extensions to generalized continua; Nonlocal elasticity; Nano-scale plasticity. Focus on multi-scale modeling: Dislocation Dynamics; Quasi-Continuum method; Molecular dynamics with introductions to quantum mechanics and statistical mechanics. Prerequisite: AERO 603 or MEMA 601. Cross-listed with MEMA 608 and MSEN 608.
- 609. Sustainability Metrics and Life Cycle Assessment in Engineering. (3-0). Credit 3.** Concepts of sustainability with associated metrics; application of systems engineering tools to facilitate assessment of viable options on products and processes; assessment of impact on the entire biosphere; product life cycle analysis. Prerequisite: Graduate classification.
- 612. Wave Propagation in Isotropic and Anisotropic Solids. (3-0). Credit 3.** Mathematical and experimental methods of studying stress waves with emphasis on anisotropic solids, e.g., fiber-reinforced composite materials; waves in an unbounded medium, in a half-space, in rods; waves in a general anisotropic medium; wave surface, slowness surface, velocity surface, energy velocity and group velocity. Prerequisites: MEMA 601 or AERO 603. Cross-listed with MEMA 612.
- 615. Numerical Methods for Internal Flow. (3-0). Credit 3.** Methods for solving internal flow problems; viscous and inviscid compressible flow, Euler/Navier Stokes solvers, boundary conditions. Prerequisite: MATH 601 or approval of instructor.
- 616. Damage and Failure in Composite Materials. (3-0). Credit 3.** Mechanisms and models related to damage and failure in composite materials subjected to mechanical loads. Prerequisite: Courses in composite materials, elasticity. Cross-listed with MEMA 616.
- 617. Micromechanics. (3-0). Credit 3.** Eigenstrains; inclusions, and inhomogeneities; Eshelby's solution for an ellipsoidal inclusion; Eshelby's equivalent inclusion method. Effective elastic properties of composites; composite spheres and cylinders models; bounds on effective moduli; Hashin-Shtrikman bounds; applications to fiber, whisker and particulate reinforced composites; introduction to micromechanics of inelastic composites and solids with damage. Prerequisites: MEMA 601, MEMA 602 or AERO 603, AERO 605. Cross-listed with MEMA 625.
- 618. Mechanics of Active Materials. (3-0). Credit 3.** Introduction to coupled field theories: constitutive response of materials with thermal and electromagnetic coupling; microstructural changes due to phase transformations; shape memory alloys; piezoelectric and magnetostrictive materials; active polymers and solutions. Micromechanics of active composites. Prerequisites: MEMA 601 or MEMA 602. Cross-listed with MEMA 626.

- 619. Materials Modeling of Phase Transformation and Microstructural Evolution. (3-0). Credit 3.** Computer modeling and simulation of microstructural evolution during various phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic transformation, ferroelectric and ferromagnetic domain evolution, dislocation dynamics, and crack propagation. Prerequisites: Graduate classification and approval of instructor. Cross-listed with MEMA 619 and MSEN 619.
- 620. Unsteady Aerodynamics. (3-0). Credit 3.** Theoretical formulation of unsteady airfoil theory and techniques used for determining airloads on oscillating lift surfaces; exact solutions and various approximations presented and evaluated; application to problems of unsteady incompressible, subsonic and transonic flows about airfoils and wings. Prerequisite: Approval of instructor.
- 622. Spacecraft Dynamics and Control. (3-0). Credit 3.** Elements of analytical dynamics; modeling different types of spacecraft and control systems, sensors, and actuators; stability; control system design; effects of flexibility; attitude and orbital coupling; environmental effects. Prerequisites: AERO 422 or ECEN 420.
- 623. Optimal Spacecraft Attitude and Orbital Maneuvers. (3-0). Credit 3.** Application of optimization and optimal control techniques to spacecraft maneuver problems; computation of open loop and feedback controls for linear and nonlinear spacecraft dynamical systems; low-thrust and impulsive control, discretization methods, case studies. Prerequisite: AERO 423 or equivalent.
- 624. Celestial Mechanics. (3-0). Credit 3.** Analytical and numerical methods for computing spacecraft orbits under the influence of gravitational, aerodynamic, thrust and other forces; Keplerian two-body problem, perturbation methods, orbit determination, navigation and guidance for aerospace vehicles. Prerequisite: AERO 423 or equivalent.
- 625. Modern Control of Aerospace Systems. (3-0). Credit 3.** Linear and nonlinear controllers for aircraft and spacecraft; state and output feedback of sampled-data control systems; feedback linearization and dynamic inversion; direct sampled-data design using optimal MIMO techniques; sensing considerations, sources and modeling of uncertainties unique to aircraft and spacecraft, robustness analysis. Prerequisite: AERO 422 or equivalent.
- 626. Estimation of Dynamic Systems. (3-0). Credit 3.** Traditional concepts and recent advances in estimation related to modern dynamic systems found in aerospace disciplines; least squares estimation, state estimation, nonlinear filtering, aircraft position and velocity tracking, attitude determination of spacecraft vehicles, gyro bias estimation and calibration. Prerequisites: AERO 310 or equivalent; STAT 211 or equivalent.
- 627. Principles of Structural Dynamics. (3-0). Credit 3.** Examination of flexible structures through a review of single degree-of-freedom dynamical systems followed by an in-depth study of continuous and multiple degree-of-freedom systems; emphasis on discrete modeling of structures for vibration analysis and dynamic analysis, with minimal development of methods such as finite elements. Prerequisite: Graduate classification.
- 628. Advanced Spacecraft Dynamics and Control. (3-0). Credit 3.** Review of fundamental principles; introduction to alternate and advanced methods of dynamics and control for aerospace systems; alternate methods for generating and analyzing equations of motion; techniques for complex multibody systems; variable speed control moment gyros; method of quadratic modes; focus on modeling techniques for aerospace systems. Prerequisite: AERO 622.
- 629. Experimental Aerodynamics. (3-0). Credit 3.** Review of fundamental principles in aerodynamics; basics of instrumentation, electronics, data-acquisition; experimental techniques in aerodynamics/fluid mechanics; pressure, skin friction, force and velocity measurement techniques in wind and water-tunnel testing; conventional and novel techniques in data-processing and systems modeling; smart systems in experimental aerodynamics. Prerequisite: AERO 601.
- 630. Introduction to Random Dynamical Systems. (3-0). Credit 3.** Building on basic probability theory, course covers theory and applications of discrete and continuous random processes. Particular attention shall be paid to the response of dynamical systems (discrete, linear and non-linear), to random input processes and their application to Engineering Systems. Prerequisite: Graduate student status.
- 631. Advanced Trajectory Optimization for Aerospace Systems. (3-0). Credit 3.** Numerical solution of optimal control problems (OCP) as a nonlinear programming problem (NLP); control of a nonlinear missile using SNOPT, trajectory generation, motion planning, atmospheric entry problems; elements of approximation, distributed and parallel computation techniques, dynamical systems, stability theory, parameter optimization. Prerequisites: Graduate classification; approval of instructor.

- 632. Design of Advanced Flight Control Systems - Theory and Application (3-0). Credit 3.** Modeling, analysis, design and implementation of advanced flight control problems, specifically aerospace engineering applications; includes choice of controlled variables, reduction of controlled variables, design methodology, computational framework, implementation issues, and software environments using various toolboxes. Prerequisites: Graduate classification and approval of instructor.
- 633. Advanced Aerospace Multibody Dynamics. (3-0). Credit 3.** Techniques for modeling, simulation, and analyzing multibody dynamical systems; includes development of kinematic expressions for articulating bodies, adding and constraining degrees of freedom through mappings; familiarization with industry codes, such as DISCOS; appreciation of learned techniques on various systems, including omni-directional vehicles, Stewart platforms, and gyroscopically-stabilized walking robots. Prerequisite(s): AERO 622 or graduate classification and approval of instructor.
- 640. Turbulence Processes. (3-0). Credit 3.** Fundamentals of conservation, Lagrangian, transformation, variance properties; flow features: laminar, transition, turbulence regimes, characteristics, spectrum; statistical (filter/average) description: scales, Reynolds, arbitrary averaging, realizability; elementary turbulence processes: viscous, advective/inertial, role of pressure; elementary process models, viscous RDT, RDT for velocity gradients, equipartition of energy, restricted Euler equations; isotropic, homogeneous turbulence. May be taken 2 times for credit.
- 641. High-Speed Combustion for Propulsion. (3-0). Credit 3.** Study topics in combustion relevant to high-speed subsonic/supersonic air-breathing propulsion; emphasis on the structure of detonations and the operation of combustors under supersonic conditions; structure of shock-waves and the mixing/chemical kinetics that take place in high speeds. Prerequisite: Graduate classification.
- 642. Laser Diagnostics for Combustion and Propulsion. (3-0). Credit 3.** Laser diagnostics topics as applied to combustion and propulsion: brief exposition of fundamental electromagnetic theory; practice of basic experimental laser techniques used to measure thermochemistry; basic implementation of Raman and Rayleigh scatterings; Laser-Induced Fluorescence (LIF); detection methods, optical systems, noise contributions, and signal enhancement techniques will be discussed. Prerequisite: Graduate classification.
- 643. High-Performance Computational Fluid Dynamics. (3-0). Credit 3.** Numerical simulations of fluid dynamics problems on massively parallel computers; focus on Direct Numerical Simulations (DNS) where all dynamically relevant scales are resolved; elements of both high-performance computing (HPC) and numerical methods to solve incompressible and compressible flows. Prerequisite: AERO 615 or approval of instructor.
- 649. Generalized Finite Element Methods. (3-0). Credit 3.** Systemic introduction to the theory and practice of generalized finite element (FE) methods, including GFEM, the hp-cloud method, particle methods, and various meshless methods with similar character; precise formulation of the methods are presented; known theoretical results for convergence; important issues related to implementation, issues of numerical integration. Prerequisite: Graduate student status. Cross-listed with MEMA 649.
- 650. Spacecraft Attitude Determination. (3-0). Credit 3.** Spacecraft attitude determination systems; attitude and error parameterizations, attitude sensors, data processing and calibration; introduction to single- and three- axis attitude determination and to optimal attitude and error estimation: ECI motion and time definitions. Prerequisite: AERO 423 or equivalent.
- 660. Nonlinear Flight Dynamics. (3-0). Credit 3.** Nonlinear equations of motion for coupled aircraft motions; coupled aerodynamic phenomena; application of the direct method of Lyapunov to nonlinear aircraft motions; elastic airplane equations of motion. Prerequisite: AERO 421 or approval of instructor.
- 672. Perturbation Methods in Mechanics. (3-0). Credit 3.** Develop approximate solutions to algebraic, differential, and integral equations; analysis of nonlinear oscillations, nonlinear waves, and boundary-layers; emphasis on combined numerical/perturbations techniques and reducing Partial Differential Equation (PDE) to Ordinary Differential Equation (ODE). Prerequisites: Graduate classification in aerospace, mechanical or civil engineering.
- 673. Boundary Layer Stability and Transition. (3-0). Credit 3.** Analytical, numerical, and experimental methods for the stability of bounded shear flows; includes techniques for estimating transition to turbulence and the control of transition through laminar flow control. Prerequisites: Graduate classification and AERO 601, AERO 602, or AERO 603 or approval of instructor.
- 674. Hypersonic Flow. (3-0). Credit 3.** Theoretical formulation of hypersonic flow theory; techniques for hypersonic flowfield analysis; high temperature effects, including both equilibrium and nonequilibrium flows; classical and modern computational methods. Prerequisite: AERO 303 or equivalent.

676. **Aerothermochemistry. (3-0). Credit 3.** Fundamentals of kinetic theory, chemical thermodynamics and statistical mechanics; applications to high temperature chemically reacting equilibrium and non-equilibrium aerodynamic flows. Prerequisite: AERO 303 or equivalent.
677. **Rarefied Gasdynamics. (3-0). Credit 3.** Analysis of phenomena occurring in low density flows emphasizing slip regime problems and solutions based on second-order solutions to the Boltzmann equation. Prerequisite: AERO 477 or approval of instructor.
681. **Seminar. (1-0). Credit 1.** Selected research topics presented by the faculty, students and outside speakers. Prerequisite: Graduate classification.
684. **Professional Internship. Credit 1 to 4.** Engineering research and design experience at government or industry facilities away from the Texas A&M campus; design projects supervised by faculty coordinators and personnel at these locations; projects selected to match student's area of specialization. Prerequisites: Graduate classification and approval of committee chair and department head.
685. **Directed Studies. Credit 1 to 12 each semester.** Special topics not within scope of thesis research and not covered by other formal courses. Prerequisite: Graduate classification in aerospace engineering.
689. **Special Topics in... Credit 1 to 4.** Selected topics in an identified area of aerospace engineering. May be repeated for credit. Prerequisite: Approval of instructor.
691. **Research. Credit 1 or more each semester.** Technical research projects approved by department head.

The following courses are described in the section entitled Mechanics and Materials (MEMA) on [page 487](#) and are part of the curriculum in aerospace engineering.

601. **Theory of Elasticity. (3-0). Credit 3.**
602. **Continuum Mechanics. (3-0). Credit 3.**
604. **Mathematical Foundations of Continuum Mechanics. (3-0). Credit 3.**
605. **Energy Methods. (3-0). Credit 3.**
606. **Multifunctional Materials. (2-1). Credit 3.**
607. **Flow and Fracture of Polymeric Solids. (3-0). Credit 3.**
608. **Nanomechanics. (3-0). Credit 3.**
609. **Materials Science. (3-0). Credit 3.**
610. **Applied Polymer Science. (3-0). Credit 3.**
611. **Fundamentals of Engineering Fracture Mechanics. (3-0). Credit 3.**
612. **Wave Propagation in Isotropic and Anisotropic Solids. (3-0). Credit 3.**
613. **Principles of Composite Materials. (3-0). Credit 3.**
614. **Physical Phenomena in Materials. (3-0). Credit 3.**
616. **Damage and Failure in Composite Materials. (3-0). Credit 3.**
619. **Materials Modeling of Phase Transformation and Microstructural Evolution. (3-0). Credit 3.**
625. **Micromechanics. (3-0). Credit 3.**
626. **Mechanics of Active Materials. (3-0). Credit 3.**
633. **Theory of Plates and Shells. (3-0). Credit 3.**
635. **Structural Analysis of Composites. (3-0). Credit 3.**
641. **Plasticity Theory. (3-0). Credit 3.**
646. **Introduction to the Finite Element Method. (3-0). Credit 3.**
647. **Theory of Finite Element Analysis. (3-0). Credit 3.**
648. **Nonlinear Finite Element Methods in Structural Mechanics. (3-0). Credit 3.**
649. **Generalized Finite Element Methods. (3-0). Credit 3.**
651. **Viscoelasticity of Solids and Structures I. (3-0). Credit 3.**
689. **Special Topics in... Credit 1 to 4.**

The following courses are described in the section entitled Materials Science and Engineering (MSEN) on [page 471](#) and are part of the curriculum in aerospace engineering.

- 601. **Fundamental Materials Science and Engineering. (4-0). Credit 4.**
- 602. **Advanced Materials Science and Engineering. (4-0). Credit 4.**
- 606. **Multifunctional Materials. (2-1). Credit 3.**
- 608. **Nanomechanics. (3-0). Credit 3.**
- 619. **Materials Modeling of Phase Transformation and Microstructural Evolution. (3-0). Credit 3.**

Africana Studies (AFST)

- 601. **Methods of Inquiry Into Africana Studies. (3-0). Credit 3.** Familiarization with the methodological tradition of African-centered thinking and its relationship to the more popular term Afro-centricity; representation of the thoughts of notable African centered and Afrocentric scholars throughout history as a means to center African descended people throughout history, social analysis and theoretical accounts. Prerequisite: Graduate classification.
- 685. **Directed Studies. Credit 1 to 4.** Directed individual study of problems in the Africana Studies field of research or scholarly activity not pertaining to thesis or dissertation, or selected instruction not covered by other courses. Prerequisites: Approval of instructor and program director; graduate classification.
- 689. **Special Topics in... Credit 1 to 4.** Selected topics in an identified area of Africana Studies. Prerequisite: Graduate classification.

Intercollegiate Faculty in Agribusiness

D. A. Bessler, O. Capps, Jr., L. G. Gresham, E. Jones*, D. A. Klinefelter, D. J. Leatham, K. K. Litzenberg, H. A. Love, B. A. McCarl, R. M. Nayga, A. G. Nelson, D. Ng, J. P. Nichols, C. J. Nixon, J. B. Penson, W. M. Pride, J. W. Richardson, V. S. Salin, B. Shetty, J. W. Siebert, B. D. Welch

* Intercollegiate Faculty Chair

The Intercollegiate Faculty of Agribusiness provides administrative leadership for the Master of Agribusiness (MAB) degree program and for the PhD in Agribusiness and Managerial Economics. The mission of the Intercollegiate Faculty of Agribusiness is to: (1) foster the synergistic development of interdisciplinary agribusiness research and teaching; (2) enhance communication between the faculty members in the College of Agriculture and Life Science (Department of Agricultural Economics) and the Mays Business School (Departments of Accounting, Finance, Information and Operations Management, Management and Marketing); (3) build a strong academic foundation in agribusiness and managerial economics that will meet the current and future needs of higher education, government agencies and industry in the U.S. and globally; and (4) capitalize on the network of leaders within the food and agribusiness industry for student recruitment, research opportunities, internships and placement.

Furthering the development of Texas, U.S. and international value-added agricultural and food enterprises will require considerable analytical and managerial expertise. Graduate-trained managers are needed who are comfortable working in technical fields of expertise and who also have an understanding of the unique challenges and issues facing the agricultural and food sector. The Master of Agribusiness program provides this training.

Students completing the PhD program in agribusiness and managerial economics will be uniquely qualified to teach agribusiness and conduct research in academic, government and consulting careers. This program provides a solid foundation of economic theory and application with field areas in the different business disciplines of finance, strategic management, marketing and supply chain management in the Mays Business School.

Training these graduates requires strong interdepartmental and interdisciplinary teaching and research programs emphasizing the application of managerial economics. The Master of Agribusiness and PhD in Agribusiness and Managerial Economics programs are designed to address these needs through the integrated curricula across Agricultural Economics, Economics and the Mays Business School.

Information regarding the programs and application process may be obtained from the website at agecon.tamu.edu/graduate/graduate_index.html (click on "degrees") or by contacting the Intercollegiate Faculty Chair.

Department of Agricultural Economics

P. Abeygunawardena, S. H. Amosson, C. Anderson, Jr., D. P. Anderson, D. A. Bessler, F. O. Boada, H. L. Bryant, O. Capps, Jr., G. M. Clary, J. R. Conner, E. E. Davis, R. Dudensing, R. A. Dunn, L. L. Falconer, D. U. Fisher, S. W. Fuller, C. E. Gilliland, R. C. Griffin, W. L. Griffin, W. A. Hayenga, A. Ishdorj, Y. Jin, J. L. Johnson, E. Jones, D. A. Klinefelter, R. D. Knutson, R. D. Lacewell, C. F. Lard, D. J. Leatham*, K. K. Litzenberg, H. A. Love, B. A. McCarl, J. M. McGrann, J. W. Mjelde, R. M. Nayga, A. G. Nelson, D. Newburn, D. Ng, J. P. Nichols, J. L. Outlaw, M. A. Palma, J. L. Park, J. B. Penson, Jr., G. Power, E. C. Price, Jr., J. W. Richardson, M. E. Rister, J. R. C. Robinson, C. P. Rosson III (Head), V. S. Salin, W. D. Shaw, J. W. Siebert, E. G. Smith, K. W. Stokes, D. V. Vedenov, M. L. Waller, J. M. Welch, G. W. Williams, J. Woodard, R. T. Woodward, X. Wu

* Graduate Advisor

The Department of Agricultural Economics engages people in the use of economic analysis for making decisions involving agribusiness (including food and fiber production, supplying inputs, processing products and marketing), natural resources and communities. Students are taught to develop their leadership, analytical and communication skills. Disciplinary research and graduate education enhance the use of economic principles and research methods in solving economic problems facing society. Applied research programs emphasize the analysis of business and public policy issues.

In planning a student's program, the need for broad training, rather than narrow specialization, is recognized. Students (regardless of their primary interests) are encouraged to take not only advanced courses covering various fields within the department but also essential supporting courses in other departments. Students are expected to acquire a knowledge of economic theory, its application to contemporary agricultural production, agribusiness and resource problems, and the ability to employ analytical techniques in making policy and business decisions.

The teaching and research activities are grouped broadly as follows: agribusiness management and finance, production economics, markets and trade, policy analysis, and resource economics. The present and expanding program of research in the department affords the student a wide choice and capable guidance in thesis or dissertation research.

Master of Science and Master of Agribusiness degrees are offered. MS students may choose between the thesis option (recommended for those students who plan to go on for further graduate studies) and the non-thesis option. Students who choose the MS non-thesis option take a greater number of courses. The Master of Agribusiness degree program is non-thesis, interdisciplinary and jointly administered by the College of Agriculture and Life Sciences and the Mays Business School. This professional curriculum is designed to provide a broad preparation for economic, financial and marketing analysis of agribusiness, food and fiber industry decisions.

The PhD program concentrates on the theory, quantitative tools and methodology required of the professional applied economist. Field areas offered within the PhD program include: Agribusiness and Managerial Economics, Markets and Information Economics, Resource and Environmental Economics and Policy and Trade. A PhD in Agribusiness and Managerial Economics is also offered by the Intercollegiate Faculty of Agribusiness (see Intercollegiate Faculty in Agribusiness). No foreign language is required for students pursuing any of our PhD programs. For more information about program requirements and employment opportunities, contact the department's graduate office.

Agricultural Economics (AGEC)

- 601. Commodity Futures and Options Markets. (3-0). Credit 3.** Price risk management using agricultural commodity futures and options markets, theories of hedging and formulation of optimal hedging strategies, applied hedging strategies evaluated with emphasis on options relative to futures. Prerequisites: One course in calculus and one course in statistics.
- 603. Land Economics. (3-0). Credit 3.** Application of economic, financial, legal and related concepts and tools for decision making in land management, real estate development and appraisal of land and attendant resources; public and private property rights and current land and resource management issues emphasized; real estate valuation methods and use of electronic information systems studied. Prerequisite: AGECE 422 or equivalent.

- 604. Natural Resource Economics. (3-0). Credit 3.** Critical evaluation of policies and procedures in natural resource development and use; identification of problems in resource development, the political-economic decision-making processes and analytical tools which can contribute to economic decisions. Prerequisite: ECON 323. Cross-listed with BUSH 663.
- 605. Rural Real Estate Appraisal and Organization. (3-0). Credit 3.** Concepts of property rights and their valuation; factors affecting the value of these rights are related to general economic theory to explain real estate market process; specific applications of appraisal techniques in valuing urban and rural real properties. Prerequisite: AGECE 422.
- 606. Water Resource Economics. (3-0). Credit 3.** Examination of economic concepts and tools contributing to the solution of water scarcity problems; development of working knowledge of water resource economics; policy options established and explored; analytical tools for performing policy and project assessment introduced and applied. Prerequisite: MATH 142.
- 607. Research Methodology. (3-0). Credit 3.** Scientific method in economic research: problem identification and selection, hypothesis testing, assumptions, model selection, data communication; evaluation of research studies and development of thesis prospectus or equivalent. Prerequisite: MS or PhD graduate classification.
- 610. Economics of Biosecurity. (3-0). Credit 3.** Economic and policy issues involved with decision making under risk of accidental or deliberate events of agricultural threats involved with animal diseases, food contamination, invasive species, infrastructure disruption, etc.; issues regarding assessments of damages, vulnerability and decision making regarding prevention, detection, response, and recovery. Prerequisite: Graduate classification.
- 611. Production Economics I. (3-0). Credit 3.** Economic theory and methods for analyzing agricultural production decisions; problems are treated regarding the technical unit and the firm; both neoclassical theory and methods for evaluating decisions under uncertainty are emphasized. Prerequisites: ECON 607; MATH 142.
- 614. Global Food and Agribusiness Policy. (3-0). Credit 3.** Public policies and programs affecting agriculture and agribusiness; development of policies and programs, identifying relevant issues, reviewing means to attain desired goals, and development of methods to evaluate the consequences of alternative farm policies on U.S. agriculture, agribusiness, trade and resources. Prerequisites: AGECE 619 or ECON 607; MATH 142.
- 618. E-Commerce: Auctions, Contracts and Exchanges. (3-0). Credit 3.** Design and implementation of contract mechanisms, auctions, and internet exchanges for business-to-business transactions; tools for dealing with these issues developed; understanding of what issues are critical to the successful implementation of virtual vertical integrations. Prerequisite: G7 classification or approval of instructor. Cross-listed with INFO 618.
- 619. Managerial Economics in Agribusiness. (3-0). Credit 3.** Practical application of operational and strategic decision-making tools to agribusiness, focusing on important managerial and economic principles and understanding needed to carry out these functions. Prerequisites: ECON 323; MATH 142; STAT 303.
- 621. Econometrics for Agribusiness. (3-0). Credit 3.** Econometric application and practice; analysis and interpretation of economic data for decision making and microcomputer implementation. Prerequisites: MATH 142; STAT 303; corequisite: ECON 323; ECON 311 or AGECE 430.
- 622. Agribusiness Analysis and Forecasting. (3-0). Credit 3.** Design, construction, use and evaluation of simulation, forecasting and optimization models to solve applied problems confronting decision makers in agribusiness. Prerequisite: AGECE 621 or approval of instructor.
- 625. Environment of Agribusiness. (3-0). Credit 3.** Analysis of the economic, social, political, technological and legal forces that impact the way in which global agribusiness firms compete; emphasis on intensive case study analysis. Prerequisites: AGECE 619 and AGECE 621.
- 629. Strategic Agribusiness Management. (3-0). Credit 3.** Practical application of operational and strategic decision-making tools to agribusiness; emphasis on problem recognition and economic analysis related to production, marketing and finance decisions facing agribusiness firms. Prerequisites: AGECE 619, AGECE 621 and AGECE 625.

- 630. Financial Analysis for Agribusiness Firms. (3-0). Credit 3.** Application of financial planning and analysis to agribusiness firms; capital budgeting and selection of investments; the role of debt structure and liquidity in firm growth and stability; alternatives for gaining control over financial resources, managing risk and maintaining business efficiency over time. Prerequisites: ACCT 640; FINC 635.
- 633. Sustainability in World Development. (3-0). Credit 3.** Economic development defined; economic structure, economic efficiency, equity, conservation and role of sustainability, characteristics of developing countries; problems facing development planners, policy makers, resource managers; role of local, regional and international institutions, policies, civil society, biodiversity, and climate change; economic foundation of project development, design, financing, and implementation issues. Prerequisites: ECON 607 or equivalent.
- 634. Rural Financial Markets and Financial Planning. (3-0). Credit 3.** Organization, structure, conduct, and regulation of lending institutions serving commercial agriculture and rural borrowers; financial statement analysis; cash management; investment planning; loan portfolio analysis; management of the lending function of lenders serving rural businesses. Prerequisite: Graduate classification.
- 635. Consumer Demand Analysis for Food and Agricultural Products. (3-0). Credit 3.** Analytical and empirical treatments of consumer behavior; use of neoclassical theory and modern adaptations in consumer demand analysis; specification, estimation, interpretation and evaluation of models of consumer behavior with emphasis on food commodities. Prerequisites: ECMT 676; ECON 629; AGEC 661.
- 636. Agribusiness Markets and Applied Welfare Analysis. (3-0). Credit 3.** Theory and practice of consumer and firm behavior in markets; the effects of various policies on markets; welfare measurement applied to problems related to the farm economy; food and resource processing; resource allocations decisions. Prerequisites: AGEC 635 and AGEC 661; ECMT 676; ECON 629 and ECON 630.
- 637. Production Economics and Dynamic Optimization in Agricultural Economics. (3-0). Credit 3.** Production under certainty and uncertainty with emphasis on agribusiness firm behavior; economic theory and analytical and numerical methods related to dynamic optimization problems. Prerequisites: AGEC 661; ECMT 675; ECON 629 and ECON 630.
- 641. Operations Research Methods in Agricultural Economics. (3-0). Credit 3.** Theory and practice regarding the application of operations research tools to agricultural economics problem areas. Mainly concentrates on optimization approaches. Prerequisite: AGEC 622.
- 643. Applied Simulation in Agricultural Economics. (3-0). Credit 3.** Design, construction, validation and use of Monte Carlo simulation models for risk analysis of economic systems; parameter estimation and simulation of multivariate probability distributions in econometric and behavioral models used for business and policy analysis under risk. Prerequisites: AGEC 622 and AGEC 661 or approval of instructor.
- 652. International Agribusiness Trade Analysis. (3-0). Credit 3.** Traditional trade theory encompassing the concepts of comparative advantage, the Hecksher-Olin-Samuelson model, the gain from specialization and trade, partial equilibrium analysis of free trade, violation of the free trade model, welfare effects of trade, trade creation and diversion, introduction to growth and development theories, the relationship between trade and development and related concepts. Prerequisites: ECON 607; MATH 142.
- 659. Ecological Economics. (3-0). Credit 3.** Study of the relationships between ecosystems and economic systems; understanding the effects of human economic endeavors on ecological systems and how the ecological benefits and costs of such activities can be quantified and internalized. Prerequisite: Graduate classification. Cross-listed with ESSM 671 and RENR 659.
- 661. Applied Econometric Methods in Agriculture. (3-0). Credit 3.** Application of econometric methods in a theoretical framework for the analysis of agricultural markets and farm firm behavior; emphasis on specifying and estimating agricultural production and demand functions and agricultural sector models; selected topics according to student needs. Prerequisite: ECMT 676.
- 671. Fundamentals in Agribusiness and Managerial Economics. (3-0). Credit 3.** Economic theory and methods for analyzing operational and strategic problems facing managers of food, fiber and resource businesses; financial, marketing and management topics, including principal-agent, bargaining power, contract theory and business forecasting. Prerequisites: ECON 629 and ECON 630.
- 672. Fundamentals in Agricultural Markets and Information Economics. (3-0). Credit 3.** Application of information economics theory for analysis of vertical and horizontal relationships between firms along the supply chain. Prerequisites: AGEC 636 and AGEC 661; ECMT 676; ECON 629 and ECON 630.

- 673. Fundamentals in Resource and Environmental Economics. (3-0). Credit 3.** Economic theories and empirical regularities related to the use and management of the environment and natural resources; valuation techniques, externalities, and intertemporal resource management. Prerequisites: AGEC 635, AGEC 636, AGEC 637; ECON 629 and ECON 630.
- 674. Food and Agricultural Trade and Policy Analysis. (3-0). Credit 3.** Trade policy, farm policy, macroeconomic policy, resource policy and development policy; analysis of policy impacts outside perfect competition and free trade assumptions. Prerequisites: AGEC 614 and AGEC 652 or approval of instructor.
- 676. Frontiers in Markets and Information Economics. (3-0). Credit 3.** Exploration of advanced topics in the field of markets and information economics. May be taken twice for credit. Prerequisite: Graduate classification.
- 677. Frontiers in Natural Resource and Environmental Economics. (3-0). Credit 3.** Exploration of advanced topics in the field of natural resource and environmental economics. May be taken twice for credit. Prerequisite: Graduate classification.
- 681. Seminar. Credit 1 each semester.** Objectives are to define research problems, develop research problem statements with objectives and hypothesis and specify relevant models to accomplish the objectives and develop the skills in written communication.
- 684. Professional Internship. Credit 1 to 3.** Pre-professional experience within department guidelines conducted in the area of the student's field of interest. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of a selected problem in the field of agricultural economics.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of agricultural economics. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Thesis or dissertation research.
- 693. Professional Study. Credit 1 to 9 each semester.** Professional paper undertaken as a requirement for the Master of Science Non-Thesis or as an elective for the Master of Agribusiness. May be taken more than once, but not to exceed 3 hours of credit towards a degree. Prerequisite: Approval of instructor.
- 695. Frontiers in Agribusiness and Managerial Economics. (3-0). Credit 3.** Exploration of advanced topics in the field of agribusiness and managerial economics. May be taken two times for credit. Prerequisite: Graduate classification.

Department of Agricultural Leadership, Education, and Communications

C. Akers, M. Baker, C. T. Boleman, B. L. Boyd, M. T. Brashears, G. E. Briers, S. Burris, J. E. Christiansen, S. R. Cummings, R. L. Cummins, D. L. Doerfert, K. E. Dooley, C. D. Elbert, J. F. Elliot (Head), S. D. Frazee, J. F. Harlin, E. Irlbeck, A. Larke, Jr., D. E. Lawver, J. R. Lindner, L. Lockett, M. J. McCormick, B. McKim, C. A. Meyers, L. L. Moore, T. P. Murphrey, T. H. Murphy, S. F. Odom, M. Piña, Jr., J. Rayfield, J. P. Ripley, R. A. Ritz, M. H. Rosser, T. A. Rutherford, G. C. Shinn, D. P. Starr, R. Strong, C. D. Townsend, J. D. Ulmer, T. A. Vestal, J. Williams, G. J. Wingenbach

The Department of Agricultural Leadership, Education, and Communications offers graduate studies leading to the degrees of Master of Agriculture in agricultural development and Master of Education, Master of Science, Doctor of Philosophy, and Doctor of Education in agricultural leadership, education, and communications. A Joint Ed.D. in Agricultural Education is offered with Texas Tech University.

Professionals who pursue advanced study work in a variety of contextual settings including agricultural communications/journalism, technology-enhanced learning, organizational and community leadership, extension education, teacher education and international agricultural development.

Graduate students, in consultation with a graduate advisor, may select different knowledge areas of emphasis. Examples include planning and needs assessment, learning and cognition, change theory and processes, communication theory and practice, leadership education theory and applications, instructional design and delivery, evaluation and performance measurements, and research measurement and analysis.

The faculty of the department maintains continuous contact with professionals in the field. These contacts enable faculty members to conduct teaching and research in support of graduate programs with understanding and appreciation of important and complex problems encountered by professional practitioners. For additional information about the department, its graduate faculty and programs, contact the graduate program coordinator or visit us on the website at alec.tamu.edu.

Agricultural Leadership, Education, and Communications (ALEC)

601. **Advanced Methods in Agricultural Education. (3-0). Credit 3.** Learning theories; techniques and procedures to enhance the teaching-learning process; methods to evaluate learning.
602. **Advanced Instructional Design in Agricultural Science. (3-0). Credit 3.** Designing instruction to meet learning outcomes, motivate students, and evaluate objectives; learning theories and their impact on the teaching and learning process; choosing appropriate teaching methods for specific content; evaluating the teaching-learning process for improvement within the context of secondary agricultural science classrooms. Prerequisites: Approval of instructor, graduate classification.
603. **Experiential Learning. (3-0). Credit 3.** Theory and practice in facilitating learning from experiences in formal, informal, and non-formal settings; experiential learning in classroom/laboratory settings, guided inquiry, internships/externships, service learning, project-based learning, and outdoor/adventure learning. Prerequisite: Graduate classification.
604. **Writing for Professional Publication. (3-0). Credit 3.** Course will provide students in Agricultural and Extension Education with the skills necessary to compose research manuscripts, conference papers, and journal articles. Prerequisites: Introductory research course and graduate classification.
605. **Facilitating Complete Secondary Agricultural Science Programs. (3-0). Credit 3.** Theory and practice in facilitating secondary agricultural science programs that include classroom instruction, supervised experience, and youth leadership development. Designed for students preparing to teach agricultural science in Texas public schools.
606. **Foundations of Leadership Theory. (3-0). Credit 3.** Theory and Practice of leadership theory foundational to leadership education. Focus on analysis of leadership theories and models; synthesis of leadership theory as a philosophy; and application of leadership theories in various professional settings. Stacked with ALED 340.
607. **Youth Leadership Programs. (3-0). Credit 3.** Methods and procedures of organizing and conducting youth leadership programs in school and non-school settings. Prerequisite: Professional experience or approval of department head.
608. **Leadership of Volunteers. (3-0). Credit 3.** Models of volunteerism; reasons for volunteers; assessment and evaluation techniques; task descriptions; organizational relationships.
609. **Learning Organizations. (3-0). Credit 3.** Theory of instruction to support education in social systems language and archetypes; systems thinking theory including mental models; mastery, team learning, concept models of human organizations. Prerequisites: ALED 340; Graduate classification.
610. **Principles of Adult Education. (3-0). Credit 3.** Identification of basic principles motivating adults to learn. Procedures to implement these principles in bringing about changes in adult behavior. Prerequisite: Professional experience or approval of department head.
611. **Advanced Methods in Distance Education. (3-0). Credit 3.** Course design theory for synchronous and asynchronous instructional methodology; teaching and training models for distance education.
612. **Advanced Instructional Design for Online Learning. (3-0). Credit 3.** Emphasis on applying learning and teaching theory as the foundation for developing engaging online instruction; designed to pull together theory, concepts, and strategies for a broad understanding of the fundamentals of online learning from the conceptual stage to the development and delivery stages. Prerequisites: Majors only and graduate classification.
613. **Techniques in eLearning Development and Delivery. (3-0). Credit 3.** The emphasis of the course is to provide the knowledge and skills necessary to develop and deliver effective online courses, training programs, and learning units. Specific topics to be covered include: management of eLearning projects, needs assessment and audience analysis, creation and editing of documents, images, audio, and video. Prerequisites: Majors only and graduate classification.
615. **Philosophy of Agricultural Education. (3-0). Credit 3.** Historical and philosophical developments in education that brought about education in agriculture; ideas of individuals that culminated in agricultural education institutions and organizations.
616. **Facilitation of Leadership Programs. (3-0). Credit 3.** Investigate models to design leadership education programs; incorporate strategies to enhance the leadership education process; critically analyze leadership education research and group leadership education processes. Prerequisite: ALED 340 or ALEC 606.

- 617. Leadership in Organizational Culture and Ethics. (3-0). Credit 3.** Integration of organizational culture and ethical theories; implications and role of leaders in organizational culture and ethical situations; critical analysis of organizational culture and ethics in agricultural organizations. Prerequisite: Graduate classification.
- 620. Instrumentation and Survey Research Methods. (3-0). Credit 3.** Principles, theories, techniques, and applications for developing survey questionnaires and conducting survey research in agriculture; developing questions; constructing instruments; implementing surveys; and reducing coverage and sampling errors.
- 621. Methods of Online Survey Research in Agricultural Science. (3-0). Credit 3.** Students explore the technical requirements necessary to correctly establish and administer online social science data collection instruments. Specific skills include writing *.asp code, database design and management, verification/permission sets, creating informational pop-ups, drop-down menus, and assorted graphics. Prerequisite: ALEC 690 or similar Theory of Research course.
- 622. Data Collection, Analysis, and Interpretation in Research in Agricultural Leadership, Education, and Communications. (3-0). Credit 3.** Principles and techniques of data collection, analysis, and interpretation in agricultural leadership, education, and communications; interpretation and implications of finds/results in relation to current research; data analysis performed using statistical package software; collection, analysis, and interpretation to conform to published research in agricultural leadership, education, and communications. Prerequisite: Research methods and basic statistics courses.
- 623. Survey of Evaluation Strategies for Agriculture. (3-0). Credit 3.** This course is designed to pull together theory, concepts, and strategies to give students a broad understanding of the fundamentals of evaluation and to arm students with the knowledge and skills necessary to design and administer appropriate and effective evaluations. Prerequisite: Graduate classification.
- 624. Developing Funded Research Projects. (3-0). Credit 3.** Students team with faculty mentor to develop a proposal for external funding from a federal agency; principles discussed to produce competitive proposals; proposal steps adapted to fit interests of the students and faculty. Prerequisite: Instructor approval.
- 625. Program Evaluation and Organizational Accountability. (3-0). Credit 3.** Examines the philosophy, methods, and issues of accountability and evaluation necessary to meet expectations of institutional mandates. Special emphasis on analytical tools and performance measures. Prerequisite: Professional experience or approval of department head.
- 630. Guidance and Counseling for Rural Youth. (3-0). Credit 3.** Problems of youth with special attention given to rural youth; theories of vocational development reviewed and techniques and procedures developed to help youth make career choices.
- 631. Development and Planning of Community Education Programs. (3-0). Credit 3.** Focuses on the principles, theories, techniques, and applications for developing and planning educational program in a community setting; program development strategies, focusing educational programming in relation to issues identified citizens will be developed and enhanced in this course. Prerequisite: Graduate classification.
- 640. Methods of Technological Change. (3-0). Credit 3.** Dynamics of cultural change as theoretical framework for planned technological change; methods of planning and implementing change, its effects and how it can be predicted.
- 641. The Transfer of Technology by Institutions. (3-0). Credit 3.** Role and organization of institutions for effective transfer of technology; institutional models, assignment of priorities, institutional linkages, communications, special program design, program strategies and program evaluation. Prerequisite: Professional experience or approval of department head.
- 644. The Agricultural Advisor in Developing Nations. (3-0). Credit 3.** Trends, conditions, critical incidents, techniques, roles and preparation affecting the success of persons desiring to provide technical assistance in projects of agricultural development by serving as agricultural advisors in developing nations, especially in cross-cultural settings. Prerequisite: Approval of instructor.
- 645. Initiating, Managing and Monitoring Projects of International Agricultural Development. (3-0). Credit 3.** Origin of projects in agricultural development involving host governments; procedures in developing contracts with sponsors; duties and responsibilities of contract administrators, project leaders and the home institution; reporting systems, project reviews and evaluation procedures; procedures effective in managing projects. Prerequisite: ALEC 640 or approval of instructor.

- 646. Institutions Serving Agriculture in Developing Nations. (3-0). Credit 3.** Comparisons among programs and functions, strengths and weaknesses, organization, and relationships of institutions and agencies in public sectors serving agriculture in developing nations; includes those responsible for agricultural extension, agricultural research, agrarian reform, price stabilization, agricultural credit and agricultural cooperatives. Prerequisite: ALEC 641 or approval of instructor.
- 652. Images of Agriculture: Visual Communication Research. (3-0). Credit 3.** Explore visual communication from theoretical, physiological, and interpretive perspectives as it applies to media images used to depict agriculture and agricultural issues; current research in visual communication and its application to agriculture; use of visual images in agricultural communication research. Prerequisite: ALEC 695 or introductory research methods.
- 681. Seminar. Credit 1 each semester.** Group study and discussion of current developments in agricultural education; research and legislation as they affect programs in teacher education, agricultural science and related areas of education.
- 684. Professional Internship. Credit 1 to 6 each semester.** On-the-job supervised experience program conducted in the area of the student's specialization. Prerequisites: Graduate classification.
- 685. Directed Studies. Credit 1 to 4 each semester.** Studies related to classroom, laboratory, supervised activities in agriculture, work experience, extension education and adult educational activities in agricultural programs.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of agricultural education. May be repeated for credit.
- 690. Theory of Agricultural Education Research. (3-0). Credit 3.** Theory and design of research problems in agricultural education; communication of research proposal and results of research; evaluation of current research of faculty and students; review of current research literature. May be taken three times for credit. Prerequisite: Approval of major advisor.
- 691. Research. Credit 1 or more each semester.** Initiation and completion of research for advanced degree. Prerequisite: Approval of department head.
- 692. Professional Study. Credit 1 or more each semester.** Approved professional study of project undertaken as the terminal requirement for degree of Doctor of Education; preparation of a record of study summarizing the rationale, procedure and results of the completed project. Prerequisite: Approval of major advisor.
- 693. Professional Study in Agricultural Leadership Education and Communications. (3-0). Credit 3.** Approved professional paper undertaken as the requirement for the Master of Agriculture. May be taken more than once, but not to exceed 3 hours of credit toward a degree. Prerequisite: Graduate classification.
- 695. Frontiers in Research. (3-0). Credit 3.** Basic concepts of quantitative and qualitative research; understanding the social science research process; using appropriate methods to address research problems; enabling students to effectively evaluate, consume, and communicate research findings.
- 696. Qualitative Research Methods. (3-0). Credit 3.** Overview of qualitative research in agricultural education including conducting a literature review, writing a working hypothesis, keeping methodological and reflexive journals, developing data gathering tools, performing data analysis, ensuring trustworthiness measures, and writing a research manuscript. Prerequisites: ALEC 690 or ALEC 695 and graduate classification.

College of Agriculture and Life Sciences (AGLS)

- 600. Agriculture and Life Sciences Graduate Study Aboard. Credit 1 to 18.** Approved study abroad student participation; reciprocal educational exchange programs. May be taken two times for credit. Prerequisite: Admission to approved program.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of agriculture and life science. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.

Department of Animal Science

G. R. Acuff, D. L. Adelson, M. Amstalden, F. W. Bazer, T. R. Bilby, Z. L. Carpenter, G. E. Carstens, A. Castillo, C. A. Cavinder, J. A. Coverdale, H. R. Cross (Head), C. G. Elsik, D. W. Forrest*, T. H. Friend, M. Galyean, P. G. Gibbs, C. A. Gill, D. Griffin, D. Hale, M. D. Hardin, P. G. Harms, K. B. Harris, J. C. Heird, A. D. Herring, J. W. Holloway, G. A. Holub, N. H. Ing, E. R. Jordan, J. T. Keeton, C. R. Kerth, D. A. Knabe, D. C. Kraemer, J. C. Laurenz, C. R. Long, C. R. Long, C. J. Lupton, F. T. McCollum, III, R. K. Miller, W. N. Osburn, J. C. Paschal, G. D. Potter, W. S. Ramsey, R. D. Randel, P. K. Riggs, D. G. Riley, J. O. Sanders, M. C. Satterfield, J. W. Savell, J. E. Sawyer, D. H. Sigler, C. L. Skaggs, S. B. Smith, T. E. Spencer, R. L. Stanko, J. A. Sterle, M. Taylor, L. O. Tedeschi, M. A. Tomaszewski, M. M. Vogelsang, D. F. Waldron, T. H. Welsh, Jr., T. A. Wickersham, G. L. Williams, G. W. Wu

* Graduate Advisor

Advanced study in animal science offers preparation for a future in teaching, research, extension, livestock and dairy production, and in industries involving food technology, livestock products and livestock management. Majors offered are:

Animal breeding	MS and PhD
Animal science	MS, MAgr and PhD
Food science and technology	MS, MAgr and PhD
Genetics	MS and PhD
Nutrition	MS and PhD
Physiology of reproduction	MS and PhD

The animal science subject matter fields are strongly supported by coursework in agricultural economics, biochemistry, biophysics, biology, genetics, statistics, and in veterinary anatomy, microbiology, parasitology, pathology, physiology, pharmacology and public health.

Laboratories available for graduate research include cytogenetics, genomics, food technology, meat science, nutrition, molecular biology and reproductive physiology. The Robert Justus Kleberg, Jr. Animal and Food Science Center provides 39 laboratories for research and graduate training. Special equipment available in these laboratories or in readily accessible facilities, such as at the Computing Services Center, offer a wide array of opportunities for study and research.

Dairy, beef, horse and swine herds and sheep and goat flocks at the main station or at research centers afford opportunities to study various problems in physiology, breeding, management, nutrition and production. The Rosenthal Meat Science and Technology Center, equipped to fabricate and process all meat foods on a semicommercial scale, is available for research problems. Texas AgriLife Research projects in all subject matter fields offer opportunities for graduate students to participate in current research activities.

Support areas such as biochemistry and biophysics, economics, genetics and statistics may be readily arranged. Food science and technology and nutrition courses are jointly listed.

There is no specific foreign language requirement for the Doctor of Philosophy degree. A student's advisory committee may require a foreign language or additional coursework in an unrelated area in lieu of a foreign language.

Animal Science (ANSC)

- 601. General Animal Nutrition. (3-0). Credit 3.** Comparative nutrition of animal species contrasting digestive, metabolic and physiological functions involved in processing and using nutrients. Prerequisite: ANSC 303 or 318 or equivalent. Cross-listed with NUTR 601.
- 602. Energetics of Metabolism and Growth. (3-0). Credit 3.** Current fundamental concepts in protein and energy metabolism relating to nutrients required for maintenance, growth and development of animals. Prerequisite: BICH 410 or approval of department head. Cross-listed with NUTR 602.
- 604. Ruminant Nutrition. (3-0). Credit 3.** Current concepts in anatomy, physiology of digestion and metabolism in ruminant nutrition and their relationships to nutrition practice and research with emphasis on ruminants. Prerequisites: ANSC 601 or ANSC 602; BICH 411 or BICH 603 and/or approval of department head.
- 605. Advancements in Beef Cattle Production. (3-0). Credit 3.** Current knowledge and concepts in production of lean beef; review of research in beef cattle production, breeding, nutrition, reproduction and economics. Prerequisites: ANSC 305, ANSC 318 and ANSC 406 or approval of department head.

- 606. Advancements in Beef Cattle Production. (3-0). Credit 3.** Continuation of ANSC 605 with emphasis on efficiency of growth and development of diverse types of cattle through computer simulation of beef production systems. Prerequisites: ANSC 307, ANSC 318 and ANSC 406 or ANSC 408 or approval of department head.
- 607. Physiology and Biochemistry of Muscle as a Food. (3-0). Credit 3.** Biochemical, histological, anatomical and physical characteristics of muscle cells and factors associated with transformation of muscle cells into meat. Prerequisite: BICH 410 or approval of department head. Cross-listed with FSTC 607.
- 608. Beef Cattle Management. (3-0). Credit 3.** Current knowledge of beef cattle ranch and feedlot production systems; nutrition, management, breeding, body composition, economics, health, pollution and sanitation control. Prerequisite: ANSC 406 or ANSC 408.
- 609. Physiology of Growth and Stress in Livestock. (3-0). Credit 3.** Basic biochemical, physiological and endocrine mechanisms involved in processes regulating metabolism, growth and stress in livestock; current research and management principles/concepts useful to study growth and stress physiology; anabolic agents, anti-stress agents, immunoneutralization; transgenic livestock. Prerequisites: BICH 410 and BICH 411 or approval of instructor.
- 610. Applied Animal Ethology. (2-2). Credit 3.** Review and evaluation of ethological research and principles as they relate to the management of animals; research principles and techniques used in studying animal behavior; psychological and physiological aspects of stress; topics of interest to students; visits to laboratories of researchers studying aspects of animal behavior/ethology.
- 611. Equine Nutrition. (3-0). Credit 3.** Review and evaluation of current research in equine nutrition; principles of digestive physiology and nutrition unique to equine species; comparative digestion; integration of scientific principles into feeding management systems to enhance productivity, health and longevity of the equine. Prerequisite: ANSC 601 or approval of department head.
- 612. Equine Reproduction. (3-0). Credit 3.** Review of current research relating to equine reproductive physiology and endocrinology; concepts from current research in equine reproduction to develop integrated reproductive management systems for horses. Prerequisites: ANSC 433; graduate classification.
- 613. Protein Metabolism. (3-0). Credit 3.** Basic concepts and recent advances in protein metabolism in animals with emphasis on physiological and nutritional significances; discussion of protein digestion; absorption of peptides; absorption, synthesis and degradation of amino acids; hormonal and nutritional regulation of protein turnover; determination of protein quality and requirements. Prerequisite: BICH 411 or BICH 601 or equivalent or approval of instructor. Cross-listed with NUTR 613.
- 614. Maximum Likelihood Estimation of Genetics. (3-0). Credit 3.** Theoretical and analytical approaches to the application of maximum likelihood for the estimation of parameters under linear and nonlinear models; single and polygene genetic models including Hardy-Weinberg equilibrium, linkage analysis and quantitative trait loci detection. Prerequisites: GENE 603; STAT 651 and STAT 652 or STAT 601. Cross-listed with GENE 614.
- 616. Equine Exercise Science. (3-0). Credit 3.** Review and evaluation of current research in equine exercise science; physical, physiologic and metabolic adaptation to physical training in the horse; bioenergetics; nutritional requirements; problems in the hard-working horse; management and training approaches to delay fatigue in race/performance horses. Prerequisites: ANSC 420; BICH 411; graduate classification.
- 617. Experimental Techniques in Meat Science. (1-6). Credit 3.** Methods used in separating and identifying muscle proteins and fats; techniques for determining postmortem changes of muscle tissue as a result of antemortem treatments. Prerequisites: ANSC 607; BICH 411. Cross-listed with NUTR 617.
- 618. Lipids and Lipid Metabolism. (3-0). Credit 3.** Chemical nature of various classes of lipids and lipid-derived hormones; absorption and metabolism of fatty-acids and lipids; regulation of lipid biosynthesis and obesity; relationship between lipid metabolism and cholesterol homeostasis; lipids as hormones. Prerequisite: BICH 410 or approval of instructor. Cross-listed with NUTR 618.
- 621. Issues in the Equine Industry. (3-0). Credit 3.** Integration of cumulative knowledge acquired in the equine science curriculum to demonstrate critical thinking and communication skills to address critical issues in the equine industry. Prerequisite: Approval of instructor or enrollment in master of equine industry management program.

- 622. Research Methods in Animal Science. (2-0). Credit 2.** Development of the conceptual framework of research; study of software programs for data recording, management, and analysis; evaluation of specific experimental designs historically used in animal experiments; discussion of interpretations found in peer-reviewed research publications; data presentation for scientific meetings and publication; the peer review process and publication in technical journals. Prerequisite: STAT 651; STAT 652.
- 623. Precision Diet Formulation. (2-2). Credit 3.** Theoretical and applied principles associated with precision feeding and diet formulation to optimize nutrient requirements; optimization using least-cost formulation, ingredient inventory, farm and feed mill management, and nutrient management of non-ruminants (poultry, swine, horse, and fish) and ruminant animals (beef and dairy). Prerequisite: POSC 411 or ANSC 318. Cross listed with POSC 625.
- 624. Mammalian Developmental Genetics. (3-0). Credit 3.** Genetic control of developmental pathways responsible for pattern formation and morphogenesis in mammals; genetic networks and genome organization; significance of genetic regulatory networks as a source of evolutionary diversity. Prerequisites: GENE 301 or GENE 320; BICH 410/BICH 411 or equivalent.
- 625. Databases Applications for Biologists. (2-2). Credit 3.** Basics of database development for biologists with little prior programming experience; Unix and Perl programming basics; concepts in database design with focus on bioinformatics; student created databases. Prerequisite: GENE 301 or GENE 603.
- 626. Analyses of Gene Expression. (1-3). Credit 2.** Proficiency in handling DNA and RNA gained during exercises used routinely in analyses of gene expression; RNA preparation and analysis on Northern blots; in vitro transcription and polyacrylamide gel analysis of nucleic acids; sub-cloning and mRNA quantitation using polymerase chain reaction. Prerequisites: GENE 450 or approval of instructor; radiation safety training. Cross-listed with GENE 626.
- 627. Carcass Composition and Quality. (3-0). Credit 3.** Survey of scientific literature regarding carcass composition; quality and palatability of meat animals; factors that affect differences among animals of the same specie; impact on value and usefulness. Prerequisite: Graduate classification.
- 628. Animal Breeding. (2-2). Credit 3.** Concepts from Mendelian, population and quantitative genetics; heritability, selection response, selection criteria, selection index, genetic relationship, inbreeding, mating systems, hybrid vigor and genetic-environmental interaction applied to livestock breeding and to production systems; interactions between genetics and nutrition, reproduction, production and management for both established concepts and recent trends emphasized according to special interests of students. Prerequisite: ANSC 305 or POSC 414.
- 629. Applied Animal Genomics. (3-0). Credit 3.** Theory and application of genomics by livestock industries; consideration of genetic markers, gene mapping methods, genome analysis and emerging technologies such as microarrays, transgenesis, cloning and marker assisted selection; exposure to bioinformatic tools for genomics. Prerequisite: GENE 603. Cross-listed with GENE 629 and POSC 630.
- 630. Reproductive Biology I. (4-0). Credit 4.** Embryological, physiological, hormonal, cellular and molecular mechanisms involving the endocrine and reproductive systems of mammals; emphasis on domestic livestock, rodents and humans; current theories evaluated and discussed using information from recent scientific publications. Prerequisites: ANSC 433; BICH 411 or equivalent.
- 631. Reproductive Biology II. (4-0). Credit 4.** Embryological, physiological, hormonal, cellular and molecular mechanisms involving the endocrine and reproductive systems of mammals; emphasis on domestic livestock, rodents and humans; current theories evaluated and discussed using information from recent scientific publications. Prerequisite: ANSC 630 or approval of instructor.
- 633. Concepts in Reproduction. (3-0). Credit 3.** Concepts from current research in physiology of reproduction evaluated and applied for enhancement of livestock production efficiency; ovulation control, embryo transfer, multiple births and control of parturition. Prerequisite: ANSC 433 or equivalent or approval of department head.
- 635. Molecular Biotechnology. (3-0). Credit 3.** Theory and application of molecular biotechnology; consideration of the structure and function of cellular components and methods to characterize these components with reference to examples in industry. Prerequisite: Approval of instructor. Cross-listed with BIOT 635.
- 637. Food Safety: Policy, Regulations and Issues. (2-2). Credit 3.** Designed to explore the complexities of the regulations governing the production of foods of animal origin in the United States; requirements for countries importing products into the United States; federal, state and local requirement will be addressed. Prerequisites: ANSC/FSTC 457/657 or instructor approval.

- 647. Technology of Meat Processing and Distribution. (3-0). Credit 3.** Quantitative and qualitative characteristics of meat and meat products as related to food technology processing operations; manufacturing, preservation, packaging and merchandising. Cross-listed with FSTC 647.
- 650. Issues in Animal Agriculture. (3-0). Credit 3.** Nonmarket factors related to food production and consumption. National and global nutritional, environmental, ethical, social and political issues faced by agricultural systems. Animal agriculture is used as a model. Prerequisite: Approval of instructor.
- 654. Molecular Endocrinology. (3-0). Credit 3.** Structure-function relationships of hormones, their receptors and biologic activities. Prerequisites: BICH 410 or equivalent; BIOL 649 or VTPP 653; or approval of instructor. Cross-listed with VTPP 654.
- 657. Hazard Analysis and Critical Control Point System. (3-0). Credit 3.** Examination of the Hazard Analysis and Critical Control Point (HACCP) principles specifically related to meat and poultry; microbiological and process overviews; good manufacturing practices (GMP) and standard operating procedures (SOP) development; team-building and implementation into industry operations. This class is designed for the production of food and fulfills the training requirements of USDA's HACCP regulation for meat and poultry (9 CFR Part 417), and FDA's HACCP regulations for fish and fishery products (21 CFR Part 123 and 1240) and for juice (21 CFR Part 120). Cross-listed with FSTC 657.
- 667. Industrial Processed Meat Operations. (2-2). Credit 3.** Application of scientific principles and business practices to manufactured meat products; interrelationships among marketing, manufacturing, product development, regulatory compliance and quality assurance in commercial processed meat operations. Prerequisite: Approval of instructor. Cross-listed with FSTC 667.
- 677. Instrumental Methods and Food Analysis: Theory and Practice. (2-6). Credit 3.** Advanced course in chemistry/analytical instrumentation theory and practice for non-chemistry majors; understand the operational principles of current instrumentation; "hands-on" experience with a variety of sample preparation techniques and modern laboratory instruments. Prerequisite: CHEM 316/CHEM 318 or approval of instructor. Cross-listed with FSTC 677.
- 681. Seminar. Credit 1 each semester.** Important current developments in field of animal science; review of current literature and presentation of papers on selected animal science topics. Prerequisite: Graduate classification in animal science.
- 684. Professional Internship. Credit 1 or more each semester.** Experience in the application of formal training to a commercial operation under supervision of the operations manager and a designated faculty member. The student will investigate a matter of mutual interest to the enterprise manager and to Texas A&M University; will collect, analyze and interpret the data and report the results in a professional paper approved by his or her graduate committee.
- 685. Directed Studies. Credit 1 to 4 each semester.** Advanced studies in animal science problems and procedures. Problems assigned according to experience, interest and needs of individual student. Prerequisite: Approval of department head.
- 687. Sensory Evaluation of Foods. (2-2). Credit 3.** Application of sensory science principles and practices to food systems including an understanding of discriminative, descriptive and consumer sensory techniques. Prerequisite: CHEM 222 or CHEM 228. Cross-listed with FSTC 687.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of animal science. May be repeated for credit. Prerequisite: Approval of department head.
- 691. Research. Credit 1 or more each semester.** Investigations leading to student's thesis or dissertation in fields of animal production, meats, wool and mohair, nutrition, inheritance of farm animals and physiology of reproduction.
- 697. Applied Microbiology for Foods of Animal Origin: Processing, Sanitation and Sanitary Design. (3-0). Credit 3.** Application of basic food microbiology knowledge and principles to food production processes and products: sources of microbiological contamination and their impact on food safety and spoilage; application of sanitary design and validation; testing and auditing to monitor and trouble-shoot the process. Prerequisites: DASC/FSTC 326 or FSTC 606 or equivalent. Cross-listed with FSTC 697.

Department of Anthropology

M. S. Alvard, S. Athreya*, V. M. Bryant, Jr., S. Busdiecker, D. L. Carlson, D. N. Carlson, N. F. Castor, K. J. Crisman, N. Dannhaeuser, D. J. de Ruiter, D. B. Dickson, S. L. Eckert, F. E. Goebel, T. A. Green, S. A. Grider, S. L. Gursky-Doyen, D. L. Hamilton, S. E. Mark, F. B. Pearl, C. M. Pulak, H. J. Shafer, C. W. Smith, A. V. Thoms, L. F. Vieira de Castro, N. Vora, S. Wachsmann, M. R. Waters, C. A. Werner (Interim Head), J. Winking, L. E. Wright

* Graduate Advisor

The Department of Anthropology offers programs of study and research leading to the M.A. and Ph.D. in anthropology. Students enrolled within these programs receive training preparing them for professional research and/or teaching careers in academic institutions, governmental agencies, museums or private industry. The department has a well-rounded program in anthropology with offerings in cultural anthropology, archaeology, biological anthropology and folklore. The department is particularly noted for its strength and emphasis in the fields of nautical archaeology, the archaeology of the first Americans, archaeological conservation, palynology and paleoethnobotany, behavioral ecology, economic anthropology, globalization, biological anthropology, and zooarchaeology.

Twelve fully-equipped, modern laboratories help the Department of Anthropology carry out its primary function of teaching and providing research facilities for its staff, students and faculty. Two research centers provide opportunities for graduate students to participate in active research projects around the world. The Center for Maritime Archaeology and Conservation conducts underwater excavations around the world and conducts research in new conservation methods for waterlogged artifacts. The Center for the Study of the First Americans conducts excavations on the earliest sites in the Americas and their likely precursors in north-east Asia. The department is affiliated with the Institute of Nautical Archaeology which provides support for research projects involving nautical archaeology and maintains research and laboratory facilities in Bodrum, Turkey. Students also work in collaboration with other campus research centers including the stable isotope lab in Geology, the Center for Chemical Characterization in Chemistry (induced neutron activation analysis and inductively coupled plasma mass spectrometry with laser ablation), the Electron Microscopy Lab, the GIS and Remote Sensing Lab in Geography, and the Center for Heritage Conservation in Architecture.

Once admitted to the graduate program, students concentrate their academic and research efforts in one or more areas within the Department of Anthropology. The degree plan is prepared by the individual student with the assistance of a faculty advisory committee and the coursework is kept flexible (within the guidelines of graduate studies) in order to allow students to pursue their individual professional goals. In addition, whenever possible graduate students are encouraged to gain teaching and/or research experience as assistants within the department.

Anthropology (ANTH)

601. **Biological Anthropology. (3-0). Credit 3.** Survey of the field of biological anthropology covering the principles of evolution, human evolution, human adaptation, human variation, primate diversity and evolution, osteology and bioarchaeology.
602. **Archaeological Methods and Theory. (3-0). Credit 3.** Development of archaeology as a discipline; methods and theories used in archaeology for reconstructing cultural history and cultural process.
603. **Seafaring Life and Maritime Communities. (3-0). Credit 3.** Course employs primary and scholarly sources to examine the social organization, work routines, living conditions, and material culture of mariners between 1450 and 1950; broader trends in maritime communities and global seafaring are also investigated. Prerequisite: Approval of Instructor.
604. **Cultural Method and Theory. (3-0). Credit 3.** Survey of the theoretical concepts used in anthropology and how to construct models used in cultural and social anthropology.
605. **Conservation of Archaeological Resources I. (3-3). Credit 4.** Fundamentals and applications of artifact conservation techniques in archaeology. Prerequisite: Knowledge of basic chemistry and physics recommended.
606. **Conservation of Archaeological Resources II. (3-3). Credit 4.** Comprehensive study of techniques used in the identification and conservation of metal and wooden artifacts. Prerequisite: ANTH 605.
607. **Historical Archaeology. (3-0). Credit 3.** Past and present theoretical positions and research strategies in historical archaeology. Prerequisite: ANTH 313 recommended.

- 608. Folklife and Material Culture. (3-0). Credit 3.** Investigation of the traditions of vernacular architecture, art, craft and other aspects of folklife. Prerequisites: Graduate classification and approval of instructor.
- 609. Culture and Evolution. (3-0). Credit 3.** This seminar will seek to integrate the study of culture with the natural sciences. The foundation of the course is the assumption that culture is a biological adaptation and that we can examine it scientifically.
- 610. Outfitting and Sailing the Wooden Ship 1400-1900. (3-0). Credit 3.** Archaeological and historical sources to exam the outfitting and sailing of wooden ships between 1400 and 1900, a period popularly known as the “Age of Sail”; emphasis on two aspects that are of particular interest to the nautical archaeologist. Prerequisites: Approval of instructor; graduate classification.
- 611. Nautical Archaeology. (3-0). Credit 3.** Introduction to the history and theoretical basis of nautical archaeology as a discipline; fundamental concepts in nautical science relevant to the history of seafaring; key developments in the history of seafaring. Prerequisites: Approval of instructor and graduate classification.
- 612. Preclassical Seafaring. (3-0). Credit 3.** Seafarers and watercraft of the ancient Near East and Mediterranean until ca. 700 B.C. Types of watercraft used, routes, cargoes, voyages of exploration and economics of maritime trade.
- 613. Classical Seafaring. (3-0). Credit 3.** Culture history of Mediterranean seafarers between ca. 700 B.C. and end of Byzantine Empire; types of ships and boats, sea law, naval tactics, harbor-works, routes, cargoes and economics of trade.
- 614. Books and Treatises on Shipbuilding. (3-0). Credit 3.** Examines a group of theoretical books of shipbuilding from the early 15th to the early 19th century; an overview of the theory and conceptual models with which ships were designed and built from the Renaissance to the 19th century. Prerequisite: ANTH 616.
- 615. History of Shipbuilding Technology. (3-0). Credit 3.** Design and construction of preserved and excavated sailing ships, the expertise of their builders and technology involved in ancient and early shipbuilding. Prerequisite: Approval of instructor.
- 616. Research and Reconstruction of Ships. (2-2). Credit 3.** Techniques of recording and interpreting excavated ships; preservation of hulls; ship drafting, modeling, lofting, testing and other methods used in the research and/or reconstruction of ships. Prerequisite: Approval of instructor.
- 617. Conservation III—Preservation of Organic Materials. (3-0). Credit 3.** Advanced and experimental methods of organic artifact conservation; emphasis on composite artifacts, gamma radiation polymerization, scanning electron microscope evaluation of artifacts and preservation of traditionally difficult to conserve artifacts. Prerequisite: ANTH 605.
- 618. Medieval Seafaring in the Mediterranean. (3-0). Credit 3.** Cultural history of seafaring in the Mediterranean region during medieval times; ship types and their uses, naval warfare, sea law, harbor-works, routes and cargoes, and maritime economic institutions and practices. Prerequisite: Approval of instructor.
- 619. Indians of Texas. (3-0). Credit 3.** Detailed study of diverse native/immigrant Texas Indian lifeways/cultures from late pre-European to contemporary times; exploration of historical underpinnings, traditional cultures, especially land-use patterns; detailed assessment of tribal relationships with colonial powers, U.S., Texas governments as evidenced in ethnographic, ethnohistoric, historical materials; application to anthropological, archaeological, and human ecology research. Prerequisite(s): Graduate classification, ANTH 602, or ANTH 604, or ANTH 620, or ANTH 650.
- 620. Prehistory of Texas. (3-0). Credit 3.** Survey of Texas prehistory from initial migration of human population 11,500 years ago to extermination or removal of Native American cultures by Europeans; processes of cultural adaptation and change to shifting environments and subsistence material correlates of world views and belief systems.
- 621. Prehistoric Technology. (3-0). Credit 3.** Role of lithic and ceramic technologies in meeting the cultural needs of human populations from prehistoric times to the Middle Ages.
- 622. Folklore Forms and Methods. (3-0). Credit 3.** Introduction to major genres of folklore, various theories and approaches employed by researchers, and specialized resource materials in the humanities and social sciences. Prerequisites: Graduate classification in liberal arts and approval of instructor.

- 623. Folk Narrative. (3-0). Credit 3.** Theories and techniques used in the study of major folk narrative genres; folktale and legend; brief survey of other narrative forms, including tall tale, epic, myth, joke, personal and family narratives. Prerequisites: Graduate classification in liberal arts and approval of instructor.
- 624. Geoarchaeology. (3-0). Credit 3.** Application of geological concepts and methods to archaeological research; history of geoarchaeology; site formation processes; modification of archaeological sites and sediments; landscape reconstruction and change and their effects on human behavior. Prerequisite: ANTH 602 or equivalent. Cross-listed with GEOG 687.
- 625. Zooarchaeology. (3-3). Credit 4.** Analysis of animal bones from archaeological sites; inference of how prehistoric peoples hunted, domesticated and used animals. Prerequisite: Basic knowledge of zoology and archaeology.
- 626. Human Paleopathology. (3-0). Credit 3.** Pathological lesions exhibited in prehistoric (or early historic) human remains; problems in diagnosing lesions in fossil skeletal remains, and evaluating the occurrence of these lesions in past populations. Prerequisite: ANTH 425.
- 627. Human Paleonutrition. (3-0). Credit 3.** Evaluation of past human diets and subsistence patterns from the perspective of research in archaeology, zooarchaeology, ethnobotany, bioarchaeology and cultural anthropology. Prerequisite: 6 hours of advanced courses in anthropology or approval of instructor.
- 628. New World Seafaring. (3-0). Credit 3.** Cultural history of seafaring in the Western Hemisphere from the fifteenth century to the present; ship types and their uses; harborworks, commerce, naval warfare, sailing routes, maritime practices. Prerequisites: ANTH 615 and ANTH 616 or approval of instructor.
- 629. Post-Medieval Seafaring. (3-0). Credit 3.** Cultural history of European seafaring from the fifteenth century to the early twentieth century; ship types and their uses, shipping routes and cargoes, maritime technology and economic institutions, seafaring practices, and naval warfare. Prerequisites: ANTH 615 and ANTH 616 or approval of instructor.
- 630. Human Evolutionary Ecology. (3-0). Credit 3.** Evolutionary ecology of human behavior and culture, including habitat choice and use of space, time allocation, resource acquisition and allocation, sex and reproduction, altruism and cooperation and the coevolution of genes and culture. Prerequisite: Graduate classification.
- 631. Primate Behavioral Ecology. (3-0). Credit 3.** Survey the behavioral ecology of the nonhuman primates exploring topics such as their hunting behavior; sexual coercion; language capabilities; culture; tool use; homosexuality; dominance; parental care, ethics of field study and their conservation. Prerequisite: Graduate classification.
- 632. Archaeology of Death. (3-0). Credit 3.** Ethnographic and archaeological literature regarding human funerary behavior; emphasis on theoretical developments in the interpretation of burials for reconstructing social organization and social change; examine how mortuary practices and archaeological excavation define the burial assemblages studied by bioarchaeologists. Prerequisite: Graduate classification.
- 633. Deep Submergence Archaeology. (3-0). Credit 3.** Seminar addressing issues in the new field of deep submergence archaeology by examining the discipline's history, technologies, specific case studies of ship wrecks in deep water and related topics. Students will interact with leaders in the field via video conferencing and visiting lecturers. Prerequisite: Permission of instructor.
- 634. Palynology. (3-3). Credit 4.** Principles and techniques used in palynology, pollen morphology, ontogeny, biochemistry, dispersion and preservation; role of palynology as a research tool in plant taxonomy agriculture, medicine, paleobotany and anthropology.
- 635. Violence and Warfare. (3-0). Credit 3.** The anthropological study of violence and warfare and the place of these phenomena in cultural evolution, religion, economics, politics and social structure; particular attention paid to the rise of industrialized warfare and its impact on the pre-industrial world. Prerequisite: Graduate standing.
- 636. Computer Graphics in Archaeology. (3-0). Credit 3.** This course will focus on the acquisition, manipulation, and presentation of archaeological data and images; a variety of state-of-the-art technologies will be employed to develop professional desktop publications, slide and digital presentations, electronic publications and images. Prerequisite: Graduate certification.
- 637. Paleoethnobotany. (3-3). Credit 4.** Interrelationship between plants and humans from prehistoric times to present, theoretical and methodological use of botany as a research tool for the understanding of cultural systems.

- 638. Proposal Writing in Anthropology. (3-0). Credit 3.** This workshop class is designed to assist advanced doctoral students in writing research grant proposals to fund their dissertation projects. Students will craft their own NSF-style Dissertation Improvement proposals, should be prepared to accept constructive criticism of their work, and to offer it on the work of their classmates. Prerequisites: G8 standing and permission of the instructor.
- 639. Gender, Ethnicity, and Class in Archaeological Research. (3-0). Credit 3.** This course explores: theoretical and methodological issues in engendering archaeology; ideological biases in the interpretation of roles attributed to women, men and underrepresented groups in the past; the impact of cultural transformations on underrepresented groups and gender relations; and how to formulate research questions concerning these issues. Prerequisite: Graduate Classification. Cross-listed with WGST 639.
- 640. Anthropological Ethics and Professionalism. (3-0). Credit 3.** Codes of professional ethics applicable to excavation and preservation of archaeological sites; ethnographic fieldwork and professional relationships with colleagues and informants; professional protocols for publication and presentation of research results. Prerequisites: Graduate classification in anthropology and approval of instructor.
- 641. Applied Anthropology. (3-0). Credit 3.** Theory, ethics and practical applications of anthropological methods and concepts as they relate to planned programs of socio-cultural change.
- 642. Research Design in Anthropology. (3-0). Credit 3.** Research design used by anthropologists to develop sampling strategies, test hypotheses and compile quantitative data. Prerequisite: ANTH 602.
- 643. Australopithecine Paleoecology. (3-0). Credit 3.** Principles and techniques used in the reconstruction of paleoecology and paleoenvironments associated with the African australopithecines; including taphonomy, faunal evolution, climate forcing analysis, habitat preference and land-use patterns; detailed overview of the australopithecine fossil record from the Miocene to the Pleistocene. Prerequisite: Graduate classification.
- 644. Classical Archaeology. (3-0). Credit 3.** History of the discipline through the individuals, organizations, excavations, theoretical models and ethical issues that have shaped it. Prerequisite: Graduate classification.
- 645. Cultural Resources Management. (3-0). Credit 3.** History of cultural resources management (CRM): current federal and state laws and regulations; methods of determining site significance; the stages of CRM investigations; and the preparation of research designs and proposals; ethical issues such as curation and the treatment of human remains discussed. Prerequisite: Graduate classification.
- 646. Ceramic Artifact Analysis. (2-3). Credit 3.** The introduction of the basic concepts, methods, and approaches used in the analysis of archaeological pottery with a focus on the techniques and theories used to bridge the gap between the recovery of ceramic artifacts and their interpretation within various anthropological contexts. Prerequisite: Graduate Classification.
- 647. Lithic Artifact Analysis. (2-3). Credit 3.** Laboratory-based course reviewing methods archaeologists use to analyze stone tools and debitage, including identification of tool-stone sources, reconstruction of technology, explanation of assemblage variability, and microscopic use-wear analysis. Prerequisite: Graduate classification and permission of instructor.
- 648. Issues in Human Evolutionary Theory. (3-0). Credit 3.** Examination of core concepts and theories in evolutionary biology and paleoanthropology, including human evolution, the species concept, and the role of the human fossil record. Prerequisite: Graduate classification.
- 649. Origin and Evolution of the Genus Homo. (3-0). Credit 3.** Survey of the human fossil record with a focus on Plio-Pleistocene specimens assigned to our own genus, Homo; provides an overarching picture of the evolutionary history of humans after the Australopithecines and reviews theoretical issues that have influenced our understanding of the evolution of Homo sapiens. Prerequisite: Graduate classification or approval of instructor.
- 650. Ethnographic Field Methods. (3-0). Credit 3.** Methods common to anthropology for the field collection of data on cultural behavior. Prerequisites: Graduate classification and approval of instructor.
- 651. Pleistocene Prehistory of Northeast Asia and Alaska. (3-0). Credit 3.** Survey of the Ice-Age paleoenvironments, prehistory and paleoanthropology of Siberia, China, Japan, and Bering Land Bridge area, especially in the context of human colonization of the region and origins of the first Americans. Prerequisite: Graduate classification.

- 652. First American Archaeology. (3-0). Credit 3.** Survey of past frontiers in First American studies important to the peopling of the Americas: review of the archaeology, geology, and dating of early sites in North, Middle, and South America; human migration hypotheses; biological evidence; and late Quaternary environmental factors. Prerequisite: Approval of instructor.
- 653. Hunter-Gatherer Archaeology. (3-0). Credit 3.** Overview of development of hunter-gatherer archaeology; current methodological and theoretical issues, especially use of ethnographic and environmental data; ecologically oriented case studies of late Pleistocene and Holocene hunter-gatherers; emphasis on land-use, site-structure, and site formation analyses, especially in North America. Prerequisites: ANTH 602 or ANTH 604 or approval of instructor.
- 654. Archaeological Photography. (3-0). Credit 3.** Instruction on how to better use cameras in the process of reporting archaeological sites and material culture by exploring old and new photographic technologies. Prerequisite: Graduate Classification.
- 655. Empires and World-System. (3-0). Credit 3.** Application of the anthropological perspective to the problem of the rise of empires and the modern world-system over the last 600 years of world history; topics include ecocide, ethnocide, ethnogenesis and warfare.
- 660. Field Archaeology. Credit 1 to 12 each semester.** Field instruction in the methods of archaeological excavations; recovery and cataloging of cultural, floral and faunal remains; and interpretation of these data. Locations of the field course will vary according to site. Field trips required. May be taken more than once but not to exceed 8 hours of credit toward an MA degree and not to exceed 12 hours of credit toward a PhD degree. Prerequisite: ANTH 602 or equivalent.
- 684. Anthropology Internship. (9-0). Credit 9.** Opportunity to put anthropology learned in the classroom into practice; may be used to gain practical experience in a variety of settings including: local, state or federal agencies; museums; non-profit organizations; non-governmental organizations; and private firms. Prerequisites: ANTH 601, ANTH 602, ANTH 604 or ANTH 602, ANTH 615, ANTH 616; approval of committee chair.
- 685. Directed Studies. Credit 1 to 12 each semester.** Directed individual study of selected problems in anthropology. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 12.** Selected topics in an identified area of anthropology. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more.** Research for thesis. Prerequisite: Approval of graduate advisor.

College of Architecture (CARC)

- 600. College of Architecture Graduate Study Abroad. (16-0). Credit 1 to 16.** For students in approved study abroad programs participating in reciprocal educational exchange programs. Prerequisite: Admission to approved program.
- 601. Foundations of Research in Planning and Design. (3-0). Credit 3.** Introduction to the research process and its application to problems in planning and design; presentation of philosophy and logic underlying the scientific method; critical analysis of planning and design literature according to each step of the research process: problem definition, hypothesis development, study design, analysis and interpretation of the findings.
- 602. Research Methods in Planning and Design. (3-0). Credit 3.** Basic empirical research methods used in planning and design research: experimental, survey and case study designs; comparisons of the various methods; application of techniques in sample selection, data collection and analytic approaches. May be repeated for credit. Prerequisite: STAT 651 or equivalent.
- 603. Research Communications. (2-2). Credit 3.** Advanced skills in research communications content; includes exercises in the form, style, composition, and usage of language in research documents and the presentation of research concepts visually and verbally. Prerequisite: College of Architecture majors only.
- 604. Advanced Field Studies in Design Innovation. (3-9). Credit 6.** Advanced design innovation in international and domestic environments away from Texas A&M University campus; emphasis on the cultural, social economic, geographical, climatic and technological factors influencing design solutions for human needs. Prerequisite: Graduate classification.

- 685. Directed Studies. Credit 1 to 6 each semester.** Individual problems involving application of theory and practice in architecture, construction science, landscape architecture and urban and regional planning in an international setting. Prerequisites: Approval of instructor and department head.
- 689. Special Topics in...** Credit 1 to 4. Selected topics in an identified field. May be repeated for credit.
- 698. Writing for Publication. (3-0). Credit 3.** Writing in academic disciplines and settings. Writing for different audiences and purposes. Style; planning and development of academic journal articles; grant proposals; correspondence; oral presentations; technical reports. Permission of departmental/college graduate advisor. Prerequisite: Advanced standing in master's doctoral programs.

Department of Architecture

L. O. Beltran, S. Caffey, M. J. Clayton, C. H. Culp, Jr., S. Deyong, F. E. Downing, J. G. Esquivel, J. G. Fairey, A. Geva, K. Glowacki, J. S. Haberl, D. K. Hamilton, W. He, R. C. Hill, N. Klein, P. Lang, G. L. Maffei, G. J. Mann, V. Miranda, A. B. Nichols, M. J. O'Brien, J. T. Regan, S. Rodiek, R. J. Schiffhauer, M. M. Shepley, P. J. Tabb, J. A. Vanegas, R. B. Warden, W. V. Wells (Head), D. G. Woodcock, W. Yan, X. Zhu

The Department of Architecture offers the following graduate degree programs for eligible students seeking advanced educational opportunities: Master of Architecture as the professional degree accredited by NAAB, Master of Science in Architecture and Doctor of Philosophy. Entry to the M.Arch is directly from a pre-architectural four-year degree program, or with appropriate prerequisite work (Career Change Program), from other 4-year degree backgrounds.

The Department of Architecture offers specialization certificates in Health Systems and Design, Historic Preservation, Environmental Hazard Management, Facility Management and Sustainable Urbanism. These areas of specialization are supported by qualified faculty, research centers and laboratories. Other areas of exploration in which graduate students are engaged include design, architectural computing, history and theory, energy and sustainability, housing, health and interior architecture. The program also offers a dual master's degree program in conjunction with the graduate program in Land Development that enables students to graduate with a Master of Architecture and Master of Science in Land Development upon completion of the combined 72-credit core curriculum.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Doctor of Architecture and Master of Architecture degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Texas A&M University, Department of Architecture offers the following NAAB-accredited degree program:

M.Arch. (pre-professional degree + 52 graduate credits)
Next accreditation visit for all programs: 2013

Because of the important role of computing the disciplines housed within the College of Architecture, all entering students are required to possess a portable, network-ready personal computer capable of running software appropriate to their academic program. Financial aid is available to assist students in their computer purchases. No student will be denied admission to Texas A&M University based on inability to purchase a computer. Additional information is available on the college website at arch.tamu.edu.

Architecture (ARCH)

- 600. Introduction to Architecture and Urban Design. (1-1). Credit 2.** Introductory seminar and studio on architecture and urban design; focus on topical readings, in-class discussions and short writing exercises; provides opportunity to learn or refine hand drawing, rendering, and model building, and to learn to be productive and creative within the studio context. Prerequisite: Graduate classification in architecture or approval of instructor.
- 601. Design Fundamentals I. (3-9). Credit 6.** Introduction to the development of verbal (design vocabulary), graphic, research and critical thinking skills through the design of small-scale projects, and investigation of typologies and precedents as the basis for architectural design. Prerequisites: Graduate classification in architecture or approval of instructor; career change program, ARCH 600 and concurrent enrollment in ARCH 610.
- 602. Design Fundamentals II. (3-9). Credit 6.** Further development of verbal, graphic, research and critical thinking skills through architectural design projects, with emphasis on basic understanding of major philosophical doctrines and their influence on architectural theory; studies of place-making, space, form and order; knowledge of world views, formal spatial manipulations and design vocabulary. Prerequisites: ARCH 601, ARCH 610, ARCH 612 or approval of instructor.
- 603. Design Fundamentals III. (2-4). Credit 6.** Theory and practice of architecture; methods and techniques used in the analysis and synthesis of concepts unique to spatial enclosure; developing responses to building systems; objects in a current cultural, physical or social context; complex building programs, site development and design solutions integrating formally expressive visual ideas and functional planning. Prerequisite: ARCH 602.
- 605. Architectural Design I. (2-12). Credit 6.** Application of verbal, graphic, research, critical thinking and fundamental design skills to architectural projects that emphasize design theory, systems of ordering in architecture and urban design, use of precedents, site and contextual issues; includes program development and concerns for public health, safety and welfare. Core design studio for professional degree candidates. Prerequisite: Graduate classification in architecture or approval of instructor.*
- 606. Architectural Design II. (2-12). Credit 6.** Application of verbal, graphic, research, critical thinking and fundamental design skills to architectural projects that emphasize the integration of structural, environmental, life safety, building envelope systems, and building service systems; includes code compliance, resource conservation, cost control and economic analysis. Core design studio for professional degree candidates. Prerequisite: ARCH 605.*
- 607. Architectural Design III. (2-12). Credit 6.** Application of verbal, graphic, research, critical thinking and comprehensive design skills to advanced architectural projects or design competitions that address cultural traditions, human behavior and diversity, the context of architecture, collaborative skills, ethics and professional judgement. Core design studio. Prerequisite: ARCH 606.*
- 610. Visual Communications. (2-4). Credit 3.** Investigation and practice of various communication techniques used to explore, verify and present design decisions in architecture; freehand drawing principles; graphic theory and mechanical drawing techniques; architectural presentation and rendering methods in different media and their application. Prerequisite: Graduate classification or approval of instructor; concurrent enrollment in ARCH 601.
- 612. Structural and Environmental Technology Concepts. (3-0). Credit 3.** An introductory course which is intended to quickly and broadly develop the vocabulary base, visual understanding and familiarity with technological systems that architects deal with throughout their practice. Prerequisites: Graduate classification or approval of instructor; MATH 142 and PHYS 201 or equivalents.
- 614. Elements of Architectural Structures. (2-2). Credit 3.** Investigation of the structural factors that influence the development of architectural space and form; introduction of the physical principles that govern statics and strength of materials through design of timber and steel components of architectural structures. Prerequisite: ARCH 612 or approval of instructor.
- 615. Elements of Environmental Control Systems. (3-0). Credit 3.** Theory and applications of building energy use, envelope design, shading analysis, heating and cooling systems, lighting design, building water supply plumbing and drainage systems, electrical, acoustical, fire and lightning protection, transportation systems and construction materials; design opportunities, calculations, equipment selection, and component sizing as they relate to design. Prerequisite: ARCH 612 or approval of instructor.

619. **Applied Solar Energy. (3-0). Credit 3.** Technology behind applied solar energy design, including: calculating solar radiation, heat transfer related to solar design; active systems; FCHART and economics. Prerequisites: Graduate classification or approval of instructor; ARCH 335 or ARCH 615 or equivalents.
621. **Energy Optimization in Building Design. (3-0). Credit 3.** Optimum energy use strategies for commercial buildings, hourly energy simulation methods, building envelope and HVAC system energy optimization by computer simulation techniques; life-cycle cost analysis of building energy systems; case studies in commercial building applications. Prerequisites: Graduate classification or approval of instructor; ARCH 633 or ARCH 615 or equivalents.*
622. **Sustainable Building Design Technology. (3-0). Credit 3.** Fundamentals of sustainability in building, including social, political and economic issues—focusing particularly on conservation of natural resources; design and construction of earth integrated solar buildings, including cooling, heating, lighting and habitability assessments. Prerequisite: Graduate classification or approval of instructor.
623. **Design Methods I. (3-0). Credit 3.** Importance of intuitive methods in design; meaning, symbolism and creativity in art and architecture; techniques to develop creative approaches to problem-solving. Prerequisite: Graduate classification or approval of instructor.
624. **Theory of Placemaking. (3-0). Credit 3.** An introduction to and an exploration of the sources, principles, theories, and physical expressions of the phenomenon of place creation and its relationship to sustainable urbanism; investigates the origin of place theory and its meaning as expressed in the various forms, functions and scales of places applicable to architecture and planning. Prerequisite: Graduate classification or approval of instructor.
625. **Sustainable Housing Design. (3-0). Credit 3.** Principles, needs and calculations procedures for the use of on site resources contributing to off grid sustainable residential design. Prerequisites: Graduate classification or approval of instructor; ARCH 335 or equivalent.
626. **The Embodiment of Place. (3-0). Credit 3.** Embodiment of Place will review the philosophies and theories of significant form embodiment and location. Place vs. space will be clarified and used to introduce the underlying patterns of “being” and the pleasure that embodied entities take from meaningful place experience. A set of domains will be introduced that cut across formal and informal place experiences as a way of thinking and transforming design, at all scales. Prerequisite: Graduate classification or approval of instructor.
628. **Tools for Green Building Design. (3-0). Credit 3.** Modeling tools and techniques to explore and support sustainable design; develop a deeper understanding of the relationship between architectural design and the environmental forces of sun, wind, and light; design-centered course; helps test the students architectural designs through the use of available modeling tools. Prerequisite: Graduate classification or approval of instructor.
631. **Applied Architectural Structures. (3-0). Credit 3.** Structural analysis of building structural systems: components, frames, shapes; selection and economics of structural systems; survey of current structural design codes; supervision practices in structural construction. Prerequisite: Graduate classification or approval of instructor.
633. **Applied Architectural Systems. (3-0). Credit 3.** Building energy consumption patterns and conservation strategies; natural and mechanical subsystems for environmental control; subsystem design criteria, economic considerations and selection methods. Prerequisite: Graduate classification or approval of instructor; ARCH 335 or ARCH 615 or equivalents.*
634. **Architectural Lighting. (2-2). Credit 3.** Attributes of the lighting environment, lighting and energy issues, daylight availability, building design for daylighting, heat loss control, solar shading, daylighting models, graphical analytical and computer methods of analysis, visual and lighting comfort evaluation, integration of daylight and electric light, energy analysis. Prerequisite: Graduate classification or approval of instructor; ARCH 335 or equivalent.
638. **Architectural Theory—Renaissance Through 19th Century. (3-0). Credit 3.** Review of architectural theory and practice from the 15th to 19th centuries with emphasis on the classical tradition, its transformations in France and in Great Britain and Germany; aspects of this evolution. Prerequisite: Graduate classification or approval of instructor.
639. **Twentieth Century Architecture: Theory and Practice. (3-0). Credit 3.** Background and exploration of Modern Architecture, including consideration of region, materials, structure and style, as well as the social and economic factors that influence architectural form and content; discussion of the work and writings of 20th century architects and architectural theorists. Prerequisite: Graduate classification or approval of instructor.

- 640. Morphology of Architectural Form. (3-0). Credit 3.** Forces influencing structure and form of architecture: climate, culture, site, economics, construction methods. Prerequisite: Graduate classification or approval of instructor.
- 642. Data Processing in Environmental Design. (2-3). Credit 3.** Application of the computer to architectural problems; the computer as a mapping device for graphical display of spatially related data; simple and multiple linear regression on sets of data; correlation analyses and practice at running the computer for these applications. Prerequisite: Graduate classification or approval of instructor.
- 643. Software Analysis for HVAC Systems in Low Energy Buildings. (2-3). Credit 3.** Energy analysis (using Energy Plus software) with an emphasis on developing strategies for low energy use; simulation of various heating and cooling systems in low energy buildings; analysis of the mechanical equipment (including air handling systems, chiller and boilers), the building envelope, energy management control systems and indoor air quality. Prerequisite: ARCH 633 or equivalent.
- 644. Seminar in Art and Architectural History. (3-0). Credit 3.** Advanced topics in art and architectural history emphasizing methods of analysis and development of theory, including case studies from both western and non-western traditions; topics vary each semester. Prerequisite: Graduate classification or approval of instructor.
- 646. Historic Preservation Theory and Practice. (3-0). Credit 3.** History of the preservation movement in the U.S. Architectural and regulatory techniques employed in building preservation; case study of selected examples. Prerequisite: Graduate classification or approval of instructor.*
- 647. Recording Historic Buildings. (2-9). Credit 5.** Techniques for recording historic buildings; measuring and drawing to Historic American Building Survey Standards; field experience in photography, field notes and record drawing preparation. Prerequisites: Graduate classification or approval of instructor.*
- 648. Building Preservation Technology. (3-0). Credit 3.** Preservation technology related to the diagnosis and treatment of defects in buildings; case studies of significant historic structures. Field study may be required for which departmental fees may be assessed to cover costs. Prerequisite: ARCH 646 or approval of instructor.
- 649. Advanced History of Building Technology. (3-0). Credit 3.** Readings and discussion of current topics in history of building technology; development of understanding the importance of materials of construction to the creation of historical forms of sacred architecture across faith and around the world. Prerequisite: Graduate classification or approval of instructor.
- 651. Emerging Strategies in Architectural Management. (3-0). Credit 3.** Emerging strategies in Architectural Management; a critical examination of alternative forms of practice; topics include: internship and practice, firm strategies, organization design and culture, firm economics, project organization and design leadership. Prerequisite: Graduate classification or approval of instructor.
- 652. Facility Information Technology. (3-0). Credit 3.** Analyze facility design and management processes; select appropriate information technologies and implement innovative information technology solutions; emphasis on addressing the facility life cycle. Prerequisite: Graduate classification or approval of instructor.
- 653. Building Information Modeling in Architecture. (3-0). Credit 3.** Building Information Modeling (BIM); principles, methods and applications in the building lifecycle with a focus on the design process; includes computer-aided design, parametric modeling, databases, web technologies, design performance simulation and visualization. Prerequisites: Graduate classification or instructor approval.
- 657. Advanced Professional Practice and Ethics. (3-0). Credit 3.** Issues and relationships within the business, legal and political environment; legal forms of practice; office organization, personnel practices, policies and management; expanded services; economics of practice, profit planning and accounting; client selection; standard form agreements with consultants and for specialized services, risk management. Prerequisites: ARCH 457 and graduate classification.
- 660. Design Programming. (3-0). Credit 3.** Study of successful programming approaches to meet user needs in design projects; history and definition of programming, programming techniques, documentation and case studies; applications to buildings, landscape projects and urban design. Prerequisite: Graduate classification or approval of instructor.
- 663. Interior Architecture. (3-0). Credit 3.** Theory and application of design processes incorporating programming, space planning, analysis and communication of interior requirements for various building types with emphasis on spatial organization, selection of components and materials to satisfy user needs; emphasis on design of the workplace as the synthesis of human factors, organizational theory, systems technology and communication. Prerequisite: Graduate classification or approval of instructor.*

- 669. Foundations of Research in Architecture. (3-0). Credit 3.** Introduction to the research process and its application to problems in architecture; survey of current literature on research design methods relevant to diverse architectural problems; qualitative and quantitative research strategies and techniques; communicating research results. May be taken two times for credit. Prerequisites: Graduate classification; concurrent enrollment in ARCH 681 and ARCH 690.
- 674. Typologies of Contemporary Hospital Design. (3-0). Credit 3.** Introduction to the contemporary planning of hospitals; comparisons of hospital design by contemporary practitioners; best practice models, repetitive patterns, and innovative designs. Prerequisite: Graduate classification or approval of instructor.
- 675. Health Design and Research. (3-0). Credit 3.** Examination of health environments to include buildings, healthcare gardens and restorative landscapes, and urban design for home-based care and independent living; emphasis on research-informed approaches for patient-centered design that reduce stress and promote improved health outcomes. Prerequisite: Graduate classification or approval of instructor.
- 676. Survey of Human Behavior and Design. (3-0). Credit 3.** Examination of human behavior and attitudes that influence spatial decision making; includes sections on environment and behavior, real estate finance, urban design decision making. Prerequisite: Graduate classification or approval of instructor.
- 681. Seminar. Credit 1 each semester.** Discussion and review of current practice in architecture and environmental design. Prerequisite: Graduate classification or approval of instructor.
- 684. Professional Internship. Credit 1 to 8.** Professional practice under approved arrangement with public or private agencies or in residence to complement academic coursework and to provide the basis for, and allow the preparation of, an appropriate report. Prerequisite: Graduate classification or approval of instructor and department head.
- 685. Directed Studies. Credit 1 to 6 each semester.** Individual problems involving application of theory and practice in design and construction of buildings and groups of buildings. Prerequisite: Graduate classification or approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 6.** Selected topics in an identified field of architecture. May be repeated for credit. Prerequisite: Graduate classification or approval of instructor or department head.
- 690. Research Ideologies for Architecture. (3-0). Credit 3.** Design of research in architecture; evaluation of research methodologies from current research literature. Prerequisite: Graduate classification or approval of instructor and department head.
- 691. Research. Credit 1 or more each semester.** Research for and preparation of dissertation. Prerequisite: Graduate classification or approval of instructor and department head.
- 693. Professional Study. Credit 1 or more each semester.** Application of verbal, graphic, research and critical thinking skills to an approved, individually selected architectural issue or design project that will advance the broad understanding of architecture and its impact on people. The terminal requirement for the Master of Architecture degree. May be taken more than once but not more than 6 hours used toward a degree. Prerequisites: ARCH 605, ARCH 606, ARCH 607; approved proposal.

* Field trips may be required for which departmental fees may be assessed to cover costs.

Astronomy

(faculty, see [page 515](#))

(ASTR)

- 681. Seminar. (1-0). Credit 1.** Subjects of current importance; normally required of all graduate students in astronomy. May be repeated for credit.
- 685. Directed Studies. Credit 1 to 9.** Individual problems not related to thesis. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of astronomy. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research toward thesis or dissertation. Prerequisite: Baccalaureate degree in physics or equivalent.

Athletic Training

(faculty, see [page 432](#))

(ATTR)

651. **Clinical Education I. (1-8). Credit 2.** Integration of clinical competencies with classroom instruction and a supervised field based experience in athletic training to link theory into practice. Prerequisite: Enrollment in MS Athletic Training program.
652. **Clinical Education II. (1-16). Credit 3.** Integration of clinical competencies with classroom instruction and a supervised field based experience in athletic training to link theory into practice. Prerequisite: ATTR 651.
653. **Clinical Education III. (1-16). Credit 3.** Integration of clinical competencies with classroom instruction and a supervised field based experience in athletic training to link theory into practice. Prerequisite: ATTR 652.
654. **Clinical Education IV. (1-8). Credit 2.** Integration of clinical competencies with classroom instruction and a supervised field based experience in athletic training to link theory into practice. Prerequisite: ATTR 653.
655. **Clinical Education V. (1-16). Credit 3.** Integration of clinical competencies with classroom instruction and a supervised field based experience in athletic training to link theory into practice. Prerequisite: ATTR 654.
656. **Clinical Education VI. (1-16). Credit 3.** Integration of clinical competencies with classroom instruction and a supervised field based experience in athletic training to link theory into practice. Prerequisite: ATTR 655.
660. **Prevention and Care of Athletic Injuries. (3-0). Credit 3.** Prevention strategies and procedures, recognition and care of common injuries and conditions; foundational concepts and principles of the athletic training profession. Prerequisite: Enrollment in MS Athletic Training program.
661. **Prevention and Care of Athletic Injuries Lab. (0-2). Credit 1.** Laboratory to accompany ATTR 660; application of theories and practice skills. Prerequisite: Concurrent enrollment in ATTR 660.
662. **Clinical Examination and Diagnosis-Lower Extremity. (3-0). Credit 3.** Pathomechanics, clinical examination, diagnosis and appropriate medical referral of orthopedic injuries and other conditions to the lower extremity and spine. Prerequisite: Enrollment in MS Athletic Training program.
663. **Clinical Examination and Diagnosis-Lower Extremity Lab. (0-2). Credit 1.** Laboratory to accompany ATTR 662; application of theories and skill practice. Prerequisites: Concurrent enrollment in ATTR 662; enrollment in MS Athletic Training program.
664. **Clinical Examination and Diagnosis-Upper Extremity. (3-0). Credit 3.** Pathomechanics, clinical examination, diagnosis and appropriate medical referral of orthopedic injuries and other conditions to the upper extremity, head and cervical spine. Prerequisite: ATTR 662.
665. **Clinical Examination and Diagnosis-Upper Extremity Lab. (0-2). Credit 1.** Laboratory to accompany ATTR 664; application of theories and skill practice. Prerequisites: Concurrent enrollment in ATTR 664; enrollment in MS Athletic Training program.
666. **Physical Rehabilitation. (3-0). Credit 3.** The study of physical rehabilitation theory and techniques used as a therapeutic intervention for orthopedic injuries and conditions. Prerequisite: Enrollment in MS Athletic Training program.
667. **Physical Rehabilitation Lab. (0-2). Credit 1.** Laboratory to accompany ATTR 666; application of theories and skill practice. Prerequisites: Concurrent enrollment in ATTR 666; enrollment in MS Athletic Training program.
668. **Therapeutic Modalities. (3-0). Credit 3.** A detailed study of modern therapeutic devices used in the treatment and rehabilitation of orthopedic injuries and conditions. Prerequisite: Enrollment in MS Athletic Training program.
669. **Therapeutic Modalities Lab. (0-2). Credit 1.** Laboratory to accompany ATTR 668; application of theories and skill practice. Prerequisites: Concurrent enrollment in ATTR 668; enrollment in MS Athletic Training program.

- 670. General Medical Conditions and Therapeutic Medication. (3-0). Credit 3.** Pathophysiology, assessment, and appropriate intervention and referral for general medical conditions and disabilities; common diagnostic tests and imaging assessment tools including commonly used therapeutic medications. Prerequisite: Enrollment in MS Athletic Training program.
- 671. Organization and Administration in Athletic Training. (3-0). Credit 3.** Organization and administration of athletic training services including financial, human resources, facility, information technology and risk management. Prerequisite: Enrollment in MS Athletic Training program.
- 672. Professional Preparation and Issues in Athletic Training. (3-0). Credit 3.** Knowledge and skills for successful pursuit of athletic training credentials, employment and continuing professional competencies; emphasis on current topics and issues contributing to the professional preparation of athletic training. Prerequisite: Enrollment in MS Athletic Training program.

Department of Atmospheric Sciences

K. P. Bowman (Head), S. D. Brooks, D. R. Collins, A. E. Dessler, C. C. Epifanio, R. Korty, M. T. Lemmon, S. L. Nasiri, J. W. Nielsen-Gammon, G. R. North, R. E. Orville, R. L. Panetta, A. Rapp, R. Saravanan*, G. W. Schade, C. J. Schumacher, R. S. Schumacher, I. Szunyogh, T. T. Wilheit, P. Yang, F. Zhang, R. Zhang

* Graduate Advisor

Thesis and non-thesis Master of Science as well as Doctor of Philosophy degrees are offered in atmospheric sciences. Students from disciplines other than meteorology are encouraged to enroll in our graduate program. Normal prerequisites are 12 hours of calculus and differential equations and 8 hours of physics. The department offers a basic sequence of courses each year that covers key topics of atmospheric relevance in the areas of fluid dynamics, thermodynamics, cloud physics, radiation, and chemistry. These courses form a base for a large number of the other graduate courses. By the end of their first year, students typically have made arrangements to begin a research project directed by a faculty member. Faculty interests span a wide range extending from field and laboratory work through data analysis, numerical modeling, and theory. Please see the department's website at atmo.tamu.edu for more information. The Department of Atmospheric Sciences can also serve as the "home" department for the Master of Geoscience Degree. The MGSc is a non-thesis degree that provides a multidisciplinary background in the geosciences that is appropriate for science teachers in public schools or for individuals interested in environmental issues.

Persons with an MS degree in atmospheric sciences typically obtain employment with government agencies, industrial organizations, and consulting firms, or they may enter the meteorological branch of one of the military services. The PhD degree is normally required for a teaching or research career.

The Department of Atmospheric Sciences occupies the upper floors in the 15-story David G. Eller Building for Oceanography and Meteorology. The 10-cm Doppler weather radar on top of the building is a campus landmark, and the department jointly operates two mobile radars. In-house laboratory facilities and fixed and mobile observing suites offer many opportunities for physical and chemical studies of the atmosphere. The department is well-equipped for data analysis and modeling, with a high-speed network, numerous personal computers, teaching laboratories, and high-performance computing systems. Additional computing resources are available at the University's Supercomputing Facility.

The Cooperative Institute for Applied Meteorological Studies (CIAMS) is affiliated with the Fort Worth-based headquarters office of the Southern Region of the National Weather Service. The Institute employs research scientists and graduate students in a broad program of applied research and service to Texas and surrounding states in agricultural meteorology, marine meteorology and air-sea interactions over the Gulf of Mexico, lightning and severe weather, and Doppler radar studies from the installments in the Department and at the Houston Forecast Office.

Atmospheric Sciences (ATMO)

- 601. Fundamentals of Atmospheric Dynamics. (3-0). Credit 3.** Basic concepts of fluid dynamics; meteorological approximations and coordinate systems; simple models and wave motion; barotropic models. Prerequisite: Approval of instructor.
- 602. Principles of Atmospheric Physics and Chemistry. (3-0). Credit 3.** Integrated treatment of fundamental aspects of physical meteorology and atmospheric chemistry; ultraviolet and infrared absorption and emission; radiative transfer; cloud and precipitation microphysics and thermodynamics. Prerequisite: ATMO 601.

- 603. Quantitative Methods for the Atmospheric Sciences. (3-0). Credit 3.** Mathematical and numerical methods applied to ODE's, PDE's and statistical methods; methods of analysis and modeling of atmospheric phenomena. Prerequisites: Concurrent registration in ATMO 601 and CSCE 203 or equivalents.
- 604. General Circulation and Climate. (3-0). Credit 3.** Observed large scale circulation and climate of the earth; physical processes which maintain relevant budgets; models and theories explaining mean observations. Prerequisite: ATMO 601.
- 605. Atmospheric Phenomena. (3-0). Credit 3.** Observed patterns of circulation in the atmosphere; physical basis of weather development. Prerequisites: ATMO 601 and ATMO 602.
- 606. Atmospheric Chemistry I. (3-0). Credit 3.** Fundamentals of atmospheric chemistry; tropospheric ozone, NO_x and HO_x cycling, sulfur chemistry, stratospheric chemistry, and aerosol composition; analytical measurement methods; review of chemical basics as needed.
- 611. Atmospheric Dynamics II. (3-0). Credit 3.** Continuation of ATMO 601; flow in planetary boundary layer; balanced flows; atmospheric instabilities; tropical dynamics. Prerequisite: ATMO 601 or approval of instructor.
- 612. Atmospheric Physics II. (3-0). Credit 3.** Fundamentals of physical meteorology; includes cloud physics, atmospheric electricity and atmospheric chemistry. Prerequisite: Graduate classification or approval of instructor.
- 613. Advanced Atmospheric Chemistry. (3-0). Credit 3.** An advanced survey of fundamental atmospheric processes involving biogeochemical cycles, air pollution, tropospheric chemistry, atmospheric aerosols and stratospheric chemistry. Prerequisite: ATMO 606.
- 621. Atmospheric Science. (3-0). Credit 3.** An introduction in Atmospheric Sciences for teachers and military professionals; structure, behavior and processes of weather with climate systems; access to atmospheric data. Prerequisites: Undergraduate degree in related field; graduate classification.
- 629. Climate Change. (3-0). Credit 3.** Climate of the geological and recent past; methods of assessing climate and climatic change; mechanisms, models, theories, impact and prediction of climatic change. Prerequisites: ATMO 324 or equivalent; approval of instructor.
- 631. Climate Modeling. (3-0). Credit 3.** A study of mathematical models used in the simulation of climate. Development and structure of selected members of the hierarchy of models ranging from energy balance models to general circulation models. Applications to paleoclimate and future climate scenarios. Prerequisite: Approval of instructor.
- 632. Statistical Methods in Climate Research. (3-0). Credit 3.** Advanced techniques especially applicable to climatology; space-time random field analysis applied to stochastic models, parameter estimation, statistical forecasting, data interpolation and signal detection; applications to real data and climate model output. Prerequisites: STAT 601 or equivalent; approval of instructor.
- 635. Atmospheric Thermodynamics. (3-0). Credit 3.** Thermodynamic principles applied to the atmosphere; vertical structure and stability; weather processes; interpretation of vertical soundings. Prerequisites: MATH 308, PHYS 218; graduate classification.
- 636. Dynamic Meteorology. (3-0). Credit 3.** General circulation; stratospheric dynamics; tropical systems. Prerequisite: ATMO 611.
- 638. Dynamics of Convective Clouds. (3-0). Credit 3.** Parcel, slice and entrainment concepts; bubble and plume theories; spherical vortex; the starting plume; one-dimensional models; selected topics of current interest. Prerequisite: ATMO 611.
- 645. Cloud and Precipitation Physics. (3-0). Credit 3.** Physics of atmospheric condensation nuclei, ice in the atmosphere; precipitation processes; artificial modification of clouds; precipitation. Prerequisite: ATMO 612 or approval of instructor.
- 655. Satellite Data in Meteorology. (3-0). Credit 3.** Meteorological satellite programs of the United States and other countries; theory of meteorological measurements from artificial satellites; applications of satellite data in determinations of atmospheric structure and in forecasting; recent and current research studies; future programs. Prerequisite: ATMO251 or approval of instructor.
- 656. Tropical Meteorology. (3-0). Credit 3.** Role of the tropics in global circulation; structure and dynamics of the tropical zone; local and diurnal phenomena; synoptic components; tropical cyclones; role of cumulus-scale convection; current topics. Prerequisite: ATMO 251 or approval of instructor.
- 657. Mesometeorology. (3-0). Credit 3.** Theory and structure of mesoscale weather systems and their relation to larger and smaller scale systems. Prerequisite: ATMO 251 or approval of instructor.

- 658. Synoptic Meteorology. (3-0). Credit 3.** Mechanism and energetics of general circulation. Structure of large-scale systems. Persons desiring practice in analysis techniques should enroll for 1 hour or more of ATMO 685. Prerequisite: ATMO 251 or approval of instructor.
- 659. Tropical Cyclones. (3-0). Credit 3.** Tropical climatology; structure evolution and motion of tropical cyclones; tropical cyclone hazards; large scale tropical phenomena. Prerequisite: ATMO 251.
- 661. Atmospheric Turbulence. (3-0). Credit 3.** Classical turbulence theories and statistical approaches; closure models; effects of rotation and stratification; interpretations of atmospheric observations. Prerequisite: ATMO 611 or suitable background in fluid dynamics.
- 664. Laboratory Methods in Atmospheric and Environmental Sciences. (2-4). Credit 3.** Classroom and laboratory course; introduction to chemical techniques used to monitor the atmosphere and environment; instrumentation, sampling strategies; survey of current literature focusing on development of new techniques. Prerequisite: Graduate classification.
- 666. Agricultural Meteorology. (3-0). Credit 3.** Application of physical concepts of meteorology to problems arising in agriculture; meso- and micro-climates and their modification. Prerequisite: ATMO 324 or approval of instructor.
- 677. Geophysical Data Assimilation. (3-2). Credit 4.** Modern data assimilation methods applied to oceanic and atmospheric circulation models, as well as in other simple models; methods to interpolate one-, two-, and three-dimensional randomly spaced data to regular grids for use in numerical models of atmospheric and oceanic circulation. Prerequisites: OCNG 657, ATMO 632, STAT 601. Cross-listed with OCNG 677.
- 681. Seminar. (1-0). Credit 1.** Presented by students and faculty based upon their research work and upon surveys of the literature.
- 685. Directed Studies. Credit 1 or more each semester.** Offered to enable majors in meteorology to undertake and complete, with credit, in their particular fields of specialization, limited investigations not covered by any other courses in established curriculum.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of meteorology. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** For thesis or dissertation. Topic subject to approval of department head.

Bilingual Education (BIED)

- 610. Hispanic Bilingual Assessment and Monitoring Students. (3-0). Credit 3.** Assessing language ability; language assessment; evaluating and scoring different types of assessments; guided field based experiences. Prerequisites: Graduate classification; approval of department head.
- 611. Dual Language Program Methodologies. (3-0). Credit 3.** Use of theory and effective teaching practice in promoting students' development of strong social and academic skills; relationship of culture to language; guided field experiences. Prerequisites: Graduate classification; approval of department head.
- 612. Content Area Instruction for Hispanic Bilingual Programs. (3-0). Credit 3.** Theories and approaches for integrating English as second language; learning strategies on how plan, procedures and units engage language teachers, students, and learning environment; guided field experiences. Prerequisites: Graduate classification; approval of department head.
- 613. Spanish/English Bilingual Literacy. (3-0). Credit 3.** Social-linguistic characteristics of second language learners acquiring literacy skills; reading and literature instruction for second language learners; reading and writing process across the curriculum for Hispanic second language learners; guided field experiences. Prerequisites: Graduate classification; approval of department head.
- 614. Bilingual Education Curriculum Development. (3-0). Credit 3.** Analysis of past and current trends in curriculum development in bilingual education; guided field experiences. Prerequisites: Graduate standing; approval of department head.
- 615. Teacher Action Research in Bilingual Education. (3-0). Credit 3.** Philosophy of teacher action research in bilingual education settings using qualitative methods with educational issues related to English language learners; provide guided practice in data collection, analysis, and presentation of action research.

- 616. Spanish for Bilingual and Dual Language Programs. (3-0). Credit 3.** Understanding of dual language programs; literacy instruction through Spanish: socio-linguistic perspectives on literacy competence and effective instructional practices; guided field experiences. Prerequisite: Graduate classification; approval of department head.
- 617. Evaluation of Programs with Bilingual and Language Minority Students K-12. (3-0). Credit 3.** Evaluation and research models and methodologies in education of bilingual/language minority students from K-12. Prerequisites: EPSY 610 or the consent of the instructor.
- 618. Early Language and Literacy. (3-0). Credit 3.** Investigation of current language and literacy intervention research for young Hispanic/Latino children in preschool through second grade; emphasis on current intervention research targeting children at risk for reading difficulties in Spanish and/or English. Prerequisites: Graduate classification; approval of department head.
- 619. Second Language Acquisition in Pre-K-12; Advanced Theory and Practice. (3-0). Credit 3.** Examination of theory as a framework for explaining relationships, a research guide, and assumptions that inform practice; review how theory and practice for English only students have attempted to explain second language acquisition in second language learners. Prerequisites: Graduate classification; approval of instructor; BIED 611; BIED 612.
- 620. Current Issues in Bilingual Education. (3-0). Credit 3.** Survey of historical, political, language and sociocultural issues and their impact on the education of language minority groups. Prerequisites: EPSY 611 and EPSY 612; graduate classification; approval of instructor and department head.
- 632. Research in Second Language Education. (3-0). Credit 3.** Studies related to the teaching/learning process in two languages and field methods for carrying out those studies. Prerequisites: EPSY 611; EPSY 612 or consent of the instructor.
- 682. Seminar in... (1-0). Credit 1.** Knowledge, skills and attitudes in bilingual education. Specific topics are announced for each seminar offered. May be taken more than once but not to exceed 6 hours of credit. Prerequisite: Approval of department head.
- 683. Field Practicum in... Credit 1 to 15.** Supervised experience in professional employment settings in bilingual education with research related to current issues; requires a self-initiated proposal, a mid-semester formative report, and an end-of-semester summative report. Repeatable to 15 hours total. Prerequisite: Approval of instructor and department head.
- 684. Professional Internship. Credit 1 to 4 each semester.** Limited to advanced doctoral students; University directed experience in a professional employment setting; full-time participation and responsibility in experiences related to bilingual education. Repeatable to 9 hours total. Prerequisites: Approval of department head six weeks prior to registration; approval of department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems. Prerequisite: Approval of department head.
- 690. Theory of Educational Psychology Research. (3-0). Credit 3.** Theory and design of research problems and experiments in various subfields of educational psychology; communication of research proposals and results; evaluation of current research of faculty and students and review of current literature. May be repeated for credit. Prerequisite: Approval of instructor and department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of department head.

Department of Biochemistry and Biophysics

M. Bryk, R. S. Chapkin, J. Cruz-Reyes, S. Datta, T. Devarenne, E. A. Funkhouser, M. Glasner, V. Gohil, J. M. Gunn, E. D. Harris, P. He, J. Herman, A. K. H. Holzenburg, M. A. O. Höök, J. C. Hu, T. Igumenova, A. E. Johnson, C. D. Kaplan, G. M. Kapler, G. R. Kunkel, P. Li, P. A. Lindahl, M. D. Manson, W. L. McKeehan, J. E. Mullet, C. N. Pace, V. M. Panin, W. D. Park*, J.-P. Pellois, D. O. Peterson, D. W. Pettigrew, M. Polymenis, F. Qiao, F. M. Raushel, G. D. Reinhart (Head), H. Rye, J. C. Sacchettini, S. H. Safe, J. M. Scholtz, D. E. Shippen, P. Straight, M. D. Summers, S. Sze, J. R. Wild, R. F. Young, L. Zeng, X. Zhang

* Graduate Advisor

The Department of Biochemistry and Biophysics offers programs of study and research leading to the MS and PhD degrees in biochemistry. These programs are designed to provide the background for a career in independent research; in addition, graduate students gain experience in teaching, inasmuch as each is required

to serve as a teaching assistant during his or her graduate work. A non-thesis option for the MS degree is available to students not intending to enter a research career.

Ongoing research activities involve plants, animals and microorganisms and span the broad fields of molecular biology, protein and nucleic acid structure, virology, enzymology, biophysical chemistry and biochemical nutrition. The department occupies a modern research building that is well equipped to conduct biochemical research. Students entering graduate work in biochemistry are required to have adequate preparation in chemistry, mathematics, physics and molecular biology. The program leading to the PhD degree is designed for extensive involvement in research. The resulting dissertation must demonstrate a superior knowledge and understanding of the subject area. In addition, the student must demonstrate a broad and commanding knowledge of general biochemistry. There is no language requirement. There is, however, an English requirement for all students, including those seeking the MS degree. The department encourages interdisciplinary research projects with other departments. Detailed information about the graduate program may be obtained from the Biochemistry Graduate Programs Office, which can be reached by mail, by email at biobiograd@tamu.edu or by telephone at 1-800-4-TAMBIO. Information can also be obtained from the website at biochemistry.tamu.edu.

Biochemistry (BICH)

601. **Fundamentals of Biochemistry I. (3-0). Credit 3.** Basic biochemical concepts pertaining to the structure of the major biomolecules (proteins, carbohydrates, lipids and nucleic acids); the relationship of structure to function of these molecules; structure and action of enzymes; principles of bioenergetics. Prerequisite: One year of organic chemistry.
602. **Fundamentals of Biochemistry II. (3-0). Credit 3.** Major metabolic pathways for carbohydrates, lipids, amino acids, proteins and nucleic acids, emphasizing oxidative processes and the biosynthesis of RNA, DNA and protein; regulation of cellular metabolism. Prerequisite: BICH 601.
603. **General Biochemistry I. (3-0). Credit 3.** The biochemical properties of macromolecules found in living matter; proteins, enzymes and nucleic acids. Prerequisites: BICH 410 or BICH 601; CHEM 228 and CHEM 323.
605. **Methods of Biochemical Analysis. (3-0). Credit 3.** Experimental techniques important in biochemistry including methodologies for data analysis. Prerequisite: Graduate classification in biochemistry or approval of instructor.
608. **Critical Analysis of the Biochemical Literature. (2-0). Credit 2.** Reading and presentation of original articles in biochemistry and related fields to enhance understanding of experimental logic and scientific communication. Prerequisite: Graduate classification in biochemistry or approval of instructor.
609. **Preparation of a Biochemical Research Proposal. (2-0). Credit 2.** Development and presentation of hypotheses, specific aims, significance and experimental approaches for a biochemical research proposal. Prerequisite: Graduate classification in biochemistry.
624. **Enzymes, Proteins and Nucleic Acids. (3-0). Credit 3.** Chemical and physical properties of enzymes, proteins and nucleic acids; thermodynamics, kinetics and mechanisms of enzyme-catalyzed reactions and protein-nucleic acid interactions. Prerequisites: BICH 603; CHEM 324.
625. **Nucleic Acid—Protein Interactions. (1-0). Credit 1.** Mechanisms of nucleic acid-protein interactions involved in fundamental biochemical processes such as DNA replication and rearrangement, transposition, transcription, RNA splicing and translation; original research articles presented focusing on experimental approaches, interpretation of results and overall significance. Course may be taken 8 times for credit. Prerequisites: BICH 431 or GENE 431 or equivalent; approval of instructor. Cross-listed with MCMD 625.
628. **Computational Biology. (3-0). Credit 3.** Introduction to computational biology; formulations of biology problems as computational problems; computational approaches to solve problems in genomics and proteomics. Prerequisite: Graduate classification or approval of instructor. Cross-listed with CSCE 628.
631. **Biochemical Genetics. (3-0). Credit 3.** Genetic control of cellular metabolism; mechanism of gene action; gene-enzyme relationships; regulation of gene expression; structure and organization of genomes; biochemical manipulation and characterization of genetic molecules. Prerequisites: BICH 431 or GENE 431; BICH 603. Cross-listed with GENE 631.

- 650. Genomics. (3-0). Credit 3.** Modern genomics as a tool for understanding biological systems, gene structure, and organization as well as the history of sequencing technologies; focus on transcriptional, translational and functional genomics. Prerequisite: Graduate classification or approval of instructor. Cross-listed with BIOL 650.
- 654. Structural Biochemistry. (3-0). Credit 3.** Basic physics of X-ray diffraction, crystal structure methods, introduction to structural data bases, molecular geometry and molecular modeling. Prerequisite: Approval of instructor.
- 655. Crystallography Methods. (2-3). Credit 3.** The practice of x-ray diffraction in the study of biomolecules; solving protein crystal structures. Prerequisite: Graduate classification.
- 662. Eukaryotic Transcription. (1-0). Credit 1.** Intensive short course in molecular mechanisms of eukaryotic transcription, and its regulation. Prerequisite: BICH 631 or GENE 631 or approval of instructor. Cross-listed with GENE 662.
- 664. Fluorescence Spectroscopy. (1-0). Credit 1.** Theory underlying fluorescence spectroscopy as well as practical considerations that must be understood when utilizing fluorescence as an analytical tool; the use of both steady-state and time-resolved fluorescence measurements to evaluate fluorescence quantum yield, quenching, anisotropy, and energy transfer. Prerequisite: Graduate classification.
- 665. Biochemical Kinetics. (1-0). Credit 1.** Theoretical principles and practical approaches to analysis of chemical kinetics with specific examples of applications to biochemistry and biochemical investigations. Prerequisite: Graduate classification.
- 671. Macromolecular Folding and Design. (1-0). Credit 1.** Oral presentations and discussions in the general area of biomolecular structure, folding, function and design. May be taken 12 times. Prerequisite: Approval of instructor. Cross-listed with CHEM 671 and MCMD 671.
- 672. Biological Membranes. (1-0). Credit 1.** Seminar-based course examining recent discoveries in the structure, function and assembly of biological membranes; oral presentation by students on current literature in molecular biology and biochemistry. Prerequisite: Approval of instructor. Cross-listed with MCMD 672.
- 673. Gene Expression. (1-0). Credit 1.** Oral presentations and discussions related to the biochemistry and molecular biology of gene expression in animal, plant and microbial systems. May be repeated for credit up to 12 times. Prerequisite: Graduate classification in biochemistry or genetics or approval of instructor. Cross-listed with GENE 673.
- 674. Protein Folding and Stability. (1-0). Credit 1.** Selected topics from recent literature in the general areas of protein folding, structure, and stability. Prerequisite: Approval of instructor. Cross-listed with MCMD 674.
- 675. Plant Biochemistry and Genomics. (1-0). Credit 1.** Overview of current literature dealing with plant biochemistry/genomics; biochemistry topics will include the function of protein-protein interactions related to plant specific processes such as plant-pathogen interactions; genomics topics will focus on current analysis of plant genomes and how the derived information is being utilized to elucidate biochemical pathways. Prerequisite: Graduate classification.
- 676. Bacteriophage Biology. (1-0). Credit 1.** Oral presentation and discussion in the general area of the viruses of microbes and bacteria; literature review with a broad scope, from basic molecular biology of phages to practical applications of microbial virus technology. May be taken 12 times for credit. Prerequisite: Approval of instructor.
- 677. Chemical Genetics and Drug Discovery. (1-0). Credit 1.** Review, discuss and present scientific literature studies based on the usage of small molecules to alter protein function. Prerequisite: Graduate classification.
- 681. Seminar. Credit 1 each semester.** Original articles in biochemistry and related fields designed to broaden understanding of problems in the field and to stimulate research.
- 685. Directed Studies. Credit 1 or more each semester.** Biochemical laboratory procedures; preparations and instrumentation; problems assigned according to experience, interests and needs of individual student. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of biochemistry. May be repeated for credit. Prerequisite: Approval of instructor.
- 690. Theory of Biochemical Research. (2-0). Credit 2.** State-of-the-art examination of modern trends in various subfields of modern biochemistry concentrating on the design of experiments, evaluation of research results and discussion of the current literature. May be repeated for credit.

- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Laboratory facilities available for original investigations in various phases of biochemistry. Prerequisite: Approval of major advisor.
- 697. Methods in Teaching Biochemistry Laboratory. (1-0). Credit 1.** Theory and practical aspects of teaching Biochemistry labs, with emphasis on content, grading, instructional methods and practical aspects of biochemistry labs. May be repeated for credit. Prerequisite: Graduate classification in biochemistry.

Department of Biological and Agricultural Engineering

S. Ale, B. W. Auvermann, S. C. Capareda, K. D. Casey, M. E. Castell-Perez, C. L. Darcey, W. A. Dugas, Jr., J. M. Enciso, C. R. Engler, W. B. Faulkner, S. D. Fernando, G. Fipps, Y. Ge, J. R. Gilley, C. L. Gomes, Y. Huang, F. J. Jaber, R. Karthikeyan, A. L. Kenimer, R. E. Lacey, B. J. Lesikar, B. P. Mohanty, R. G. Moreira*, S. Mukhtar, C. L. Munster, Z. Nikolov, C. B. Parnell, G. L. Riskowski, S. W. Searcy (Head), B. W. Shaw, V. P. Singh, P. K. Smith, R. Srinivasan, R. Sui, J. M. Sweeten, J. A. Thomasson, X. Wang

* Graduate Advisor

The Department of Biological and Agricultural Engineering offers graduate studies leading to both engineering degrees and non-engineering degrees. Engineering degrees include Master of Science, Master of Engineering (non-thesis) and Doctor of Philosophy. In addition, the department offers courses and faculty supervision for students pursuing the Doctor of Engineering degree. Faculty expertise exists for study in the fields of environmental and natural resource engineering; bioprocess engineering; food engineering; biomaterial science; machine and energy systems; systems analysis; food, feed and fiber processing. Active research programs are ongoing in all of these areas. Minimum preparation for entry into advanced study for engineering degrees would include a baccalaureate degree in engineering. Students with non-engineering degrees can be accepted into an engineering program but must complete some basic engineering prerequisite courses.

The department offers two non-engineering graduate degrees. The Master of Science in Agricultural Systems Management provides students with agricultural and business backgrounds the opportunity to pursue either a research-based or a non-thesis graduate degree in systems management techniques for agricultural industries. The Master of Agriculture in Agricultural Systems Management is technology oriented with emphasis on systems analysis and management. It requires an internship for practical experience. The faculty also participates in supervision of students pursuing Master of Science and Doctor of Philosophy degrees from interdisciplinary faculties such as Food Science and Technology and Water Management and Hydrologic Sciences. Minimum preparation for entry into advanced study for non-engineering degrees would include a baccalaureate degree in Agricultural Systems Management, Food Science and Technology, or equivalent. Depending on degree and area of study, prerequisite courses may be required to provide the technology background.

Excellent research and study facilities exist which enhance all degree programs. Research facilities include modern laboratories, computer systems, testing equipment, data acquisition systems, technical support and areas for field studies. Supporting courses are available in a wide variety of disciplines as well as within the department. No foreign language is required for a PhD in Biological and Agricultural Engineering.

Biological and Agricultural Engineering (BAEN)

- 601. Advanced Agricultural Systems Analysis. (3-0). Credit 3.** Application of operations research tools and techniques to the analysis and management of technical systems in agriculture; optimization techniques applied to materials handling, supply chain logistics and other food and agricultural applications. Prerequisite: AGSM 301 or approval of instructor.
- 610. Spatial Technology for Site-Specific Crop Management. (2-3). Credit 3.** Techniques and technologies of precision crop management with emphasis on commercial practices; includes global positioning system, mapping software, variable rate technologies and decision support systems. Prerequisites: SCSC 301; graduate classification.
- 614. Renewable Energy Conversions (2-2). Credit 3.** Managing energy/power systems through engineering and technical aspects of quantifying and designing the suitability of several types of renewable energy resources; providing new insights of vast resources that future engineers can harness to augment diminishing supplies of non-renewable energy. Prerequisites: BAEN 320, BAEN 366 or equivalent; or instructor approval.

- 620. Food Rheology. (2-3). Credit 3.** Principles of elasticity, viscous flow and visco-elasticity applied to solid and liquid food materials; experimental determination of rheological properties using fundamental methods and empirical textural measurements; applications to food engineering research, textural measurement and quality control. Prerequisites: FSTC 315; PHYS 201; graduate classification.
- 622. Unit Operations in Food Processing (2-2). Credit 3.** Design of food process engineering systems; basic concepts of rheology and physical properties of foods; fundamentals of heat and mass transfer and process control. Prerequisites: Fluid Mechanics, Thermodynamics, Fluid Dynamics.
- 625. Advances in Food Process Engineering. (3-0). Credit 3.** Application of engineering fundamentals to the design of novel/advanced food processing systems including food irradiation, advances in thermal process, food freezing, food dehydration. Prerequisite: Graduate classification.
- 627. Engineering Aspects of Packaging. (3-0). Credit 3.** Introduction to properties and engineering aspects of materials for use as components of a package and/or packaging system; principles of design and development of packages; evaluation of product-package-environment interaction mechanisms; testing methods; environmental concerns; regulations. Prerequisite: Graduate classification.
- 631. Bioprocesses and Separations in Biotechnology. (3-0). Credit 3.** Application of engineering principles to recovery and purification of biological compounds derived from cell grown in bioreactors, transgenic animals, and plants. Process development, design, and scale up of downstream processes used in biotechnology and pharmaceutical industry. Emphasis on extraction, sedimentation, membrane filtration, precipitation, and liquid chromatography. Prerequisites: Senior classification in engineering, G7, G8 or approval of instructor.
- 651. Geographic Information System. (2-2). Credit 3.** Design, planning and implementation of geographic information systems; computer hardware and software evaluation; practical experience in data entry analysis and update of spatial and characteristic data; linkages of GIS and artificial intelligence; use of maps and remotely sensed data as data inputs. Prerequisites: RENR 444 and GEOG 398 or approval of instructor. Cross-listed with ESSM 651.
- 652. Advanced Topics in Geographic Information Systems. (2-1). Credit 3.** Advanced GIS topics with a focus on modeling actual GIS applications including relational and database theory, design and implementation and its connection to GIS; surface analysis with digital terrain models; and an introduction to spatial statistics. Prerequisite: BAEN 651.
- 653. Bioreactor Design. (3-0). Credit 3.** Kinetics of enzyme reactions and cell growth applied to bioreactor design, media formulation, cell culture conditions, oxygen transfer and sterilization. Prerequisite: CHEN 651 or approval of instructor.
- 661. Experimental Methods in Biological and Agricultural Engineering. (3-0). Credit 3.** Planning and carrying out empirical research with appropriate application of statistical methods for experimental design and analysis; experimental design, data analysis, hypothesis testing, and experimental errors. STAT 601 or STAT 651 and STAT 652 or equivalent with approval of the instructor.
- 662. Statistical Methods in Biological and Agricultural Engineering. (3-0). Credit 3.** Statistical methods applied to problems in biological and agricultural engineering; parameter estimation; probability distribution fitting; time-series analysis; random variable generation; uncertainty analysis. Prerequisite: Graduate classification.
- 665. Design of Biological Waste Treatment Systems. (3-0). Credit 3.** Management and treatment of organic wastes, with emphasis on human, agricultural and food processing wastes; engineering design of biological waste treatment processes; regulatory aspects affecting management of organic waste. Prerequisite: Graduate classification.
- 667. Entropy Theory and its Application in Water and Environmental Engineering. (3-0). Credit 3.** Entropy theory, probability distributions, parameter estimation, hydrologic design, rainfall-runoff, infiltration and soil moisture, frequency analyses, sediment yield, velocity distributions, flow forecasting, hydraulic geometry, geomorphic structure, water distribution reliability and water availability assessment. Prerequisites: Graduate classification; knowledge of calculus and statistics at the undergraduate level and approval of instructor.
- 669. Water Quality Engineering. (3-0). Credit 3.** Nonpoint source pollution processes including transport mechanisms and contaminant fate; design of best management practices for abating nonpoint source pollution. Prerequisites: AGEN 350 or equivalent; SCSC 301; ENGR 214; graduate classification.

- 670. Air Pollution Engineering. (3-0). Credit 3.** Current topics in air pollution engineering including design and operation of air pollution abatement systems (cyclone, bag filters and scrubbers), emission factors, dispersion modeling, permitting, odor sensing and control, EPA/State Air Pollution Regulatory Agency (SAPRA), TSP, PM10, and PM2.5. Prerequisites: AGEN 477 or MEEN 477; MEEN 328 and MEEN 344; or approval of instructor.
- 672. Small Watershed Hydrology. (3-0). Credit 3.** Hydrology of small agricultural watersheds; precipitation frequency analysis; infiltration; runoff; erosion theory; sediment transport theory; evapotranspiration, and use of hydrological models. Prerequisites: AGEN 350, SCSC 301 and MATH 308 or their equivalent; graduate classification.
- 673. Modeling Small Watersheds. (3-0). Credit 3.** Transport of water and chemicals in small agricultural watersheds; simulation using hydrologic models coupled with geographical information systems (GIS); impact of land use on the quality of surface water and groundwater evaluated. Prerequisites: Basic hydrology course and graduate classification.
- 674. Vadose Zone Hydrology. (3-0). Credit 3.** Fundamental concepts and advanced mathematical and experimental techniques for quantifying water, chemical, microorganism, and heat transport in the vadose zone (between soil surfaces and groundwater); provides a common platform for addressing issues related to soil and water resources, hydrology, geochemistry, microbiology, ecology, hydrogeology, and environmental engineering. Prerequisite: Graduate classification.
- 675. Hydrology Across Scale. (3-0). Credit 3.** Advanced concepts of surface and subsurface hydrologic processes, measurements, and modeling techniques across different spatio-temporal scales; contemporary issues related to the soil and water resources, hydrogeology, geochemistry, microbiology, ecology, hydrology, and environmental engineering. Prerequisite: Graduate classification in any engineering, agricultural science or geoscience program with environmental focus.
- 681. Seminar. Credit 1 each semester.** Reviews, reports and discussion of ideas, recent advances and current topics.
- 683. Peer-Review Process and Publication. (1-0). Credit 1.** Techniques for communicating results of research that are defensible in a peer review process; student and advisor will select a research topic, identifying an appropriate target refereed journal; no thesis/dissertation preparation as a writing project accepted; critique other papers; prepare paper for review by instructor. Prerequisite: Graduate classification in Biological and Agricultural Engineering only.
- 684. Professional Internship. Credit 1 to 4.** An on-the-job supervised experience program, conducted on an individual basis in the area of the student's specialization in mechanized agriculture. Prerequisite: Graduate classification or approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Advanced laboratory or field problems not related to student's thesis. Prerequisite: Graduate classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of agricultural engineering. May be repeated for credit.
- 690. Theory of Research. (1-0). Credit 1.** Development of research inquiry and discussion of applicable experimental design, theoretical techniques and methodological principles of conducting original research; evaluation of current research of faculty and students and in engineering and scientific literature. Communication of research proposals and results. May be repeated for credit. Prerequisites: Graduate classification and approval of department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Department of Biology

R. Aramayo, K. J. Aufderheide, D. Bell-Pedersen, M. J. Benedik, L. Campbell, G. E. Carney, V. M. Cassone, C. Criscione, D. J. Earnest, J. W. Erickson, L. R. Garcia, R. H. Gomer, I. F. Greenbaum, L. R. Griffing, T. C. Hall, P. E. Hardin, M. L. Harlow, A. K. H. Holzenburg, A. G. Jones, J. E. Kanz, W. M. Kemp, A. C. Lekven*, X. Lin, R. Lints, T. J. Lints, S. W. Lockless, D. S. MacKenzie, K. A. Maggert, J. R. Manhart, M. D. Manson, T. D. McKnight, U. J. McMahan (Head), C. O. Patterson, A. E. Pepper, B. D. Perkins, H. Qin, B. B. Riley, P. J. Rizzo, G. Rosenthal, K. J. Ryan, M. S. Sachs, H. W. Sauer, D. A. Siegele, J. L. Smith, M. S. Smotherman, J. Sorg, T. A. Stidham, M. D. Summers, M. H. Sweet, T. L. Thomas, W. K. Versaw, M. K. Wicksten, H. D. Wilson, R. F. Young, M. J. Zoran

* Graduate Advisor

Resources for Graduate Study

The Department of Biology offers graduate programs designed to prepare students for careers in academic institutions, government agencies and industry. The Biological Sciences Complex is centrally located on the campus of Texas A&M University. Graduate research is emphasized in over 50 laboratories that contain modern and sophisticated instrumentation for cellular, molecular, organismal and ecological studies. These laboratories provide opportunities for a broad spectrum of research specializations. The Microscopy Imaging Center, animal care facilities and a state-of-the-art DNA sequencing laboratory are among the many facilities housed in the Biological Sciences Complex.

The Department of Biology faculty has research interests that interface with those of faculty in the Colleges of Agriculture and Life Sciences, Geosciences, Medicine and Veterinary Medicine. Biology faculty participate in interdisciplinary programs in biological clocks, filamentous fungi, genetics, genomics, neuroscience and plant sciences. Cooperation is encouraged to broaden the research experience of graduate students.

Areas of Specialization in Graduate Research

PhD and MS degrees are offered in Biology, Botany, Microbiology and Zoology. General areas of research interests within these degrees include:

Cellular and Developmental Biology. Plant protoplast and tissue culture, transformation and regeneration; molecular biology and genetics of development and differentiation; nuclear organization; developmental neurobiology; cell surface interactions; physiology of photosynthesis.

Evolutionary Biology. Modern and classical approaches to plant and animal systematics and evolution; genomic and biochemical evolution; cytogenetics.

Molecular Biology. DNA and RNA isolation, cloning and sequencing; gene isolation, characterization, transfer and expression; bacterial and phage genetics; molecular processes of differentiation and embryogenesis; molecular microbiology and virology; genomics and informatics.

Organismal Biology. Comparative endocrinology and physiology; neurobiology; invertebrate ecology and ethology; marine biology; biological clocks.

Entrance Requirements

Coursework taken at the baccalaureate level normally must include mathematics through calculus, statistics, chemistry including organic chemistry, biochemistry, physics, genetics and adequate preparation in a biological science. Any remedial work will be in addition to the semester hours required for the degree. Graduate admissions decisions are based on students' academic record, research experience, letters of recommendation, GRE scores (verbal, quantitative and analytical) and suitability of students' research interests for programs in the department. For information about admissions, contact the Graduate Advisor, Department of Biology or visit us on the website at www.bio.tamu.edu.

Language Requirement

The Department of Biology has no foreign language requirement for any graduate degree program.

Biology

The PhD degree program in Biology is designed to provide the student with training in cellular, molecular and developmental and evolutionary biology, and to prepare the student for a leadership position in academic or industrial research. The Department of Biology offers a broad spectrum of research opportunities including plant molecular biology, molecular and cell biology of differentiation and development, gene structure and regulation in eukaryotic and prokaryotic organisms and their viruses, and cell structure and function. Students obtaining a degree in biology may also work closely with faculty in biochemistry, entomology, genet-

ics, plant physiology, medicine and veterinary medicine.

Biology PhD students must demonstrate competence in their specific area of research and are expected to develop proficiency in four of the following seven areas at the time of the preliminary examination: biochemistry, cell biology, developmental biology, genetics, microbiology, computational/mathematical biology and molecular biology. An MS student must demonstrate competence in at least three of the above seven areas at the time of the final examination.

(BIOL)

601. **Biological Clocks. (3-0). Credit 3.** Introduction to the formal properties of biological rhythms; cellular and molecular bases for rhythmicity; temporal adaptations of organisms using clocks. Prerequisite: Graduate classification or approval of instructor. Cross-listed with NRSC 635.
602. **Fundamentals of Transmission Electron Microscopy. (3-6). Credit 5.** This course is designed to provide students with state-of-the-art fundamentals in transmission electron microscopy (TEM). Students will be equipped with the necessary theoretical background in support of a strong hands-on course component comprising specimen preparation, image acquisition and interpretation. Students will gain sufficient practical experience to attain a proficiency level permitting independent operation of one of the transmission electron microscopes in the Microscopy and Imaging Center. Prerequisite: Students are required to write a half-page summary describing the specific problem they wish to resolve using transmission electron microscopy.
603. **Advanced TEM Methodologies in Life and Material Sciences (TEM II). (1-6). Credit 3.** Provides students with advanced TEM methodologies including specimen preparation and TEM imaging/analysis techniques as applicable to both biological and material samples; theory designed to support a strong hands-on component comprising specimen preparation, different imaging/diffraction/spectroscopic techniques and data interpretation. Prerequisites: BIOL 602; graduate classification.
604. **Fundamentals of Scanning Electron Microscopy (SEM) and Environmental Scanning Electron Microscopy (ESEM). (1-3). Credit 2.** Provides biologists, material scientists, and students from other disciplines with the techniques of operation of the scanning electron microscope (SEM) and the environmental SEM (ESEM) coupled with the appropriate theoretical background knowledge; individual instruction in support of their research endeavors involving SEM/ESEM. Prerequisite: Graduate classification.
605. **Principles and Methods of Systematic Biology. (3-3). Credit 4.** Evolutionary theory, sub-specific variation, speciation and phylogeny; evolutionary, cladistical and numerical taxonomy, methods and rules used in viral, bacteriological, botanical and zoological classification. Prerequisite: Graduate classification.
606. **Microbial Genetics. (3-0). Credit 3.** Basic understanding of microbial genetic systems and how genetic analyses can be used to investigate fundamental biological processes in bacteria. Prerequisite: Approval of instructor.
607. **Terrestrial Ecosystems. (3-3). Credit 4.** Population and community structure and function in organization of terrestrial ecosystems, the worldwide pattern of major terrestrial ecosystems. Representative ecosystems studied in the field. Prerequisite: BIOL 357 or equivalent.
608. **Theory and Applications of Light Microscopy. (2-3). Credit 3.** This course provides biologists, material scientists and students from other disciplines with the theoretical background and practical techniques of sample preparation, operation of light microscopes as well as image acquisition and processing. In addition, students will receive individual instruction which will facilitate the completion of their research projects involving light microscopic techniques. Prerequisite: half-page write-up describing how their graduate work will benefit.
609. **Molecular Tools in Biology. (3-0). Credit 3.** Interactive lecture course in molecular biology for beginning graduate students; introduction to tools and methodologies used in prokaryotic and eukaryotic molecular labs; choosing the appropriate experimental technique for a given scientific question; virtual experiments will reinforce the applications and introduce useful bioinformatics tools. Prerequisite: Graduate classification.
610. **Evolution. (3-0). Credit 3.** Fundamentals of evolutionary biology with an emphasis on evolutionary theory. Prerequisite: Graduate classification or approval of instructor.
611. **Molecular Biology of Differentiation and Development. (3-0). Credit 3.** Major paradigms of eukaryotic gene regulation in terms of the role of gene expression during ontogeny and the effect of dysfunction in these processes on the neoplastic state. Cross-listed with NRSC 611.

- 613. Cell Biology. (3-0). Credit 3.** Consideration of the eukaryotic cell as a functional, integrated unit in living organisms: structure, composition, function and biogenesis of subcellular components; dynamic processes and interactions of cells, including division, communication, and death; experimental approaches in modern cell biology and selected applications of experimental cell biology to problems in medicine. Prerequisite: BICH 410 or BIOL 213. Concurrent enrollment in BIOL 213 or BICH 410 strongly discouraged.
- 614. Signaling and Development. (3-0). Credit 3.** Sensing, signal transduction, regulation, differentiation, and morphogenesis as it occurs in prokaryotic and eukaryotic microorganisms at molecular, cellular, and genetic levels explored through classic and current research literature. Prerequisites: Graduate classification.
- 615. Signaling in Behavior and Development. (3-0). Credit 3.** Will focus on signaling pathways used in multicellular animals. In each lecture, major signaling pathways used in behavior, physiology, and development will be introduced at the molecular level, and then be discussed in the context of organismal biology. Prerequisite: Graduate classification. Cross-listed with NRSC 636.
- 620. Mechanisms of Transcription Initiation. (3-0). Credit 3.** Molecular mechanisms of transcription in prokaryotes and eukaryotes, with an emphasis on prokaryotic systems; scientific papers will provide the basis for class discussion. Prerequisite: Graduate classification.
- 622. Microbial Physiology. (3-0). Credit 3.** An area of microbial physiology will be explored at the molecular, cellular, and genetic levels through reading and discussion of classic and current research literature. The area of focus may change from semester to semester. May be taken three times for credit with approval of instructor. Prerequisite: Graduate classification.
- 624. Fungal Genetics. (3-0). Credit 3.** Development of classical and modern genetic approaches in Fungi; genetic approaches to understanding basic biological processes including gene regulation, cell-cell interactions and cellular organization. Prerequisite: Graduate classification.
- 627. Principles of Neuroscience I. (3-0). Credit 3.** This course presents a detailed introduction to the basic fundamentals of cellular and molecular neuroscience. Topics will include membrane potentials, action potential generation, and the mechanisms underlying synaptic transmission, as well as their molecular basis. Prerequisites: Graduate standing or permission of instructor. Cross-listed with NRSC 601.
- 628. Principles of Neuroscience II. (3-0). Credit 3.** This course presents a fully integrated overview of nervous system organization and systems-level neurobiology. Broad topics to be covered include sensory systems and sensory systems function, motor systems and neuromuscular function, central pattern generation and locomotion, homeostatic regulation, motivation, emotions, learning and memory, and circadian rhythms. Prerequisites: Graduate standing or permission of instructor. Cross-listed with NRSC 602.
- 634. Comparative Neurobiology. (3-0). Credit 3.** Cellular, molecular and systems neurobiology, together with neuroethology. A comparative approach to subject matter is stressed. Topics such as evolution of nervous systems and their diverse structure and complex functions are dealt with. Cross-listed with NRSC 634.
- 635. Plant Molecular Biology. (3-0). Credit 3.** Molecular aspects of plant growth, development, reproduction and evolution, emphasizing the structure, function, regulation, interaction and manipulation of plant genes; practical applications of plant molecular biology. Prerequisite: GENE 431.
- 636. Plant Cell Biology. (3-0). Credit 3.** Biogenesis, structure, function and interactions of plant cells during development, with emphasis on current literature and experimental approaches. Prerequisite: BIOL 413 or BIOL 613 or approval of instructor.
- 637. Field Systematic Botany. (2-6). Credit 4.** Basic principles and concepts of seed plant systematics; procedures of identification, family recognition, terminology, nomenclature, herbarium techniques, systems of classification and the taxonomic literature. Prerequisite: BIOL 301 or equivalent or approval of instructor.
- 644. Neural Development. (3-0). Credit 3.** Classical and current research literature to explore the major events in the development of a nervous system, including topics ranging from neurogenesis to synapse information. Prerequisite: Graduate classification. Cross-listed with NRSC 644.

- 649. Comparative Endocrinology. (3-3). Credit 4.** Function of endocrine glands and hormonal regulatory systems in different animal groups, vertebrates and invertebrates; mechanisms of action of hormones at the cellular and molecular level; recent experimental advances in endocrinological research; isolation, purification and assay of certain hormones. Prerequisite: Course in physiology, BICH 410 or equivalent, or approval of instructor.
- 650. Genomics. (3-0). Credit 3.** Modern genomics as a tool for understanding biological systems; review of gene structure and organization and the history of sequencing technologies; focus on transcriptional, translational and functional genomics. Prerequisite: Graduate classification or approval of instructor. Cross-listed with BICH 650.
- 651. Bioinformatics. (3-0). Credit 3.** Introduction to applications related to information processing in biological research with practical training exercises; includes internet databases, sequence alignment, motif prediction, gene and promoter prediction, phylogenetic analysis, protein structure classification, analysis and prediction, genome annotation, assembly and comparative analysis, and proteomics analysis. Prerequisite: Graduate classification or approval of instructor.
- 652. Epigenetic Mechanisms. (3-0). Credit 3.** Lectures and discussion of current research in epigenetic inheritance and its mechanisms in a variety of organisms. Structure of the course includes paper discussion and presentation, grant-writing, and grant-review. Prerequisite: BICH 631.
- 653. Zoogeography. (3-0). Credit 3.** Evolutionary, geological and ecological interpretations of the present and past distributions of terrestrial, freshwater and marine organisms.
- 654. Field Zoogeography. (0-3). Credit 1.** An optional laboratory designed to accompany BIOL 653, Zoogeography; field studies of ecological, geological and systematic processes which govern the geographical distribution of animals and formation of biogeographical provinces. Prerequisite: Graduate classification.
- 663. Biology of the Crustacea. (3-3). Credit 4.** Classification, life history, morphology, physiology, ecology, diseases, parasites and predators of crustaceans; economic aspects of crustaceans; original literature emphasized. Prerequisite: BIOL 335 or equivalent, or approval of instructor.
- 665. Biology of Invertebrates. (3-3). Credit 4.** Morphology, biology and phylogeny of invertebrates. Topics may be either detailed discussions of specific organisms or comparative information on a process. Prerequisite: BIOL 335 or equivalent.
- 667. Biology of Marine Annelida. (3-3). Credit 4.** Survey of marine annelids including their physiology, reproduction; emphasis on morphology and taxonomy of polychaetous annelids to enable students to more rapidly and accurately analyze benthic assemblage data. Prerequisites: BIOL 335 or equivalent; approval of instructor.
- 670. The Cell Cycle. (1-0). Credit 1.** Discussion of current cell cycle research, a universal principle of molecular, cellular and developmental biology, and of the causation of cancer and aging. Prerequisite: BIOL 413 or approval of instructor.
- 672. Molecular Biology of Photosynthesis and Light Signal Transduction. (3-0). Credit 3.** Structure, function, and regulation of the photosynthetic apparatus of a variety of photosynthetic systems, including plant chloroplasts, cyanobacteria, and purple and green photosynthetic bacteria; Photoreceptors involved in metabolic and developmental control in photosynthetic organisms. Prerequisite: BICH 631.
- 674. Cellular and Molecular Aspects of Development. (3-0). Credit 3.** Mechanisms of development at the cellular and molecular levels; gene regulation during embryogenesis; tissue interactions in relation to morphogenesis and differentiation, and pattern formation; emphasis on eukaryotic systems. Prerequisite: BIOL 413 or BIOL 414 or equivalent.
- 681. Seminar. (1-0). Credit 1.** Detailed reports on specific topics in field chosen. Students may register in up to but no more than three sections of this course in the same semester.
- 682. Research Seminar. (1-0). Credit 1.** Seminars presented by students based upon their research projects. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigations in fields other than those chosen for thesis or dissertation.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of biology.
- 690. Theory of Research. Credit 1 to 3.** Examination of subdisciplines of biology concentrating on the design of experiments, evaluation of research results, and the discussion of the primary literature. May be repeated for credit.

- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 697. Methods in Teaching Biology Laboratory. (1-0). Credit 1.** Introduction to teaching methods associated with the teaching of undergraduate biology laboratories; emphasis on effective preparation and delivery of laboratory course content, clear instructions for procedures and laboratory safety. Prerequisite: Graduate classification in a biological science.
- 698. Special Topics Behavior, Genes and Evolution. (3-0). Credit 3.** This literature and lecture-based course will introduce an integrative approach to the study of animal behavior, complementing evolutionary and ecological perspectives with molecular and genetic approaches and methodologies. Prerequisite: Graduate classification. Cross-listed with NRSC 698.

Other related graduate courses offered by the Department of Biology that may be of interest to biology students include BIOL 614 Microbial Development and MICR 689 Special Topics in...

Biophysics

(faculty, see [page 326](#))

(BIPH)

- 655. Molecular Biophysics: Macromolecular Interactions. (3-0). Credit 3.** Macromolecular interactions (i.e., binding from a perspective strongly rooted in statistical thermodynamics); understanding of the rates and equilibria of macromolecular interactions involving proteins, nucleic acids, and biological membranes; emphasize quantitative analysis and evaluation of different binding models relevant to biological regulation and signal transduction. Prerequisites: BICH 603, CHEM 601, knowledge of comprehensive biochemistry.

Department of Biomedical Engineering

B. E. Applegate, F. J. Clubb, E. M. Cosgriff-Hernandez, G. L. Coté (Head), J. C. Criscione, M. A. Grunlan, M. S. Hahn, A. Han, T. P. Hedman, H. A. Hogan, M. Hogan, W. Hwang, W. A. Hyman, A. Jayaraman, J. A. Jo, R. R. Kaunas, D. J. Maitland, K. C. Maitland, M. P. McDougall, M. J. McShane II, K. E. Meissner, J. E. Moore, Jr.*, M. Moreno, M. Pishko, C. M. Quick, K. R. Rajagopal, C. J. Schwartz, A. Trache, V. M. Ugaz, S. M. Wright, V. V. Yakovlev, A. T. Yeh

* Graduate Advisor

The thrust of the biomedical engineering graduate program is in the areas of biomedical sensing and imaging, biomedical optics, cardiovascular biomechanics and mechanobiology, and biomaterials. These concepts are applied and studied at whole body, tissue, cellular and molecular levels. Faculty members are presently involved in research from the macroscopic to the nanoscale in the areas of diagnostic and therapeutic systems, imaging systems, soft and hard tissue biomechanics, tissue characterization, biomaterials used in the human body, orthopedic biomechanics, FDA regulatory practices, bioinstrumentation, measurement and analysis of human body signals, and analysis of the interaction between humans and medical devices.

Biomedical Engineering (BMEN)

- 603. Information Processing in Biomedical Engineering. (3-3). Credit 4.** Methods for evaluating alternative approaches in signal processing systems for biomedical applications; provides familiarity with the wide variety of existing software and hardware systems. Prerequisite: Approval of instructor.
- 604. FDA Good Laboratory and Clinical Practices. (3-0). Credit 3.** Implementation of Good Laboratory Practices (GLP) for the submission of preclinical studies and use of Good Clinical Practices (GCP) in clinical trials in accordance with Food and Drug Administration (FDA) regulations; includes similarities and differences in GLP and GCP critical for the introduction of new drugs and medical devices. Prerequisites: BMEN 430 or BMEN 630 and Graduate classification, or approval of instructor.
- 605. Virtual Instrumentation Design for Medical Systems. (2-3). Credit 3.** Design of medical systems using graphics programming language of LabVIEW including the designing and programming of three virtual systems: cardiac monitor, electromyogram system for biomechanics, and sleep stage analyses for electroencephalograms. Prerequisite: Approval of instructor.

- 607. Clinical Engineering. (3-0). Credit 3.** Responsibilities, functions and duties of the hospital based biomedical engineer including program organization, management, medical equipment acquisition and use, preventive maintenance and repair and hospital safety. Prerequisite: Approval of instructor.
- 608. Optical Diagnostic and Monitoring Principles. (3-0). Credit 3.** Principles of optical spectroscopy, including absorption, fluorescence and scattering spectroscopy; emphasis on understanding how light interacts with biological samples and how these interactions can be optically measured, quantified and used for medical diagnosis and sensing. Prerequisites: MATH 308; PHYS 208.
- 609. Optical Therapeutic and Interventional Principles. (3-0). Credit 3.** Study of mechanical and thermal processes of radiation interaction with biological tissue; issues and objectives in therapeutic, surgical, and diagnostic applications; basic engineering principles used in developing therapeutic with a focus on the use of lasers and optical technology. Prerequisites: MATH 308; PHYS 208.
- 611. Biomedical Imaging Systems. (3-0). Credit 3.** The physics behind the major medical imaging systems including CT, MRI, Ultrasound and X-Ray will be introduced and described; a linear systems approach will be used along with basic diffraction theory. Prerequisites: BMEN 322; MATH 308.
- 620. Bio-Optical Imaging. (3-0). Credit 3.** Optical imaging techniques for detection of structures and functions of biological tissues; basic physics and engineering of each imaging technique. Prerequisite: MATH 308.
- 621. Microscale Bio-Optical Applications. (3-0). Credit 3.** Introduction to the biomedical application of lasers to manipulation, detection and visualization on (sub)cellular length scales, with emphasis on governing principles on which applications are founded; applications from recent literature (state-of-the-art) presented. Prerequisites: Approval of instructor.
- 624. Biomedical Sensing and Imaging at the Nanoscale. (3-0). Credit 3.** This course serves as an introduction to nanotechnology with an emphasis on biomedical techniques and medical applications. The material covered ranges from the basic physics of contrast agents to the engineering of current sensing and imaging systems applied at the nanoscale. Prerequisites: PHYS 208, MATH 308.
- 625. Biophotonics. (3-0). Credit 3.** Theory and application of optical instrumentation, including light sources, lasers, detectors, and optical fibers; instrumentation and engineering in biomedical applications of optics in therapeutics, diagnostics, and biosensing. Prerequisite: Graduate classification or approval of instructor.
- 626. Optical Biosensors. (3-0). Credit 3.** Introduction to biosensing principles and detailed analysis of optical methods for transduction; fluorescence-based transduction; molecular recognition of targets; immobilization of sensing reagents; quantitative analysis of sensing systems; design and characterization of sensing assays and associated measurement systems; review of historical and current trends in optical biosensors. Prerequisite: Approval of instructor.
- 627. Magnetic Resonance Engineering. (2-3). Credit 3.** Design, construction and application of instrumentation for MR imaging; fundamentals of the architecture of an MR spectrometer and the gradient subsystem used for image localization; emphasis on the radiofrequency sensors and systems used for signal generation and reception. Prerequisites: BMEN 420; ECEN 410, or ECEN 411, or approval of instructor; graduate classification. Cross-listed with ECEN 763.
- 630. Global Medical Device Regulation. (3-0). Credit 3.** Overview of applicable U.S. and international regulations and regulatory processes for the design, approval and marketing of medical devices. Prerequisite: Approval of instructor.
- 631. Thermodynamics of Biomolecular Systems. (3-0). Credit 3.** Introduces equilibrium and non-equilibrium statistical mechanics and applies them to understand various biomolecular systems; including ensemble theory, reaction kinetics, nonlinear dynamics, and stochastic processes; with applied examples such as enzyme-ligand binding kinetics, conformational dynamic of proteins and nucleic acids, population dynamics, and noise in biological signals. Prerequisites: BMEN 240, PHYS 208 and MATH 308.
- 632. Molecular and Cellular Biomechanics. (3-0). Credit 3.** Introduces biomolecules and their assemblies that play structural and dynamical roles in subcellular to cellular level mechanics, with emphasis on quantitative/theoretical descriptions, and discussions of the relevant experiment approaches to probe these nano to micro-scale phenomena; including topics in (1) self-assembly of cytoskeleton and biomembranes, (2) molecular motors, (3) cell motility, and mechanotransduction. Prerequisites: BMEN 240 and MATH 308.

- 635. Biomaterials Compatibility. (3-0). Credit 3.** Relevance of mechanical and physical properties to implant selection and design; effect of the body environment on metallic, ceramic and plastic materials; tissue engineering; rejection mechanisms used by the body to maintain homeostasis regulatory requirements. Prerequisites: Approval of instructor.
- 640. Design of Medical Devices. (3-0). Credit 3.** Overview of the multiple issues in managing the design of a marketable medical device, including the design process from clinical problem definition through prototype and clinical testing to market readiness; includes FDA pre- and post-market regulation, human factors and system safety considerations, and medical product liability. Prerequisite: Approval of instructor.
- 650. Biomedical Optics Laboratory. (2-3). Credit 3.** Biomedical optics technology; basic engineering principles used in developing therapeutic and diagnostic devices; a series of hands-on labs will be performed including optical monitoring, diagnostic and therapeutic experiments. Prerequisites: MATH 308; PHYS 208.
- 652. Cell Mechanobiology. (3-0). Credit 3.** The course will focus on how mechanical forces influence cell behavior through physical and biochemical mechanisms. The objectives include integrating engineering and cell biology to solve biomedical problems, which includes developing models for applying forces to cultured cells and tissues and measuring changes in cell biochemistry, structure, and function. Prerequisites: BMEN 282.
- 660. Vascular Mechanics. (3-0). Credit 3.** Application of continuum mechanics to the study of the heart arteries; on the measurement and quantification of material properties, and the calculation of vascular stresses; analysis of several cardiovascular devices to reinforce the need for careful analysis in the device design. Prerequisites: BMEN 240 and BMEN 341 or equivalents.
- 661. Cardiac Mechanics. (3-0). Credit 3.** Application of continuum mechanics and computational solid mechanics to the study of the mammalian heart; utilization of continuum mechanics and finite element analysis in solving non-linear boundary value problems in biomechanics. Prerequisites: BMEN 240 and BMEN 602; MEMA 467; or equivalents.
- 662. Vascular Fluid Mechanics. (3-0). Credit 3.** Bio-fluid mechanics of the human circulatory system including examination of disease development and medical treatments. Prerequisites: BMEN 240 or equivalent.
- 663. Soft Tissue Mechanics and Finite Element Methods. (3-0). Credit 3.** Application of continuum mechanics and finite element methods to the study of the mechanical behavior or soft tissues and associative applications in biomedicine. Prerequisites: BMEN 240 or equivalent.
- 668. Biothermomechanics. (3-0). Credit 3.** Application of continuum thermomechanics to quantify soft tissue behavior in response to combined thermal and mechanical loads including thermoelasticity and thermal damage. Prerequisites: BMEN 240, BMEN 341.
- 669. Entrepreneurial Issues in Biomedical Engineering. (3-0). Credit 3.** Description and analysis of issues associated with initiating business ventures to transfer biomedical technologies into the health care sector, including intellectual engineering technology area; and utilizing recent case studies of previous ventures. Prerequisite: Approval of instructor.
- 674. Communications in Biomedical Engineering. (3-0). Credit 3.** General concepts for communicating the results of biomedical research including written papers, conference proceedings, proposals and grants, as well as oral presentations and basic ethics. Prerequisite: Approval of instructor.
- 675. Biomedical Case Studies. (1-0). Credit 1.** Introduction to the engineering design process for solving biomedical problems by using the case study method in biomedical instrument design. Prerequisite: Approval of instructor.
- 680. Biomedical Engineering of Tissues. (3-0). Credit 3.** Introduction to engineering strategies used to repair tissue; literature-grounded overview of current strategies using stem cells, 3D scaffolds and drug/gene delivery including ethical considerations of these therapies. Prerequisite: BMEN 343 or approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Designed to permit student to broaden capability, performance and perspective in biomedical engineering via his or her own formal presentation and by presentations from other professionals. Prerequisite: Approval of instructor.

- 682. Polymeric Biomaterials. (3-0). Credit 3.** Preparation, properties, and biomedical applications of polymers including: polymerization; structure-property relationships; molecular weight and measurement; morphology; thermal transitions; network formation; mechanical behavior; polymeric surface modification; polymer biocompatibility and bioadhesion; polymers in medicine, dentistry, and surgery; polymers for drug delivery; polymeric hydrogels; and biodegradable polymers. Prerequisites: BMEN 342, or instructor approval.
- 683. Polymeric Biomaterial Synthesis. (3-0). Credit 3.** Overview of polymer synthetic routes and key structure-property relationships with emphasis on the design of polymeric systems to achieve specific properties; tissue engineering and drug delivery applications will be used as model systems to explore the process of biomaterial design from synthesis to device evaluation. Prerequisites: BMEN 343 or instructor approval.
- 684. Professional Internship. Credit 1 or more each semester.** Training under the supervision of practicing engineers in settings appropriate to the student's professional objectives. Prerequisites: Approval of chair of student's advisory committee and department head.
- 685. Directed Studies. Credit 1 to 12 each semester.** Allows students the opportunity to undertake and complete, for credit, limited investigations not included within thesis or dissertation research and not covered by other courses. May be repeated for credit. Prerequisites: Approval of designated instructor and approved project proposal.
- 686. Biomedical Nanotechnology. (3-0). Credit 3.** Introduction to nanotechnology applications in biomedicine; concepts of scale; unique properties at the nanoscale; biological interaction, transport, and biocompatibility of nanomaterials; current research and development of nanotechnology for medical applications, including sensors, diagnostic tools, drug delivery systems, therapeutic devices, and interactions of cells and biomolecules with nanostructured surfaces. Prerequisites: BMEN 343, approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of biomedical engineering. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Intercollegiate Faculty in Biotechnology

L. G. Adams, R. C. Alaniz, R. Aramayo, J. M. Ball, L. R. Berghman, R. C. Burghardt, R. S. Chapkin, Z. Cheng, C. J. Coates, E. G. Cothran, M. F. Criscitiello, T. A. Cudd, P. de Figueiredo, J. N. Derr, T. Duong, E. A. Funkhouser, B. J. Gastel, T. J. Gentry, C. A. Gill, M. A. Grunlan, J. M. Gunn, T. C. Hall, A. Han, C. B. Hilty, P. Holman, M. T. Holtzapple, N. H. Ing, A. Jayaraman, J. S. Johnston, K. C. Kao, W. Liu, C. A. Loopstra, C. W. Magill, J. C. Miller, R. C. J. Miranda, J. E. Mullet, M. Muthuchamy, W. Mwangi, D. Ng, Z. Nikolov, W. D. Park, C. O. Patterson, S. D. Pillai, M. Pishko, K. S. Rathore, D. H. Russell, J. C. Sacchetti, J. E. Samuel, C. J. Schwartz, D. A. Siegele, L. C. Skow, A. Sorescu, D. M. Stelly, T. L. Thomas, E. Tiffany-Castiglioni, V. M. Ugaz (Intercollegiate Faculty Chair), C. J. Welsh, J. R. Wild, R. F. Young, S. Yuan, H. Zhang

The Master of Biotechnology (MBIOT) is designed for students who want professional graduate training with an industry orientation in the life sciences. It is intended to emphasize the use of problem solving and technical skills in the life sciences. The Master of Biotechnology degree program is non-thesis, interdisciplinary, and jointly administered by five colleges (Agriculture and Life Sciences, Dwight Look College of Engineering, Mays Business School, Science, Veterinary Medicine and Biomedical Sciences). Program administration includes a Program Chair and Faculty of Biotechnology. This program is one of a select few nationally that is designed to cut across the business and life science disciplines to better prepare students for the variety of career pathways associated with the life science industries. It is a degree combining business and science and requires the completion of a minimum of 39 hours of coursework and a satisfactory comprehensive final exam.

Individuals with a baccalaureate degree in a life science field from a college or university of recognized standing, or qualified seniors in their last semester, may apply for admission to the program. Due to the combination of professional and technical classes, prerequisites may be required before students can take the core curriculum courses. The Program Chair will specify prerequisite work when necessary. Please see [page 88](#) for more information.

Biotechnology (BIOT)

- 601. Biotechnology Principles and Techniques I. (0-8). Credit 4.** Basic theories and techniques essential to laboratory research in agricultural, environmental or medical biotechnology such as laboratory safety and records keeping, genome informatics, DNA analysis, RNA analysis, protein analysis and analysis of biological systems. Prerequisite: Graduate classification and approval of instructor.
- 602. Biotechnology Principles and Techniques II. (0-8). Credit 4.** Application of basic theories and principles of biotechnology to team and individual research problems in a laboratory setting. Prerequisites: BIOT 601; graduate classification.
- 603. Applied Principles of Biotechnology. (1-9). Credit 4.** Applied experience with biotechnology laboratory procedures and instrumentation in a research environment. May be repeated twice for credit. Prerequisites: BIOT 601; graduate classification.
- 635. Molecular Biotechnology. (3-0). Credit 3.** Theory and application of molecular biotechnology; consideration of the structure and function of cellular components and methods to characterize these components with reference to examples in industry. Prerequisite: Approval of instructor. Cross-listed with ANSC 635.
- 645. Biotechnology Writing. (3-0). Credit 3.** Development of biotechnology writing and editorial skills; communication of specialized information to the public and peers. Prerequisite: Graduate classification and approval of instructor.
- 681. Biotechnology Seminar. (1-0). Credit 1.** Review and discussion of current topics in biotechnology industries, with focus on skills essential to success in the corporate environment such as communication, interviewing and interpersonal skills. Prerequisite: Graduate classification and approval of instructor.
- 684. Directed Professional Internship. (4-0). Credit 4.** A directed internship in an organization that provide on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. May be taken two times for credit. Prerequisite: Approval of the Chair of the Faculty of Biotechnology.
- 685. Directed Studies. Credit 1 to 4.** Provides customized training and experience to students in the Biotechnology Program; topics can include laboratory research, scientific literature reviews, biotechnology market surveys, and training in technology commercialization. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of biotechnology. May be repeated for credit. Prerequisite: Approval of instructor.

Botany

The aims of a PhD degree program in Botany are to train the student to do original and imaginative research in the botanical sciences, to develop the student's ability to expertly judge current research, and to provide experience and training in the presentation and publication of scientific findings. The Department of Biology offers the opportunity for research in plant cell and molecular biology, organismal plant biology, and plant systematics and evolution. Association with other departments could emphasize various aspects of plant science, such as physiology, genetics, pathology, horticulture, crops and forestry.

Botany PhD students must demonstrate competence in their specific area of research and are expected to develop proficiency in four of the following seven areas: biochemistry/molecular biology, cell biology, genetics, physiology, structure/development, computational/mathematical biology and systematics. In addition, the candidate should have a sufficient depth-of-knowledge of the organism or system used in the dissertation research. An MS student must demonstrate competence in at least three of the above seven areas at the time of the final examination.

(BOTN)(faculty and courses are listed under BIOL., see [page 332](#))

685. Directed Studies. Credit 1 to 6 each semester. Limited investigations in fields other than those chosen for thesis or dissertation.

691. Research. Credit 1 or more each semester. Research for thesis or dissertation.

Other related graduate courses offered by the Department of Biology that may be of interest to botany students include BIOL 602 Transmission Electron Microscopy, BIOL 617 Cell Biology, BIOL 672 Molecular Biology of Photosynthesis and BIOL 689 or MICR 689 Special Topics in...

The Bush School of Government and Public Service

D. Bearfield, A. L. Bies, A. O. Bowman, L. Bright, W. A. Brown, A. H. Card, J. R. Cerami, K. E. Cortes, R. C. Crocker, L. A. Eden, J. A. Engel, K. S. Gawande, J. M. Griffin, C. F. Hermann, V. Hudson, D. L. Kerr, S. Kirkpatrick, J. Lahey, C. Layne, X. Lu, R. Mu, J. L. Mumpower, L. C. Napper, W. Norris, J. M. Olson, G. Y. Reinhardt, S. E. Robinson, L. Taylor, A. Vedlitz, W. F. West, G. W. Williams

The Bush School of Government and Public Service offers master's degrees in two areas as well as five graduate certificate programs. Study at the Bush School can lead to a Master of Public Service and Administration degree (MPSA) or Master in International Affairs (MPIA) degree. The professional degree programs prepare students for careers in public service spanning the public and not-for-profit sectors, both domestically and internationally. The courses offered in this catalog are designed for individuals with those interests. For those students seeking to strengthen their skills in international affairs or homeland security with graduate coursework, the Graduate Certificate in Advanced International Affairs or the Graduate Certificate in Homeland Security are offered. The Bush School also offers the Graduate Certificate in Nonprofit Management for individuals who seek to enhance their understanding of nonprofit organizations and management practices appropriate to the nonprofit sector. Two other certificates are intended for specialized audiences. The Graduate Certificate in China Studies, sponsored jointly with the College of Liberal Arts, is available to all degree-seeking graduate students at Texas A&M. The Graduate Certificate in National Security Affairs provides instruction for those with relevant career experience.

The interdisciplinary curriculum for both degrees combines a solid foundation of theoretical and empirical knowledge with the development of leadership skills and instruction in an area of prime interest to prospective employers. The MPSA program offers a two-year, full-time course of study that includes 48 hours of academic coursework in one of two tracks: Public Management or Public Policy Analysis. Additionally, students have the option to choose a concentration in a substantive area, such as nonprofit management; state and local policy and management; energy, environment, and technology policy and management; security policy and management; and health policy and management. The program requires students without at least two years of professional experience related to the degree program to complete an internship in a public agency or nonprofit organization during the summer between the first and second years of study. The program concludes with two semesters of capstone policy seminars that give students the opportunity to apply their knowledge and skills to address an important policy or management issue for a government or nonprofit agency.

The Master of Public Service and Administration program, in conjunction with the Political Science, Economics, and Sociology departments, also offers dual degree programs which enable students to receive a Political Science, Economics, or Sociology undergraduate degree and a Master of Public Service and Administration (MPSA) degree in five years. Students admitted into one of the dual degree programs will be enrolled in Bush School graduate courses with an undergraduate classification for the fall of their fourth year. They will be reclassified as a graduate student upon completing 108 credit hours, typically in the following fall semester. To be eligible for admission into a dual degree program, students must have a GPA of at least 3.25 and must have completed the specific course prerequisites either for a Bachelor of Arts or a Bachelor of Science degree in Political Science, Economics, or Sociology, as well as the courses required by the College of Liberal Arts and by Texas A&M University for an undergraduate degree by the end of their third year. Students admitted into the dual degree program will complete the same two-year, 48-hour curriculum as other students admitted to the Bush School's MPSA program.

The MPIA program offers a two year, full-time program that includes 48 hours of academic coursework in one of two tracks: international economics and development or national security and diplomacy. This is a professional graduate program with course offerings designed for students planning careers in the conduct of international affairs. An internship or intensive foreign language study is required during the summer between the second and third semesters of study. To refine study in either track, students construct a program

of study based on two or more concentrations or clusters of related courses such as economic development, diplomacy in world affairs, intelligence statecraft, national security policy or various regional studies. To graduate from this program, students must successfully pass a foreign language test administered by the American Council on the Teaching of Foreign Languages demonstrating a minimal proficiency in speaking and comprehension at the established rating of “intermediate low.”

The MPIA program, in conjunction with the Economics department, also offers a dual degree program that enables students to receive both their Economics undergraduate degree and a Master of International Affairs (MPIA) degree in international economics and development in five years. Students admitted into this program will be enrolled in Bush School graduate courses with an undergraduate classification for the fall and spring of their fourth year and will be reclassified as master’s degree students upon completing 120 credit hours, typically in the following fall semester. To be eligible for the joint program, students must have completed the specific course prerequisites either for a Bachelor of Arts or a Bachelor of Science degree in Economics, as well as the courses required by the College of Liberal Arts and by Texas A&M University for an undergraduate degree by the end of their third year and have a GPA of at least 3.25. Students who are admitted will complete the same two-year, 48-hour curriculum and language requirement as other students admitted to the Bush School’s MPIA program.

The MPIA program, in conjunction with the International Studies degree program in the College of Liberal Arts, also offers a dual degree program that enables students to receive both their International Studies undergraduate B.A. degree and a Master of International Affairs graduate degree in five years. Students admitted to the joint degree program will have at least a 3.5 GPA, have taken all of their prerequisite courses within the politics and diplomacy emphasis track and have completed 96 hours by the fall of their fourth year. Students will be reclassified as master’s degree students upon completing 120 credit hours, typically the following fall semester. Admitted students are required to complete all courses required by the College of Liberal Arts and Texas A&M University for an undergraduate degree and the same 48 hour curriculum as other students admitted to the Bush School’s Master’s Degree in International Affairs.

The Bush School Graduate Certificate in Advanced International Affairs (CAIA) packages critical graduate education experiences in a novel way. It involves a multidisciplinary series of graduate courses for people whose careers or personal interest cause them to seek a more complete understanding of world affairs, but who may not have the time or disposition for a longer, residential graduate degree. Students admitted to the certificate program complete 12 credit hours of study typically involving four graduate-level courses. The set of courses from which students select include international security, diplomatic history, international business and government, geography and world systems, international law and certain skill courses.

The Bush School Graduate Certificate in Homeland Security (CHLS) is a 15-credit graduate certificate program designed for students from a wide variety of academic and professional backgrounds. Combining a broad understanding of homeland security issues and strategies at the national level with an in-depth analysis of key security issues affecting federal, state, and local government, as well as private business, the CHLS can serve as a stand-alone enhancement to other field-specific qualifications. All CHLS students complete a 3-credit hour entry-level course in homeland security fundamentals and choose four elective courses based on their individual preferences or needs. There are a variety of elective courses to choose from to complete the certificate. The CHLS is offered totally and only as a web-based distance education program with no residency requirements.

The Bush School Graduate Certificate in Nonprofit Management (CNPM) enables students to gain an increased understanding of the nonprofit sector, nonprofit organizational structures (i.e., legal frameworks and governance institutions) and management practices appropriate to the sector (i.e., strategy, volunteer behavior, and fund raising). With this preparation, students will be able to offer effective leadership in the management of nonprofit organizations. The certificate requires students to complete 12 credit hours of graduate level coursework. This includes two required courses: Foundations of the Nonprofit Sector and Management and Leadership of Nonprofit Organizations. Students can select from a variety of electives, such as fundraising and program evaluation, to satisfy the remaining six hours of required coursework.

The Bush School Graduate Certificate in China Studies (CCS) is a collaborative academic program of the Bush School of Government and Public Service and the College of Liberal Arts. The certificate program is open to students from any graduate degree program at Texas A&M University. It provides students a menu of courses offered by various departments and colleges that in aggregate create a more robust curriculum of courses on China than is currently available in any single department. A student admitted to the certificate program completes 12 credit hours of study typically involving four graduate level courses available in residence. The set of courses from which a student selects includes such topics as economic development, foreign policy, history, population and society, and strategic thought. Designed as an interdisciplinary learning experience, no more than two courses from any one department will count toward the certificate. Inquiries may be addressed to the Bush School. An individual who successfully completes the certificate program will be

supervised by the Bush School and College of Liberal Arts. Grades for courses taken as part of this program will appear on the official transcript, together with notation that the certificate has been achieved.

The Bush School Graduate Certificate in National Security Affairs (CNSA) is a 12 credit hour graduate certificate offered by the Bush School of Government and Public Service. It is intended to provide a comprehensive overview of the formation and operation of the United States national security policy for individuals with specific background and experience. Individuals may apply who hold a terminal or graduate degree from an accredited university and three years employment (or a bachelor's degree and five years employment) in a firm, laboratory, agency or non-governmental organization in which the individual's responsibilities involve the development or provision of systems, services or products for use in national or international security. Applicants must meet these requirements and those for admission for graduate study at Texas A&M University as a non-degree seeking student (G-6). Proficiency in reading, writing and comprehending spoken English at a level necessary for graduate instruction is required.

Graduate-level courses for the certificate include a mix of required courses and electives selected from a structured menu. Among those courses included are those dealing with deterrence, intelligence, terrorism, and national security policy. An individual who successfully completes the program will be awarded the certificate by the Bush School. Grades for courses taken as part of this program will appear on the official university transcript, together with notation that the certificate has been achieved. Inquiries may be addressed to the Bush School.

An applicant, once admitted, can enter the certificate program within one calendar year and must have a bachelor's degree and meet certain other qualifications. Individuals who successfully complete a certificate program will be awarded a certificate by the Bush School.

For further information about the Bush School including requests for admission materials, write to Bush School, Texas A&M University, 4220 TAMU, College Station, TX 77843-4220, send an email to admissions@bushschool.tamu.edu or visit us on the website at bush.tamu.edu.

(BUSH)

(International Affairs courses are listed under INTA, see [page 453](#))

(Public Service and Administration courses are listed under PSAA, see [page 529](#))

- 601. Leadership and Public Administration. (3-0). Credit 3.** Overview of the field of public administration; theory and practice of leadership. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 631. Quantitative Methods in Public Management I. (3-0). Credit 3.** Introduction to the common methods for social and policy analysis with a focus on application of methods such as analysis of variance and regression, to tasks including policy analysis, evaluation and survey research; emphasis on the performance of social and policy analysis, although some statistical theory is introduced. Prerequisites: Graduate classification and approval of MPSA or MPIA director; STAT 303 or equivalent.
- 632. Quantitative Methods in Public Management II. (3-0). Credit 3.** Numerous formal aspects and methods of decision-making useful in public management including benefit-cost analysis, program evaluation and survey sampling; emphasis on theoretical foundation and practical application; collection and analysis of information, formulation of results and presentation of conclusions. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 635. Quantitative Methods in Public Management II: Policy Analysis Emphasis. (3-0). Credit 3.** Continuation of BUSH 631. Advanced instruction in making useful policy recommendations based on regression analysis, survey design, data analysis, and techniques for interpreting statistical output from multiple disciplines; application of analysis software. Prerequisites: BUSH 631; approval of MPSA or MPIA Director.
- 636. Quantitative Methods II: Game Theory Emphasis. (3-0). Credit 3.** Continuation of BUSH 631; advanced instruction in quantitative social science research methods; designed to help students understand influences and constraints on decision-makers, improve the ability to characterize and predict decisions and assess the validity of information presented, and analyze situations of relevance to making decisions as a public manager. Prerequisites: BUSH 631; PSAA or INTA majors only.
- 685. Directed Studies. Credit 1 to 4.** Directed individual instruction in selected problems in government and public service. Prerequisites: Graduate classification and approval of program director.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Mays Business School (BUAD)

- 620. Business Communication. Credit 1 to 3.** Effective oral and written communication for corporate settings; communication theory and practice with core MBA and other courses; practice with oral presentation skills in corporate situations. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** One credit hour seminar focusing upon a variety of skills essential in a management career including communications, business and government relations and interpersonal skills. An Executive Lecture Series may form a component of this course. Classification 6 students may not enroll in this course. Prerequisite: Enrollment is limited to BUAD classification 7 and 8 graduate students.
- 684. Professional Internship. Credit 1 to 6.** A directed internship in an organization to provide students with on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. Classification 6 students may not enroll in this course. Prerequisite: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed study of selected problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of business administration. Prerequisite: Approval of instructor.
- 693. Professional Study. Credit 1 to 6.** Approved professional study project as part of the Mays MBA Program. Enrollment limited to Business Administration G7 students.
- 698. Writing for Publication. (3-0). Credit 3.** Writing in academic disciplines and settings. Writing for different audiences and purposes. Style; planning and development of journal articles; grant proposals; correspondence; oral presentations; technical reports. Permission of departmental/college graduate advisor. Prerequisite: advanced standing in master's/doctoral program.

Artie McFerrin Department of Chemical Engineering

A. Abdel-Wahab, M. Akbulut, P. B. Balbuena, M. A. Barrufet, D. B. Bukur, T. Cagin, M. Castier, Z. Chen, Z. Cheng, N. Elbashir, M. M. El-Halwagi, G. F. Froment, C. J. Glover (Interim Head), J. C. Grunlan, J. Hahn, M. S. Hahn, K. R. Hall, J. C. Holste*, M. T. Holtzapple, A. Jayaraman, H. Jeong, K. C. Kao, Y. Kuo, C. D. Laird, P. Linke, J. L. Lutkenhaus, M. S. Mannan, Z. Nikolov, M. Nounou, B. Palmer, M. Pishko, K. R. Rajagopal, M. O. Scully, J. M. Seminario, D. F. Shantz, V. M. Ugaz, S. Vaddiraju, B. A. Wilhite, T. K. Wood

* Graduate Advisor

The Department of Chemical Engineering offers three graduate degrees: Doctor of Philosophy (PhD), Master of Science (MS), and Master of Engineering (MEng). The PhD and MS degree programs include a significant research component in addition to graduate coursework. Information about specific departmental requirements for coursework and examinations is available upon request from the graduate advisor and on our website: www.che.tamu.edu.

Some of the research areas available within the department include: advanced materials, applied fluid mechanics and transport phenomena, biochemical engineering, catalysis, environmental process engineering, kinetics and reaction engineering, microelectronics and plasma processing, nanotechnology, natural gas conversion, polymers, process modeling and control, process optimization, process safety and design, systems biology, thermodynamics, tissue engineering, and molecular simulation. Modern equipment is available in numerous laboratories to perform research in these and other areas.

There is no foreign language requirement for the PhD program in chemical engineering.

Chemical Engineering (CHEN)

601. **Chemical Engineering Laboratory Safety and Health. (1-0). Credit 1.** Control of hazards associated with chemical engineering research laboratories and the chemical process industry; causes and prevention of accidents, emergency procedures, safety codes, health effects of toxic substances and experimental design for safety. Prerequisite: Graduate classification.
604. **Chemical Engineering Process Analysis I. (3-0). Credit 3.** Development and analysis of chemical process models that involve systems of algebraic equations, ordinary differential equations and partial differential equations. Prerequisite: MATH 308 or approval of instructor.
605. **Chemical Engineering Process Analysis II. (3-0). Credit 3.** Formulation of mathematical models and solution of resulting mass and energy balance equations by modern computational techniques, applications to separation processes, chemical kinetics, reaction engineering, heat and mass transfer. Prerequisite: CHEN 320 or approval of instructor.
614. **Advanced Transport Phenomena I. (4-0). Credit 4.** First part of a two-semester sequence covering advanced transport phenomena; emphasis is placed on momentum transfer or fluid mechanics applied to chemical engineering problems. Prerequisite: Approval of instructor.
615. **Advanced Transport Phenomena II. (3-0). Credit 3.** Advanced energy and mass transfer in chemical engineering processes. Prerequisite: Approval of instructor.
623. **Applications of Thermodynamics to Chemical Engineering. (3-0). Credit 3.** Application of thermodynamics to chemical engineering operations and processes. Prerequisite: CHEN 354 or approval of instructor.
624. **Chemical Engineering Kinetics and Reactor Design. (3-0). Credit 3.** Rates and mechanisms of chemical reactions. Thermal and catalytic reactions both homogeneous and heterogeneous. Prerequisite: CHEN 464 or approval of instructor.
629. **Transport Phenomena. (3-0). Credit 3.** Principles of transfer of momentum, energy and mass studied by application to advanced chemical engineering problems. Theoretical analogy of these three modes of transfer. Prerequisite: CHEN 424 or approval of instructor.
631. **Process Dynamics and Advanced Process Control. (3-0). Credit 3.** Modeling, analysis, and simulation of linear and nonlinear process systems; model-based control techniques for achieving desired process dynamics. Prerequisite: CHEN 461 or approval of instructor.
633. **Thermodynamics and Kinetics of Confined Fluids. (3-0). Credit 3.** Emphasis on fluids, adsorption phenomena (theory and applications), phase transitions in confined fluids (capillary condensation and freezing), the behavior of confined water, reactions in confinement, and applications. Prerequisite: CHEN 623 or approval of instructor.
634. **Catalysis and Multiphase Reactor Design. (3-0). Credit 3.** Introduction and overview of catalyzed reactions; topics include heterogeneous catalysis and relevant surface science concepts, mass transport, and reactor design; discussion of industrially relevant chemistries. Prerequisite: CHEN 624 or approval of instructor.
635. **Advanced Nanostructured Materials. (3-0). Credit 3.** Chemical synthesis and characterization of materials with structures and properties in the nano-scale; emphasis on the fundamental science and engineering of understanding and manipulating “bottom-up” material formation. Prerequisite: Approval of instructor.
640. **Rheology. (3-0). Credit 3.** Principles of stress, deformation and flow; vector and tensor equations of fluid mechanics. Behavior of Newtonian, non-Newtonian and viscoelastic fluids. Prerequisite: MATH 601 or approval of instructor.
641. **Polymer Engineering. (3-0). Credit 3.** Principles and practice of polymer structure, synthesis, reaction mechanisms and kinetics; polymer characterization, chemical and physical properties degradation and recycling, melt and solid mechanical and rheological properties. Technology of production and processing operations. Prerequisite: Graduate classification.
642. **Colloidal and Interfacial Systems. (3-0). Credit 3.** Fundamental principles related to interactions, dynamic, and structure in colloidal and interfacial systems. Concepts covered include hydrodynamics, brownian motion, diffusion sedimentation, electrophoresis, colloidal forces, surface forces, polymeric forces, aggregation, deposition, equilibrium phase behavior, rheology, and experimental methods. Prerequisites: None.

- 643. Applied Statistical Mechanics of Fluids. (3-0). Credit 3.** Application of molecular theories and computer simulation techniques to describe the thermodynamics and transport properties of fluids and fluid mixtures. Prerequisite: CHEN 623 or approval of instructor.
- 644. Nanotechnology: The Physics, Chemistry, and Engineering of Nanotechnology. (3-0). Credit 3.** Introduction to the basics and tools of nanotechnology; nanotechnology approaches and algorithms to analyze, design and simulate systems; focus on developing, modifying, adapting and creating tools to solve problems in the field. Prerequisite: Approval of instructor.
- 650. Introduction to Microfabrication and Microfluidics Technology. (3-0). Credit 3.** Micro Electro Mechanical Systems (MEMS Technology). To study the fundamentals of fluidics, heat and mass transfer, surface chemistry, and electrochemical interactions. Prerequisite: None.
- 651. Biochemical Engineering. (3-0). Credit 3.** Integration of principles of engineering, biochemistry and microbiology; application to the design, development and improvement of industrial processes that employ biological materials. Engineering discipline directed toward creative application of interdisciplinary information to the economic processing of biological and related materials. Prerequisite: Approval of instructor.
- 653. Chemical Engineering in Tissue Engineering and Drug and Gene Delivery. (3-0). Credit 3.** Application of chemical engineering principles to the examination of tissue engineering systems, metabolic engineering systems, drug design and delivery, and gene delivery. Prerequisite: Approval of instructor.
- 655. Process Safety Engineering. (3-0). Credit 3.** Applications of engineering principles to process hazards analysis including source and dispersion modeling, emergency relief systems, fire and explosion prevention and mitigation, hazard identification, risk assessment, process safety management, etc. Prerequisite: Approval of instructor. Cross-listed with SENG 655.
- 658. Fundamentals of Environmental Remediation Processes. (3-0). Credit 3.** Fundamental approach to various remediation technologies, topics in environmental thermodynamics and mass transfer, adsorption, desorption, ion exchange, air stripping, extraction, chemical oxidation, biodegradation. Prerequisite: Graduate classification in engineering.
- 660. Quantitative Risk Analysis. (3-0). Credit 3.** Fundamental concepts, techniques, and applications of risk analysis and risk-informed decision making for engineering students. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas. Prerequisites: Graduate or Senior status. Cross-listed with SENG 660 and ISEN 660.
- 661. Optimization of Chemical Engineering Processes. (3-0). Credit 3.** Methods of optimization applied for the design and control of chemical engineering processes. Prerequisite: Approval of instructor.
- 662. Computational Chemistry and Molecular Modeling for Engineers. (3-0). Credit 3.** Applications of computational chemistry and molecular modeling relevant to engineers, especially predictions for thermophysical properties and reaction rates; emphasis on the creative and intelligent use of commercial software to solve practical problems; problems relevant to process safety engineer. Prerequisites: CHEN 623 and CHEN 624 or approval of instructor.
- 663. Systems Biology. (3-0). Credit 3.** Introduction to experimental and computational techniques in systems biology; includes high throughput experiments, data analysis, modeling and simulation; discussion in the context of specific applications such as signal transduction. Prerequisite: Approval of instructor.
- 664. Global Optimization of Chemical Engineering Problems. (3-0). Credit 3.** Advances in global optimization and applications to chemical engineering systems; modeling and formulation of optimization problems, general theories and techniques of global optimization, and applications to problems on process design and integration. Prerequisite: Approval of instructor.
- 665. Sustainable Design of Chemical Processes. (3-0). Credit 3.** Sustainability in chemical engineering; includes sustainable approaches to design and development of processes, products, energy usage; issues and roles of chemical engineers, service learning. Prerequisite: Graduate and senior level in engineering or approval of instructor.

- 670. Computational Materials Science and Engineering. (3-0). Credit 3.** Modern methods of computational modeling and simulation of materials properties and phenomena, including synthesis, characterization, and processing of materials, structures and devices; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input. Prerequisites: Approval of instructor; graduate classification. Cross-listed with MSEN 670 and MEMA 670.
- 675. Microelectronics Process Engineering. (3-0). Credit 3.** State-of-art process engineering principles on microelectronics, especially for the fabrication of very large scale integrated circuits (VLSICs); fundamental unit processes, such as thin film deposition, thermal growth, lithography, etching and doping, material structures and properties, and basic device operation principles. Prerequisites: CHEN 623 and CHEN 624 or approval of instructor.
- 677. Advanced Process Integration and Synthesis. (3-0). Credit 3.** Systematic and state-of-the-art techniques of understanding the global insights of mass and energy flows within a process; use of integrated insights to optimize process performance; includes a variety of mathematical and visualization tools. Prerequisite: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Presentations and discussions covering problems of current importance in chemical engineering research.
- 684. Professional Internship. Credit 1 each semester.** Engineering research experience in industrial setting away from Texas A&M campus; projects supervised jointly by faculty and industrial representative. Prerequisites: Approval of student's advisory committee chair and department head.
- 685. Directed Studies. Credit 1 to 12.** Limited investigations in fields other than those chosen for thesis or dissertation research and not covered by other formal courses. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in particular areas of chemical engineering. May be repeated for credit. Prerequisites: Approval of department head and instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of department head.
- 695. Graduate Mentoring Seminar. (1-0). Credit 1.** Develop student skills in assessment; expose students to education in classroom setting. Prerequisites: 4 chemical engineering core graduate courses; graduate advisor approval.

Department of Chemistry

D. P. Barondeau, J. D. Batteas, T. P. Begley, D. E. Bergbreiter, J. W. Bevan, J. F. Bluemel, K. Burgess, A. Clearfield, P. S. Cremer, D. J. Darenbourg, M. Y. Darenbourg, K. R. Dunbar, F. P. Gabbai, J. A. Gladysz, M. B. Hall, K. E. Harding, C. B. Hilty, T. R. Hughbanks, A. E. Johnson, J. Laane, P. A. Lindahl, W. Liu, R. R. Lucchese, R. D. Macfarlane, J. B. Natowitz, S. W. North*, O. V. Ozerov, F. M. Raushel, D. Romo, M. P. Rosynek, M. W. Rowe, D. H. Russell (Head), J. C. Sacchetti, E. A. Schweikert, M. O. Scully, D. A. Singleton, D. H. Son, M. P. Soriaga, G. Vigh, C. M. Watanabe, S. E. Wheeler, K. L. Wooley, J. Yang, D. L. Yeager, S. J. Yennello, R. Zhang, H. Z. Zhou

* Graduate Advisor

The Department of Chemistry offers programs of study leading to the MS and PhD degrees in chemistry, with primary emphasis on admitting students who intend to pursue the PhD degree.

The program leading to the PhD degree is designed to ensure that the student receives extensive research experience. The dissertation which results from this research must satisfactorily demonstrate that the student is capable of independent and creative research in a specialized area of chemistry and has a satisfactory knowledge and understanding of the area in which research activities were performed. In addition, the student must demonstrate that he or she has a broad and commanding knowledge of the subject matter in the general field of chemistry. The MS degree program includes both coursework and a required thesis which provides the student with experience in experimental or theoretical research. The Department of Chemistry requires that each student participate in the teaching program of the department for at least two semesters as part of the MS or PhD degree requirement. There is no foreign language requirement.

Opportunities for research are available to graduate students in the principal subfields of chemistry and in a variety of specialized areas. Faculty members conduct research programs to provide students with opportunities to make significant research contributions in modern physical, organic, inorganic, analytical and

biological chemistry. There is also considerable departmental research activity in various interdisciplinary areas such as theoretical chemistry, materials science, medicinal chemistry, bio-analytical, bio-physical, bio-organic and bio-inorganic chemistry. In addition, departmental faculty who are members of the university's Cyclotron Institute provide outstanding opportunities for research in nuclear chemistry. The department also offers strong research programs in heterogeneous and homogeneous catalysis, surface chemistry, analytical instrumentation, coordination chemistry, organic and inorganic synthetic chemistry, environmental chemistry, spectroscopy, photochemistry and organometallic chemistry.

Major scientific equipment required for modern chemical research is available in the department for use by graduate students. These include x-ray diffractometers; NMR, EPR, ENDOR, SQUID, AFM, STM and photoelectron spectrometers; mass spectrometers; and infrared, Raman, ultraviolet, optical rotatory and circular dichroism spectrophotometers. Total space available for departmental instructional and research programs is more than 200,000 net square feet. For further details about programs, faculty, facilities and financial assistance, write to the Graduate Advisor of the Department of Chemistry, or send an email message to gradmail@mail.chem.tamu.edu. Additional information may be found on the departmental website at www.chem.tamu.edu.

Chemistry (CHEM)

- 601. Analytical Chemistry I. (3-0). Credit 3.** Fundamentals of chemical instrumentation. Modular approach to instrumental methods of chemical analysis; modules to be covered include digital electronics, modern optics, basic quantification and signal-to-noise enhancements. Prerequisite: Graduate classification in chemistry or approval of instructor.
- 602. Analytical Chemistry II. (3-0). Credit 3.** Modern analytical techniques, spectroscopies, chromatography, and "hyphenated" methods such as GC-FTIR, GC-MS, HPLC-MS, CE-LIF, and CE-MS are examined from the perspective of surface analysis, fundamentals of separation science and structural characterization of complex molecular systems. Prerequisite: CHEM 601.
- 603. Modern Chromatographic Separation Methods. (3-0). Credit 3.** Detailed treatment of the most recent developments in the theory and methodology of high performance chromatographic techniques. Intended for graduate students in chemistry, chemical engineering, and the life sciences. Prerequisite: Graduate standing.
- 604. Modern Electrophoretic Separation Methods. (3-0). Credit 3.** This 3 credit hours course is concerned with the most recent developments in the theory and methodology of modern electrophoretic separation methods. The course is designed for graduate students in chemistry, chemical engineering and the life sciences who have taken or are taking now CHEM 601, are familiar with the fundamentals of analytical separation methods and require the knowledge of electrophoretic separations for their research. Prerequisite: CHEM 601 or instructor's approval.
- 610. Organic Reactions. (3-0). Credit 3.** Introduction to mechanisms and scope of the basic organic reaction types as applied to major functional groups. Prerequisite: CHEM 646 or approval of instructor.
- 615. Organic Synthesis. (3-0). Credit 3.** Application of organic reactions to synthesis of complex organic molecules. Synthesis design and methodology, scope and limitations of reactions and experimental design. Prerequisite: CHEM 610.
- 616. Organometallic Transformations for Organic Synthesis. (3-0). Credit 3.** Introduction to transition and main group metal-mediated reactions in organic synthesis; organometallic mechanisms in the context of homogeneous catalytic systems currently employed in synthetic laboratories; emphasis on the properties of transition metal complexes and their interactions with organic substrates that promote useful chemical transformations. Prerequisite: CHEM 646 recommended.
- 618. NMR Spectroscopy. (3-0). Credit 3.** Theory and practice of modern nuclear magnetic resonance spectroscopy; Bloch equations, relaxation and relaxation mechanisms, chemical exchange, pulse and Fourier-transform methods, selective excitation, 2-D methods and solid-state nuclear magnetic resonance. Prerequisite: Graduate classification in chemistry or approval of instructor.
- 619. Analytical Spectroscopy. (3-0). Credit 3.** Modern analytical spectroscopic techniques; U.V., visible spectroscopy, atomic absorption, emission spectrometry, flame emission, fluorometry, x-ray methods and other new developments in analytical spectroscopy. Prerequisite: CHEM 602 or approval of instructor.

621. **Chemical Kinetics. (3-0). Credit 3.** Present theories about chemical reaction rates and mechanisms. Prerequisite: CHEM 328.
622. **Adsorption Phenomena and Heterogeneous Catalysis. (3-0). Credit 3.** Chemistry of the gas-solid interface; energetics, isotherms and rates of gas adsorption on solid surfaces; experimental methods of studying solid surfaces and adsorption phenomena; kinetics and mechanisms of selected heterogeneous catalytic reactions.
623. **Surface Chemistry. (3-0). Credit 3.** Nature, structure and chemistry of surfaces; characterization of surfaces from surface energy to structure; relation to chemical processes. Prerequisite: Graduate classification in chemistry or approval of instructor.
626. **Thermodynamics. (3-0). Credit 3.** Theory and applications of classical thermodynamic functions. Prerequisite: CHEM 328.
627. **Principles of Biological Chemistry. (3-0). Credit 3.** General principles of biological chemistry with an emphasis on the structures and mechanisms of action for proteins, nucleic acids and lipids. Prerequisite: Graduate classification.
628. **Coordination and Bioinorganic Chemistry. (3-0). Credit 3.** Structure and reactivity of coordination compounds; reactions of metal ions with small biomolecules and the reactions of toxic metal ions; role of metal ions in biological systems including the function of metal ions in enzymes. Prerequisite: CHEM 633.
629. **Main Group Chemistry. (3-0). Credit 3.** Chemistry of the ns and np elements of the periodic table and the noble gases including the organometallic chemistry of these elements. Prerequisite: CHEM 633.
630. **Biorganic Chemistry. (3-0). Credit 3.** Introduction to current research areas of bioorganic chemistry and chemical genetic tools in exploring biological systems; DNA recombinant technology; histone chemical biology; protein glycosylation; protein engineering methods; gene transcription regulation; semi-synthesis of proteins with PTM analogs. Prerequisites: CHEM 627 or approval of instructor.
631. **Statistical Thermodynamics. (3-0). Credit 3.** Methods of statistical mechanics based primarily on Boltzmann statistics; approach to thermodynamics through partition function; statistical concept of entropy. Prerequisite: CHEM 626.
633. **Principles of Inorganic Chemistry. (3-0). Credit 3.** General principles of inorganic chemistry treated with a view to applications in other subfields of chemistry. Prerequisite: Graduate classification in chemistry or approval of instructor.
634. **Physical Methods in Inorganic Chemistry. (3-0). Credit 3.** Determination of the molecular structure of inorganic and organometallic species; modern aspects of diffraction, magnetic resonance and vibrational methods. Prerequisite: CHEM 641 or CHEM 673.
635. **Introduction to X-ray Diffraction Methods. (3-0). Credit 3.** This course presents the fundamentals of diffraction theory by crystals and the solution of crystal structures using this methodology. Prerequisite: BS in Chemistry, Physics, or Engineering.
636. **Mechanistic Inorganic Chemistry. (3-0). Credit 3.** Reaction pathways in both main group and transition-metal complexes; factors which influence the reaction rate including nature of the metal, the coordination sphere, reaction conditions and catalytic intermediates. Prerequisite: CHEM 633.
637. **Electroanalytical Chemistry. (3-0). Credit 3.** Modern electroanalytical methods including potentiostatic, galvanostatic, sweep and periodic techniques. Prerequisite: CHEM 602 or approval of instructor.
640. **Laboratory Methods in Biological Chemistry. (1-6). Credit 3.** Application of chemical techniques to the investigation and/or manipulation of biological systems; laboratory methods provides a hands-on opportunity to gain an understanding and appreciation for chemical biology techniques. Prerequisite: Graduate classification or approval of instructor.
641. **Structural Inorganic Chemistry. (3-0). Credit 3.** Introduction to chemical bonding; ionic, covalent, coordinate and hydrogen bonding; relationship of molecular orbital and ligand field theories to experimental studies of the electronic structure of inorganic molecules. Prerequisites: CHEM 633 and CHEM 673.
642. **Organometallic Chemistry and Homogeneous Catalysis. (3-0). Credit 3.** Synthesis, structure and reactivity of organometallic compounds; elementary processes for general and radical reactions, mechanism of reactions at metal centers and applications to homogeneous catalysis. Prerequisite: CHEM 633.

- 644. Natural Products Biosynthesis. (3-0). Credit 3.** Survey of the chemical reactions occurring in living systems, describe the experimental methods used to study these reactions and examine the biosynthesis of the major families of natural products; emphasis on the mechanistic chemistry of the biosynthetic pathway. Prerequisite: Graduate classification or approval of instructor.
- 646. Physical Organic Chemistry. (3-0). Credit 3.** A detailed introduction to the theory and principles of organic chemistry; bonding and structure in organic chemistry, stereochemistry, reactive intermediates in organic chemistry and transition state theory; kinetics and thermodynamic approaches. Prerequisite: CHEM 228 or approval of instructor.
- 647. Spectra of Organic Compounds. (3-0). Credit 3.** Correlations of molecular structure with spectroscopic and other physical properties; applications to modern problems in organic chemistry. Prerequisite: CHEM 646 or approval of instructor.
- 648. Principles of Quantum Mechanics. (3-0). Credit 3.** Classical mechanics and development of wave mechanics; application of wave mechanics to special chemical problems. Prerequisite: Approval of instructor.
- 650. Molecular Spectra and Structure. (3-0). Credit 3.** Introduction to molecular spectroscopy and its relations to structure, theoretical treatments, quantum and wave mechanics, vibrations and normal coordinates, molecular symmetry and group theory. Prerequisite: Qualifying graduate students in chemistry and physics or approval of instructor.
- 658. Molecular Modeling. (1-1). Credit 2.** An introduction to molecular modeling with an emphasis on quantum level calculations. Lectures will cover the basic theory behind the calculations and lab work will focus on the practical application of modern computational chemistry codes. Prerequisite: Graduate classification or approval of instructor.
- 660. Nuclear Chemistry. (3-0). Credit 3.** Radioactive decay, nuclear models, nuclear spectroscopy, nuclear reactions, fission and other topics of current interest in nuclear chemical research. Prerequisite: CHEM 464 or approval of instructor.
- 670. Physical Methods in Biological Chemistry. (3-0). Credit 3.** Overview of current methods for the characterization of biological macromolecules, including protein structure, protein-ligand interactions, protein folding; techniques discussed include nuclear magnetic resonance, optical spectroscopy, calorimetry, electron paramagnetic resonance, Mössbauer spectroscopy, X-ray crystallography, electron microscopy, and mass spectrometry. Prerequisite: Graduate classification or approval of instructor.
- 671. Macromolecular Folding and Design. (1-0). Credit 1.** Oral presentations and discussions in the general area of biomolecular structure, folding, function and design. May be taken 12 times. Prerequisite: Approval of instructor. Cross-listed with BICH 671 and MBCH 671.
- 672. Bioorganic Reaction Mechanisms. (3-0). Credit 3.** Proposed mechanisms of action of various enzymes and coenzymes from the "model systems" approach; new developments, theory and established mechanisms. Prerequisites: CHEM 646; BICH 624.
- 673. Symmetry and Group Theory in Chemistry. (3-0). Credit 3.** Applications of symmetry and group theory to various types of chemical systems; classification of molecules into symmetry point groups and use of character tables. Prerequisite: Bachelor's degree in chemistry.
- 681. Seminar. Credit 1 each semester.** Oral presentations and discussions of recent advances in chemistry.
- 684. Professional Internship. Credit 1 to 4.** Supervised practical experience in professional functions appropriate to career goals in chemical education. Students will be required to complete a scholarly report of these activities acceptable to graduate committee. Enrollment limited to students pursuing a non-thesis MS degree, with emphasis on chemical education. Requires approval of committee chair and department head with non-thesis MS degree plan filed. Prerequisite: Graduate classification in chemistry.
- 685. Directed Studies. Credit 1 to 6.** Special topics to suit small group requirements; more recent problems and results in various branches of chemistry; laboratory work or conference and discussion. Prerequisite: Graduate classification.
- 686. Ethics in Chemical Research and Scholarship. (1-0). Credit 1.** Ethical issues in chemical research and scholarship and methods for resolution of such issues; includes Texas A&M University Policies and Procedures, ethics and scientific truth, ethics and other scientists and ethics and society; case studies. Prerequisite: Graduate classification in chemistry or biochemistry.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of chemistry. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.

- 690. Theory of Chemical Research. (3-0). Credit 3.** The design of research experiments in various sub-fields of chemistry and the evaluation of research results with the aid of examples taken from the current scientific literature. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 695. Frontiers in Chemical Research. (3-0). Credit 3.** Present status of research in a variety of significant chemical fields. Content will depend on the availability of visiting lecturers who will be selected because of distinguished international recognition in their fields of research. May be taken twice. Prerequisite: Graduate classification.
- 696. Modern Applications in Chemistry. (3-0). Credit 3.** Investigates modern topics in chemistry and their application in pre-college classrooms in a manner compatible with good scientific inquiry; designed for in-service teachers or those who have permission from their graduate advisory committee. Prerequisite: CHEM 101/CHEM 102 or approval of instructor.
- 697. Methods in Teaching Chemistry Laboratory. (1-2). Credit 1.** An introduction to teaching methods associated with the teaching of introductory chemistry laboratories using graduate teaching assistants. Emphasis placed on effective communication, preparation, record keeping, and safe and effective management of an instructional laboratory. May be repeated for credit. Prerequisite: Graduate classification in chemistry.
- 698. Inquiry and Chemical Concepts. (2-0). Credit 2.** Essential concepts in chemistry at the pre-college level; investigates methods and techniques of inquiry teaching as called for by state and national standards; parallels between inquiry teaching and scientific inquiry. This course will be a combination of regular and Internet-based classes. Prerequisite: CHEM 102 or approval of instructor.

Zachry Department of Civil Engineering

Civil Engineering: R. K. Abu Al-Rub, S. D. Anderson, C. Arson, C. P. Aubeny, R. L. Autenrieth, M. K. Banks, L. R. Barroso, B. Batchelor, W. L. Beason, G. Biscontin, B. Boulanger, J. M. Bracci, J. L. Briaud, J. K. Brumbelow, M. W. Burris*, A. T. Cahill, K. Chang, H. C. Chen, K. Chu, I. Damjanovic, B. L. Edge, A. Epps Martin, J. M. Falzarano, D. N. Ford, G. T. Fry, P. Gardoni, N. G. Gharaibeh, Z. Grasley, S. D. Guikema, R. W. Hann, Jr., H. E. Hawkins, Jr., M. Hite Head, J. J. Horrillo, M. B. D. Hueste, S. Hurlebaus, J. Irish, R. W. James, H. L. Jones, J. M. Kaihatu, P. B. Keating, C. H. Kim, M. H. Kim, D. N. Little, Jr., D. Lord, L. L. Lowery, Jr., P. J. Lynett, R. L. Lytton, J. B. Mander, E. A. Masad, T. J. McDonald, Z. Medina-Cetina, R. S. Mercier, G. R. Miller, J. R. Morgan, J. M. Niedzwecki (Head), F. Olivera, P. Park, L. Quadrifoglio, R. E. Randall, J. N. Reddy, K. F. Reinschmidt, J. M. Roesset, P. N. Roschke, D. V. Rosowsky, M. Sanchez, D. Saylak, V. P. Singh, R. E. Smith, S. A. Socolofsky, N. Stubbs, J. A. Sweetman, D. Trejo, J. A. Walewski, B. X. Wang, C. E. Woods, R. A. Wurbs, Q. Ying, E. M. Zechman, J. Zhang, Y. Zhang, D. G. Zollinger

Ocean Engineering: K. Chang, H. C. Chen, B. L. Edge, J. M. Falzarano, J. Irish, J. M. Kaihatu, C. H. Kim, M. H. Kim, P. J. Lynett, R. S. Mercier, J. M. Niedzwecki, R. E. Randall, J. M. Roesset, S. A. Socolofsky, J. Zhang

* Graduate Advisor

Civil Engineering

A variety of courses is offered in civil engineering to permit a student to study one of nine specialty areas. The department is especially well equipped to offer research and courses in coastal and ocean engineering; construction engineering management; environmental engineering; geotechnical engineering; water resources engineering; materials engineering; structural engineering and structural mechanics; and transportation engineering.

Modern facilities and current equipment are available to enhance study and instruction in civil engineering. These facilities include the following laboratories: fluid and wave mechanics, construction materials, materials science, sensors, soil mechanics, biological, high bay, Offshore Technology Research Center and several facilities shared with the Texas Transportation Institute.

No foreign language is required for the PhD in civil engineering. Students pursuing a PhD or DEng are required to pass the Civil Engineering qualifying exam.

(CVEN)

- 601. Environmental Engineering Processes III. (3-0). Credit 3.** Biological processes that describe behavior of materials in natural and engineered environmental systems including fundamental theory of kinetics, bioenergetics, genetics and cellular functions. Prerequisites: CHEM 222; CVEN 301.
- 603. Environmental Engineering Management. (3-0). Credit 3.** Federal and state regulatory framework for environmental engineering; techniques for environmental control; risk assessment; evaluation of critical environmental problems with multimedia aspects. Prerequisite: CVEN 301 or approval of instructor.
- 604. Engineering Analysis of Treatment Systems. (3-0). Credit 3.** Theory of processes used to treat water, wastewater and hazardous wastes; applications of theory to design and operation of treatment systems, including biological treatment, adsorption, coagulation, filtration and precipitation. Prerequisites: CVEN 601, CVEN 619, CVEN 620.
- 605. Environmental Measurement. (1-6). Credit 3.** Theory and practice of analytical methods used in the environmental engineering field; instrumental and wet chemical techniques used in measurement of environmental quality parameters and pollutants. Prerequisite: CVEN 620 or approval of instructor.
- 606. Environmental Engineering Design. (3-0). Credit 3.** Design of engineered environmental systems for water or wastewater treatment in domestic or industrial applications. Prerequisite: CVEN 604 or approval of instructor.
- 607. Engineering Aspects of Air Quality. (3-0). Credit 3.** Characterization of air contaminants; health effects and legal aspects; dispersion of pollutants in the atmosphere; technology for the control of gaseous and particulate emissions. Prerequisite: CVEN 311.
- 609. Environmental Control of Oil and Hazardous Materials. (2-3). Credit 3.** Oil and hazardous material (OHM) spills in the engineering design process; evaluation of OHM properties and their behavior and impact to environmental systems; prevention programs and documents, technology for spill containment and removal; contingency planning cycle including administrative site-specific plans and resource acquisition; response organization; restoration and documentation. Prerequisite: CVEN 301 or approval of instructor.
- 610. Environmental Risk Assessment. (3-0). Credit 3.** Risk assessment of the environment and human exposure in a statistically-based approach to determine allowable levels of exposure without significant deleterious effects; the basic approach of hazard identification; data collection and analysis; toxicity assessment; risk characterization; applications in ecological and human risk assessment; risk analysis performed. Prerequisite: CHEM 222 or equivalent. Cross-listed with PHEO 650.
- 613. Micromechanics of Civil Engineering Materials. (2-2). Credit 3.** Discrete-particle and continuum micromechanics energy principles; finite-element and discrete-element formulations for constitutive modeling of asphalt, concrete, and coarse and fine-grained soils; adhesive and cohesive fracture and healing; stress-dependent plasticity; principles and measurement of surface energy and pseudo-strain. Prerequisite: CVEN 615, CVEN 616 or approval of instructor.
- 614. Stabilization of Soil-Aggregate Systems. (3-0). Credit 3.** Theory and practice of chemical stabilization of soils and aggregate systems with traditional methods of chemical stabilization including Portland cement, lime, fly ash and by products (kiln dusts, fly ash and slag materials); selected non-traditional methods including polymers, ionic systems, and enzymes; mechanisms and methods to avoid deleterious reactions.
- 615. Structural Design of Pavements. (3-0). Credit 3.** Characteristics of pavement loads, stress analysis in pavements, design practices, construction, rehabilitation and maintenance. Prerequisite: CVEN 418.
- 616. Systems Design of Pavements. (2-3). Credit 3.** Optimization of the design of rigid and flexible pavement systems; empirical and mechanistic stochastic structural subsystems; utility theory, serviceability concept, cost studies, traffic delay, environmental deterioration, rehabilitation and maintenance optimization systems. Prerequisite: CVEN 418.
- 617. Traffic Engineering: Characteristics. (2-3). Credit 3.** Human, vehicular and traffic characteristics as they relate to driver-vehicle-roadway operational systems; traffic studies and methods of analysis and evaluation. Prerequisite: CVEN 457 or equivalent.
- 618. Traffic Engineering: Operations. (2-3). Credit 3.** Advanced theory and application of traffic control; signalization and freeway operations. Prerequisite: CVEN 457 or equivalent.

619. **Environmental Engineering Processes I. (3-0). Credit 3.** Physical processes that describe behavior of materials in natural and engineered environmental systems including transport phenomenon, sorption, desorption, flocculation and sedimentation. Prerequisite: CVEN 301.
620. **Environmental Engineering Processes II. (3-0). Credit 3.** Chemical processes that describe behavior of materials in natural and engineered environmental systems including neutralization, precipitation, complex formation, adsorption, oxidation-reduction, coagulation, volatilization and absorption. Prerequisites: CVEN 301; course in organic chemistry.
621. **Advanced Reinforced Concrete Design. (3-0). Credit 3.** Reinforced concrete principles; analysis of rigid building frames, design of building frames, slabs, biaxially loaded columns, rectangular and circular tanks, and deep beams. Prerequisite: CVEN 444 or equivalent.
622. **Properties of Concrete. (3-0). Credit 3.** Materials, properties and behavior of concrete; cement, cement types, aggregate characteristics; properties of fresh concrete; structure of portland cement paste; mechanical properties of hardened concrete; durability and repair of concrete structures. Prerequisites: CVEN 342.
623. **Nondestructive Pavement Evaluation. (2-2). Credit 3.** Nondestructive measurements and analysis methods of pavement data collection to determine riding quality, vehicle dynamics, surface texture, layer thickness, stiffness, moisture and distress using seismic, laser, radar, infrared, impulse, image analysis, and wave propagation. Content applies to construction quality control and evaluation of risk, reliability and remaining life of pavements. Prerequisite: CVEN 616 or approval of instructor.
624. **Infrastructure Engineering and Management. (3-0). Credit 3.** Defines the infrastructure deterioration problems in the United States and describes the engineering and management approaches to arrest the deterioration. Prerequisite: Graduate classification in engineering or approval of instructor.
625. **Traffic Engineering: Design. (2-3). Credit 3.** Design of traffic control device installations with special emphasis on traffic signal design and installation, including the design features of detector placement and operation; national and state design standards and guidelines for traffic control device installation. Prerequisite: CVEN 457.
626. **Roadside Safety Design. (3-0). Credit 3.** Fundamental concepts of designing safety into roadways; safety improvement programs, accident data analysis, safety methodology, safety in cross section design and the design of safety devices; safety improvement programs, sideslopes and ditches, breakaway devices, crash cushions and roadside barriers.
627. **Engineering Surface Water Hydrology. (3-0). Credit 3.** Precipitation-runoff processes; watershed and streamflow modeling; frequency analysis; erosion and sedimentation engineering; hydrologic design of hydraulic structures and nonstructural stormwater management strategies. Prerequisite: Graduate classification in engineering or approval of instructor.
628. **Advanced Hydraulic Engineering. (3-0). Credit 3.** Modeling of steady and unsteady flow in natural and constructed channels and hydraulic structures. Open channel hydraulics. Design and analysis of hydraulic structures, canals, and flood mitigation projects. Sediment and contaminant transport in river systems. Prerequisite: CVEN 339 or approval of instructor.
631. **System Identification and Nondestructive Damage Evaluation of Civil Engineering Structures. (3-0). Credit 3.** Invasive assessment of civil structures; concepts of systems identification, damage detection, and safety evaluation; estimation of mass, damping, and stiffness properties; determination of load capacity and useful life. Prerequisite: Graduate Status in CVEN, AERO or MEEN.
632. **Transportation Engineering: Economics. (3-0). Credit 3.** Engineering and economic principles for transportation systems; engineering evaluation using methods of travel demand, costs, equilibrium and pricing; use of economic principles for the finance, engineering and management of transportation systems. Prerequisite: CVEN 672 or approval of instructor.
633. **Advanced Mechanics of Materials. (3-0). Credit 3.** Stresses and strains at a point, torsion of noncircular cross sections, beams with combined axial and lateral loads, energy methods, thick walled pressure vessels, theories of failure, introduction to the theory of elasticity, theory of plates, theory of elastic stability and solution to elementary problems. Prerequisite: MATH 308 or approval of instructor.
635. **Street and Highway Design. (3-0). Credit 3.** Advanced concepts of the design of streets and highways, design criteria, controls and standards for design alignment, cross section, intersections and interchanges and environmental impacts of surface transport facilities. Prerequisite: CVEN 456 or equivalent.

- 637. Rigid Pavement Analysis and Design. (3-0). Credit 3.** Introduction to mechanistic rigid pavement design concepts; development of mathematical pavement models and application of the models to design analysis; relationship of pavement response to performance and fatigue damage concepts in design; evaluation of pavement design practice and procedures for highways and airports; rigid pavement overlay design concept. Prerequisite: CVEN 418.
- 638. Computer Integrated Construction Engineering Systems. (3-0). Credit 3.** Modeling concepts, issues and techniques of computer integrated construction engineering systems; current research and practice in design and implementation of computer integrated construction systems, with emphasis on the integration of engineering, construction planning, monitoring and control through management information systems, decision support systems, knowledge based systems and discrete event simulation systems. Prerequisite: CVEN 349.
- 639. Methods Improvement for Construction Engineers. (3-0). Credit 3.** Application of work methods and measurements to civil engineering construction; examination of factors that affect productivity in construction; study of motivational factors; review of the principles of accident prevention. Prerequisites: CVEN 405 and CVEN 473 or approval of instructor. Cross-listed with ISEN 639.
- 640. Project Development: Methods and Models. (3-0). Credit 3.** Developing new projects; public-private partnerships; flexible design and stage-based construction; project risk analysis and management; estimating and budgeting; optimal project decisions; advanced techniques for modeling project performance. Prerequisite: STAT 601 or approval of instructor.
- 641. Construction Engineering Systems. (3-2). Credit 4.** Application of systems theory to project planning and control; probabilistic network diagramming, resource allocation, statistical bidding analysis, activity planning, financial management of construction projects and project control. Prerequisite: CVEN 473 or approval of instructor.
- 643. Advanced Construction Methods. (3-0). Credit 3.** Provides an overview of materials used in construction industry; methods used to construct facilities with these materials; present practices that can affect production during construction and serviceability during operation of these facilities. Prerequisite: Graduate classification.
- 644. Project Risk Management. (3-0). Credit 3.** Identifies causes of risks in projects; discusses probabilistic description of risks and formulation of risk models; Bayesian methods for revising probabilities; qualitative and quantitative risk assessment; setting contingencies on budgets and schedules; risk mitigation and risk management; handling technological risk; Utility theory and game theory in management of risks. Prerequisites: ISEN 644; STAT 211, STAT 601 or equivalent.
- 645. Geotechnical Site Investigation. (2-0). Credit 2.** Soil sampling techniques to obtain disturbed and undisturbed samples; in situ field tests including standard penetration test, cone penetration test, vane test, pressuremeter test and their use in practice; other recent advances in sampling, in situ testing and site investigation both onshore and offshore. Prerequisites: CVEN 365; CVEN 435 or equivalent.
- 646. Foundations on Expansive Soils. (3-0). Credit 3.** Properties of partially saturated soils, analysis of beams and plates on foundations, slab-subgrade friction, design of slabs and drilled piers, soil improvement techniques, risk analysis and foundation rehabilitation operations. Prerequisites: CVEN 365 and MATH 308 or approval of instructor.
- 647. Numerical Methods in Geotechnical Engineering. (2-2). Credit 3.** Formulation and application of finite element and discrete element methods in solving geotechnical engineering problems related to seepage, diffusion, elasticity, plasticity, fracture and dynamic motion of soil masses, stability and convergence problems and use of existing computer programs in working applied problems. Prerequisite: Degree in engineering or approval of instructor.
- 648. Advanced Numerical Methods in Geotechnical Engineering. (3-0). Credit 3.** Formulation and application of finite difference and finite element methods in geotechnical problems related to elasticity, plasticity, seepage, consolidation, dynamic response, and pile analysis; constitutive models of soil behavior; and analysis of nonlinear systems. Prerequisites: MEMA 646 or equivalent; CVEN 651 or registration therein.
- 649. Physical and Engineering Properties of Soil. (3-3). Credit 4.** Introduction to physico-chemical properties of soils; soil structure; soil classification; permeability; principle of effective stress; stress-deformation and strength characteristics; partly saturated soils; testing procedures. Prerequisites: CVEN 365 and CVEN 435 or approval of instructor.

651. **Geomechanics. (3-0). Credit 3.** Fundamentals of mechanics of deformable bodies; theory and application of elasticity, plasticity, viscoelasticity and approximate rheological models to soil mechanics problems. Prerequisite: Approval of instructor.
652. **Soil Dynamics. (3-0). Credit 3.** Dynamic properties of soil; wave propagation in an elastic medium; analysis of dynamic soil-structure interaction and machine foundations; earthquake engineering; soil liquefaction; seismic design of foundations, dams, retaining walls and pipelines. Prerequisite: MATH 308.
653. **Bituminous Materials. (2-3). Credit 3.** Production, specifications and tests of bituminous materials; design and evaluation of asphaltic concrete for construction and maintenance; inspection control of street, parking and highway paving surfaces. Prerequisite: Approval of instructor.
654. **Strategic Construction and Engineering Management. (3-0). Credit 3.** Strategic and systems perspectives applied to construction and engineering management projects, organizations and industries; system dynamics methodology to model construction and engineering systems; understanding drivers of performance; feedback and high leverage points for performance improvement. Prerequisite: Graduate classification or approval of instructor. Cross-listed with ISEN 643.
655. **Structural Reliability. (3-0). Credit 3.** Uncertainties in structural mechanics; probabilistic models for load and resistance variables, fundamentals of structural reliability theory, advanced first-order second moment methods and reliability of complex structural systems; applications to selected structures. Prerequisites: CVEN 345 and CVEN 421.
656. **Bridge Engineering. (3-0). Credit 3.** An overview of design of highway bridges, and an introduction to maintenance of highway bridges; history of bridge engineering, types of bridges and materials of construction, design rules, loads, inspection, rating and preventive maintenance, esthetics. Prerequisite: CVEN 345.
657. **Dynamic Loads and Structural Behavior. (3-0). Credit 3.** Dynamic modeling of single, multidegree of freedom and continuous systems; dynamic load factors; damping; mode superpositions; numerical integration; dynamic behavior of structures and structural elements under action of dynamic loads resulting from wind, earthquake, blast, impact, moving loads and machinery. Prerequisites: MATH 308 and MEMA 467 or approval of instructor.
658. **Civil Engineering Applications of GIS. (2-2). Credit 3.** Use of geographic information system (GIS) concepts and methods to solve civil engineering problems; emphasis on different areas of civil engineering. Class presentations and laboratory sessions used to familiarize students with computer software. Prerequisite: Graduate classification.
659. **Behavior and Design of Steel Structures. (3-0). Credit 3.** Buckling and post-buckling strength of stiffened and unstiffened plate elements and members; torsional behavior and design of beams; stability of frames; frames subject to sidesway; bracing design; non-destructive evaluation and application of fracture mechanics principles to welded structures. Prerequisite: 3 credit hours of structural steel design or approval of instructor.
660. **Probabilistic Structural Dynamics. (3-0). Credit 3.** Dynamic response of structural systems to excitations characterized as stochastic processes; approximate methods for single degree-of-freedom nonlinear structures; methods for single and multiple degrees-of-freedom linear structures; probabilities of failure for first passage and for fatigue. Prerequisites: CVEN 657; AERO 310 or OCEN 301; MEEN 459 and MEEN 617.
661. **Research Methods for Civil Engineers. (3-0). Credit 3.** Develop research skills in the scientific method as a process of developing new knowledge by testing theory with data in the field of civil engineering; evaluation of the products of research by professional researchers; preparation of research proposals; practice in the written and oral communication of research results. Prerequisite: Graduate classification.
662. **Experimental Methods in Civil Engineering. (2-3). Credit 3.** Introduction to experimental methods, instrumentation, data acquisition and data processing; experimental aspects of static and dynamic testing in the various areas of civil engineering; overview of laboratory work with several hands-on applications in the laboratory. Prerequisite: Graduate classification in engineering.
663. **Structural Stability. (3-0). Credit 3.** Buckling of columns, frames, arches, rings, plates and shells, lateral and torsional buckling of beams, Newmark's method, equilibrium method, Rayleigh-Ritz, variational principles; Galerkin method, Trefftz method, review of current literature. Prerequisites: MATH 308; approval of instructor.

- 664. Water Resources Engineering Planning and Management. (3-0). Credit 3.** Managing water resources; the planning process, systems analysis methods; institutional framework for water resources engineering; comprehensive integration of engineering, economic, environmental, legal and political considerations in water resources development and management. Prerequisite: Graduate classification in engineering or approval of instructor.
- 665. Water Resources Systems Engineering. (3-0). Credit 3.** Linear and non-linear optimization models and simulation models for planning and management of water systems; single- and multi-objective analysis and deterministic and stochastic techniques. Prerequisites: CVEN 339; CVEN 422 or equivalent.
- 666. Foundation Structures. (3-0). Credit 3.** Geological and soil mechanics principles: load bearing capacity, soil pressure and settlement; design of shallow foundation sub-structures: pedestals, spread footings, combined footings, mats and underream footings; design of deep foundations: piles and drilled piers; retaining walls, cofferdams and sheet piles.
- 667. Slope Stability and Retaining Walls. (2-2). Credit 3.** Slope stability; failure analysis including methods of slices; risk analysis; earthquake analysis; monitoring; remedial measures; retaining structures; basic theories; gravity walls; cantilever walls; tieback walls; mechanically stabilized walls; soil nailing; deflecting-based analysis. Prerequisites: CVEN 365 or equivalent; graduate classification.
- 668. Advanced EPC Project Development. (3-0). Credit 3.** Examines the advanced project development process-business planning and pre-project planning for engineering, procurement and construction (EPC); a process approach is followed. Issues covered are project technical and economic feasibility; scope definition; project risks; preliminary budgeting; scheduling and parametric estimating; execution strategies; negotiations; organizational design and development. Prerequisite: Graduate classification in engineering or approval of instructor.
- 669. Design of Structures for Hazardous Environmental Loads. (3-0). Credit 3.** Introduction to wind and earthquake engineering with focus on studying the characteristics and effects of various types of windstorms and earthquakes; development of tools that can be used in specifying wind and earthquake loads on structures. Prerequisite: Approval of instructor.
- 670. Behavior and Design of Composite Structures. (3-0). Credit 3.** Design of composite structural systems comprising structural steel and reinforced concrete; composite slabs on steel beams; composite slabs on formed metal deck; columns; moment frame systems; shear wall systems; braced frame systems; dual systems; introduction to retrofitting applications. Prerequisites: CVEN 444; CVEN 446 or equivalent; graduate classification.
- 671. Behavior and Design of Prestressed Concrete Structures. (3-0). Credit 3.** Introduction to the behavior and design of prestressed concrete structural members for several limit states; including flexure, shear, torsion and deflection; exposure to composite beams; indeterminate systems; bridge design and construction. Prerequisites: CVEN 444; graduate classification in civil engineering or approval of instructor.
- 672. Engineering and Urban Transportation Systems. (3-0). Credit 3.** Characteristics of transportation engineering systems; transportation engineering data collection; modeling effects of engineering project planning, trip generation, trip distribution, mode choice and traffic assignment; use and interpretation of engineering modeling results; engineering project analysis. Prerequisite: Graduate classification in engineering or urban and regional planning or approval of instructor.
- 673. Transport Phenomena in Porous Media. (3-0). Credit 3.** Transport phenomena in porous media with special emphasis on fundamentals and applications to various geo-environmental problems. Prerequisites: CVEN 311 and MATH 308 or approval of instructor.
- 674. Groundwater Engineering. (3-0). Credit 3.** Groundwater hydrology, theory of groundwater movement, steady-state flow, potential flow, mechanics of well flow, multiple-phase flow, salt water intrusion, artificial recharge, groundwater contamination and models. Prerequisite: CVEN 311 or approval of instructor.
- 675. Stochastic Hydrology. (3-0). Credit 3.** Analysis, simulation and forecasting of hydro-climatic variables. Prerequisites: CVEN 421 and CVEN 463 or approval of instructor.
- 677. Advanced Surface Transportation Systems. (3-0). Credit 3.** Design and operational issues and systems related to advanced traffic systems; advanced studies on traffic management systems, travelers information systems, public transportation systems and commercial vehicle operation. Prerequisite: Graduate classification in engineering or approval of instructor.

- 679. Experimental Fluid Mechanics Modeling. (3-0). Credit 3.** Dimensional analysis; modeling laws; measurement techniques and instrumentation; experimental control and data acquisition; sampling theory and signal processing; applications to coastal, ocean, and hydraulic engineering models. Prerequisite: Approval of instructor.
- 680. Advanced Computation Methods for Fluid Flow. (3-0). Credit 3.** Unsteady three-dimensional Navier-Stokes equations in general nonorthogonal curvilinear coordinates; algebraic and elliptic grid generation; turbulence modeling for complex flows; advanced numerical methods for unsteady incompressible turbulent flows; large-eddy simulations; Reynolds-averaged Navier-Stokes simulation; chimera domain decomposition and interactive zonal approach. Prerequisite: CVEN 688 or approval of instructor.
- 681. Seminar. (0-2). Credit 1.** Reports and discussion of current research and selected published technical articles.
- 682. Environmental Remediation of Contaminated Sites. (3-0). Credit 3.** Aspects of characterization and design of plans for remediation of sites contaminated with hazardous wastes; review of federal and state regulations; risk assessment; remedial technology screening and design of remedial plans. Prerequisites: CVEN 601, CVEN 619, CVEN 620.
- 683. Dynamic Soil Structure Interaction. (3-0). Credit 3.** Introduction to basic concepts of wave propagation; soil dynamics; applications to the design of machine foundations; geotechnical earthquake engineering; soil effects on the characteristics of earthquake motions; liquefaction; dynamic stiffness of foundations; seismic soil structure interaction. Prerequisite: Graduate classification.
- 684. Professional Internship. (3-0). Credit 3.** Training under the supervision of practicing professional engineers in settings appropriate to the student's professional objectives, away from Texas A&M campus. Prerequisites: Approval of the department head and one semester of graduate work completed.
- 685. Directed Studies. Credit 1 to 12 each semester.** Enables majors in civil engineering to undertake and complete with credit in their particular fields of specialization limited investigations not within their thesis research and not covered by other courses in established curriculum.
- 686. Offshore and Coastal Structures. (3-0). Credit 3.** Fundamental design and analysis techniques; offshore platforms for shallow and deep water, pile supported, gravity based and floating platforms; new design problems faced by offshore industry will be examined by class during the semester. Prerequisite: Approval of instructor.
- 687. Foundation Engineering. (3-0). Credit 3.** Settlement and bearing capacity analysis of foundations; computer programs used to analyze axially-loaded piles, laterally-loaded piles and sheet-pile walls. Prerequisites: CVEN 365; approval of instructor.
- 688. Computational Fluid Dynamics. (3-0). Credit 3.** Finite-difference and finite-element methods and basic numerical concepts for the solution of dispersion, propagation and equilibrium problems commonly encountered in real fluid flows; theoretical accuracy analysis techniques. Prerequisites: Undergraduate course in fluid mechanics; MATH 601 and/or basic course in linear algebra; knowledge of one programming language.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of civil engineering. May be repeated for credit. Prerequisites: Approval of instructor and department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 695. Frontiers in Civil Engineering Research. Credit 1 to 3.** The present status of investigative work in a variety of civil engineering fields; content selected based on visiting lecturers of distinguished international recognition in their fields of research. Prerequisite: Approval of instructor.
- 696. Urban Traffic Facilities. (3-0). Credit 3.** Driver, vehicle and roadway characteristics related to design and operation of traffic facilities; selection and design of traffic control devices and information systems for streets and highways; accident analysis and tort liability related to traffic engineering. Prerequisite: Graduate classification.
- 699. Engineering Risk Analysis. (3-0). Credit 3.** Introduces students to applications of probability theory, statistics, and decision analysis to civil engineering problems; emphasis on probabilistic modeling and analysis of civil engineering problems, Bayesian statistics, risk analysis, and decision under uncertainty. Prerequisite: STAT 211 or approval of instructor.

- 710. Civil Engineering Project Finance. (3-0). Credit 3.** Fundamentals of financing civil engineering projects; Public-Private Partnerships (PPPs); interdependencies between engineering and financing decisions; equity and debt markets; type of debt instruments: loans vs. bonds; risk identification, quantification, and management; engineering due-diligence; pricing risk premium; hedging using civil engineering design strategies.
- 717. Engineering Project Control. (3-0). Credit 3.** Project controls bridge from information-based to physical-based development processes; includes detailed design, testing of designs, design realization, and preparation of facilities for steady state operations; application of basic project control theories, tools, and methods to development projects. Prerequisite: Graduate classification in civil engineering or industrial and systems engineering or approval of instructor. Cross-listed with ISEN 642.
- 740. Advanced Constitutive Behavior of Cementitious Materials. (3-0). Credit 3.** Advanced multi-scale constitutive behavior of cementitious materials, including composite behavior, elasticity, viscoelasticity, aging, free strains, poromechanical behavior, thermal and moisture strains, and thermal, moisture, and ionic transport; focus on experimental observation and analytical modeling. Prerequisite: CVEN 343 or CVEN 622 or approval of instructor.
- 750. Finite Element Applications in Structural Engineering. (2-2). Credit 3.** Role of the finite element method (FEM) in structural engineering; use of commercial finite element software; application of FEM method for various structural engineering problems; selection of appropriate FEM models; types of elements and mesh sizes; use and interpretation of FEM results. Prerequisite: CVEN 445 or approval of instructor.
- 751. Advanced Dynamics and Control of Civil Engineering Structures. (3-0). Credit 3.** Laplace transforms; nonlinear dynamics; base isolation; viscous dampers; classical control; state-space formulation; LQR controllers; estimator design; compensator design; advanced control techniques; emphasis on the issues and applications to bridges, buildings and other large civil structures. Prerequisite(s): CVEN 657, MEMA 647 or equivalent, or approval of instructor.
- 752. Smart Structures. (3-0). Credit 3.** Fundamentals of smart structures including structural dynamics, damping, sensors, control concepts, smart materials, modeling of smart structures, and signal processing; semi-passive concepts, energy harvesting, semi-active concepts, active vibration control, active noise control, shape adaptation, and structural health monitoring. Prerequisite: CVEN 363 or equivalent or graduate classification in CVEN or approval of instructor.
- 753. Damage Mechanics of Solids and Structures. (3-0). Credit 3.** Damage mechanics; constitutive modeling of damage behavior of materials; application of thermodynamic laws; computational techniques for predicting progressive damage and failure; plasticity; viscoplasticity; viscoelasticity; cohesive zone modeling; fatigue and creep damage; damage in various brittle and ductile materials (e.g., metal, concrete, polymer, ceramic, asphalt, biomaterial, composites). Prerequisite: CVEN 633 or approval of instructor. Cross-listed with MEMA 634.
- 754. Advanced Structural Design Studio. (1-6). Credit 3.** Comparative design, construction, and service-life performance analysis of integrated and complex structural systems, including design loads, load paths, and structural detailing requirements; comparison of alternative structural system solutions; investigation into new technologies and structural design and/or construction approaches; examples drawn from bridges, buildings and other large civil structures. Prerequisites: CVEN 659 or registration therein, CVEN 671 or registration therein, CVEN 750 or registration therein, or approval of instructor.
- 765. Advanced Civil Engineering Systems. (3-0). Credit 3.** Formulation of decision making problems at different hierarchical levels: strategic, planning and operational; includes application problems in project selection, networks, allocation, routing/scheduling, distribution, and multi-objective; introduction to exact and approximate solving techniques: optimization, heuristics, simulation, and decision analysis; solution interpretation and sensitivity analyses. Prerequisite: CVEN 322 or equivalent.
- 766. Highway Design. (2-3). Credit 3.** Theory and practice in highway design; highway classification and design criteria, location studies, design of vertical and horizontal alignment, cross section, intersections, environmental factors, and highway drainage elements. Prerequisites: CVEN 307; Graduate classification.

The following courses are described in the section entitled Mechanics and Materials (MEMA) on [page 487](#) and are part of the curriculum in civil engineering.

- 601. Theory of Elasticity. (3-0). Credit 3.**
605. Energy Methods. (3-0). Credit 3.

- 607. **Flow and Fracture of Polymeric Solids. (3-0). Credit 3.**
- 609. **Materials Science. (3-0). Credit 3.**
- 613. **Principles of Composite Materials. (3-0). Credit 3.**
- 633. **Theory of Plates and Shells. (3-0). Credit 3.**
- 641. **Plasticity Theory. (3-0). Credit 3.**
- 647. **Theory of Finite Element Analysis. (3-0). Credit 3.**
- 651. **Viscoelasticity of Solids and Structures I. (3-0). Credit 3.**
- 689. **Special Topics in... Credit 1 to 4.**

Classics

(faculty, see [page 413](#))

(CLAS)

- 692. **Readings. (3-0). Credit 3.** Readings in Greek or Latin literary texts in the original language. Prerequisite: Graduate classification.

Department of Communication

J. A. Aune (Head), J. B. Barbour, J. K. Barge*, C. E. Beaudoin, P. Burkart, H. A. Campbell, C. R. Conrad, L. G. Dorsey, T. N. Dubriwny, A. S. Durham, R. E. Gill, T. J. Hong, J. O. Iverson, A. R. Kluver, A. C. La Pastina, J. J. Mease, J. R. Mercieca, K. I. Miller, K. A. Poirot, M. S. Poole, L. L. Putnam, S. Ramasubramanian, E. W. Rothenbuhler, B. F. Sharf, M. T. Stephenson, R. L. Street, Jr., R. S. Sumpter, C. N. Swift, C. J. Wallis

* Graduate Director

The Department of Communication offers two graduate degrees: the Doctor of Philosophy and the Master of Arts. The PhD requires 64 hours of coursework, a sequence of research methodology courses and a dissertation. In conjunction with their advisory committees, PhD students devise an individualized program of study which encompasses one or more of the four research foci in the department: organizational communication, health communication, telecommunication and media studies, and rhetoric and public affairs. The PhD program is appropriate either for students who plan careers in academia, or in research-oriented careers in government or the private sector. The MA program is research and theory-oriented. MA students may opt for a thesis option (30 hours of coursework, including the thesis), or a nonthesis option (36 hours of coursework and a comprehensive examination). They may focus in one or more of the areas described above, or pursue a generalist degree.

Communication (COMM)

- 610. **Social Science Methods in Communication Research. (3-0). Credit 3.** Quantitative research methods in communication, including design, measurement and analysis for descriptive and experimental research; practice in evaluating and conducting research projects. Prerequisite: Graduate classification or approval of instructor.
- 615. **Interpretive Methods in Communication Research. (3-0). Credit 3.** Introduction to interpretive and qualitative methods in communication research; underlying epistemologies, design issues, and explanation of knowledge claims; methods including participant observation and interviewing. Prerequisite: Graduate classification.
- 620. **Communication Theory. (3-0). Credit 3.** The nature and role of communication theory; systems of ontology and epistemology in theory development; critical review of current theories concerning communication codes, functions and processes in various contexts. Prerequisite: Graduate classification or approval of instructor.
- 630. **Interpersonal Communication. (3-0). Credit 3.** Major theories in interpersonal communication; critical examination of current research programs on communication in interpersonal influence, relational development and conflict management. Prerequisite: Graduate classification.

- 631. Group Communication. (3-0). Credit 3.** Major concepts and theories of communicative processes in task-oriented groups from a social scientific perspective; the role of group communication in (1) group decision processes, (2) decision development, (3) decision-making agendas, and (4) conflict and performance quality. Prerequisite: Graduate classification.
- 632. Communication and Conflict. (3-0). Credit 3.** Elements and central features of conflict theories and different approaches to communication in conflict management; analysis of communication research in interpersonal, family/marital, group, organizational, and public conflicts and the role of the media in social and international disputes. Prerequisite: Graduate classification.
- 634. Communication and Gender. (3-0). Credit 3.** Gender considered as a complex phenomenon constituted through communication; topics include femininities, masculinities, language, power, non-verbal behavior, gender in media, organizations, interpersonal relationships, and social movements. Prerequisite: Graduate classification.
- 636. Survey of Organizational Communication. (3-0). Credit 3.** Theoretical and empirical literature on human communication and complex organizations; the study of messages, interaction, and meaning in the process of organizing; topics include superior-subordinate communication, communication networks, and technologies, language, message flow, symbols and organizational culture, negotiation and conflict, and power and politics. Prerequisite: Graduate classification.
- 637. Organizational Communication Seminar. (3-0). Credit 3.** Investigation of a subject important to the understanding of organizational communication, such as communication and organizational decision-making, group communication within organizations, communication and organizational culture, and organizational rhetoric and issue management. May be repeated for credit with different content up to a total of three times. Prerequisite: Graduate classification.
- 640. Rhetorical Theory. (3-0). Credit 3.** Close reading of classical and contemporary systems of rhetoric; survey of principal applications to communication theory and research. Prerequisite: Graduate classification or approval of instructor.
- 645. Rhetorical and Textual Methods in Communication Research. (3-0). Credit 3.** Comparative study of traditional and contemporary perspectives on the description, interpretation, and evaluation of public discourse, including textual analysis, neo-classical analysis, Burkean criticism, quantitative and qualitative approaches to content analysis, fantasy theme analysis, and semiotic analysis. Prerequisite: Graduate classification or approval of instructor.
- 649. American Public Discourse to 1865. (3-0). Credit 3.** Public discourse and political rhetoric in America in colonial and pre-Civil War years; historical, conceptual, and practical examination of political campaign rhetoric, legislative rhetoric, judicial rhetoric, and advocacy group rhetoric. Prerequisite: Graduate classification.
- 650. American Public Discourse Since 1865. (3-0). Credit 3.** Public discourse and political rhetoric in America in post-Civil War years; historical, conceptual, and practical examination of political campaign rhetoric, legislative rhetoric, judicial rhetoric, and advocacy group rhetoric. Prerequisite: Graduate classification.
- 651. Presidential Rhetoric. (3-0). Credit 3.** Rhetorical discourse of American presidents, including principal genres of presidential communication, speechwriting and media strategies; case studies of presidential communication ranging from campaign oratory, to crisis rhetoric, and ceremonial addresses. Prerequisite: Graduate classification.
- 654. History and Theory of Rhetoric to 1800. (3-0). Credit 3.** Emphasis on interactions between rhetorical theory and practices; includes Sophists, Stoic logic and rhetoric, poetics and stylistics from Plato through Cicero, semiotics and hermeneutics in medieval rhetoric, Enlightenment rhetoric and moral philosophy, literary. Cross-listed with ENGL 654.
- 655. History and Theory of Rhetoric since 1800. (3-0). Credit 3.** Major figures and movements in rhetorical theory; revisionist effect of psychology, linguistics, and romanticism upon classical rhetorics; associationist psychology; belles lettres movement, twentieth-century linguistic turn; current-traditional rhetoric and its successors; rhetorical critical theory. Cross-listed with ENGL 655.
- 658. Seminar in Communication and Culture. (3-0). Credit 3.** Investigation of the ways that culture, religion, identity, gender, popular culture, community, history, and related ideas are shaped through communication in order to understand the development of social norms, political values, and the human experience. May be repeated for credit with different content up to a total of three times. Prerequisite: Graduate classification.

- 659. Communication and Citizenship in the Public Sphere. (3-0). Credit 3.** Theoretical examination of communication within democratic, republican, and liberal conceptions of citizenship: consideration of the ideal of the public sphere, and communication in global civil society; specific attention to the practices of American citizenship within the global civil society. Prerequisite: Graduate classification.
- 662. Survey of Telecommunication and Media Studies. (3-0). Credit 3.** Survey of research and theory in media studies and telecommunication, review of literature on mass communication, media, culture, and society, media audiences, texts, industries, and technologies; provides students an overview of the literature and theoretical orientation. Prerequisite: Graduate classification.
- 663. Seminar in Telecommunication and Media Studies. (3-0). Credit 3.** Intensive work on selected topics of research in telecommunication and media studies; may address work in the areas of audience studies, media effects, industries, policy, international issues, media and culture, media history, or theory; may be repeated for credit with different content up to a total of three times. Prerequisite: Graduate classification.
- 665. Communication and Technology. (3-0). Credit 3.** Examines the relationships between human communication and technology, investigating the social effects of communication technologies, the quality of messages, communicative practices, and rhetorical norms that typify effective communication in technological society. Prerequisite: Graduate classification.
- 669. Survey of Health Communication. (3-0). Credit 3.** Theories and research in health communication considering functions and outcomes of communication processes in various health contexts, ranging from interpersonal settings to public campaigns; emphasis on providing a framework for synthesizing and critically evaluating health communication research. Prerequisite: Graduate classification.
- 670. Health Communication Seminar. (3-0). Credit 3.** Investigation of a subject important to the understanding of health communication, such as persuasion and public health campaigns, physician-patient communication, or communication in health care organizations. May be repeated for credit with different content up to a total of three times. Prerequisites: Graduate classification and approval of instructor.
- 671. Interdisciplinary Seminar in Prevention Science. (1-0). Credit 1.** Contemporary research programs that represent the interdisciplinary field of prevention science; strengths and limitations of diverse theoretical and conceptual bases of research in prevention science; application of research findings to issues related to the prevention of mental, emotional, and physical health problems and the promotion of well-being. May be taken 3 times for credit. Prerequisite: Graduate standing and enrollment in the interdisciplinary graduate certificate in prevention science or approval of instructor. Cross-listed with HLTH 671, RPT'S 620 and SPSY 620.
- 681. Professional Seminar. (1-0). Credit 1.** Provides socialization to the profession of communication, focusing on graduate students' roles as scholars and teachers; provides instruction on teaching communication, conducting and writing publishable research, and fulfilling responsibilities to one's organization and profession. May be repeated up to three times. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 6 each semester.** Directed studies in specific problem areas in communication. Student may take up to two sections of directed studies in communication in the same semester, with a maximum of 6 credits. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4 each semester.** Selected topics in an identified area of communication. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis.

Comparative Literature (COML)

- 603. Introduction to Comparative Literature. (3-0). Credit 3.** Introduction to the discipline of Comparative Literature and Culture by examples of specific area studies or by an overview of the field; introduction to the pedagogical practices on teaching Comparative Literature and Culture. Cross-listed with ENGL 688.
- 645. Studies in Comparative Literature and Culture. (3-0). Credit 3.** Rotating topics in identified areas of Comparative Literature and Culture. Team-taught. The course may be repeated for credit. Prerequisite: COML 603.

- 685. Directed Studies. Credit 1 to 6.** Research to supplement student's knowledge of Comparative Literature and Culture in areas not studied in other courses; research papers; study of pedagogical issues in the field. Prerequisites: Graduate classification and approval of program coordinator.
- 689. Special Topics in Comparative Literature and Culture. Credit 1 to 4.** Selected topics in an identified area of Comparative Literature and Culture. May be repeated for credit. Prerequisite: Graduate classification.
- 691. Research. Credit 1 to 6.** Research for thesis. Prerequisite: Graduate classification.
- 697. Methodology of Teaching English and Foreign Language and Literature. Credit 1 to 3.** Theory of teaching of English and foreign language and literature; supervised teaching; evaluation of current research and its relationship to current practice. Prerequisite: Approval of instructor.

Computer Engineering

The programs offered in computer engineering include the research-oriented Master of Science and Doctor of Philosophy degrees, and the professional Master of Engineering degree. The MS and the PhD degrees include a research (thesis or dissertation) requirement.

Computer Engineering is an interdisciplinary field of study involving both the Computer Science and Engineering and the Electrical and Computer Engineering Departments. The Computer Engineering curriculum provides a balanced view of hardware, software, and hardware-software tradeoffs, analysis, design, and implementation techniques. Computer Engineering is a dynamic and broadly interdisciplinary field that impacts almost every area of human endeavor.

Well equipped laboratories are available for work in this program. Special laboratory facilities are available to graduate students in artificial intelligence, computer architecture, computer vision, distributed processing, graphics, integrated circuit design, parallel processing, real-time computing, robotics, software engineering, and testing and fault-tolerant computing.

There is no foreign language requirement for the PhD program in computer engineering.

Department of Computer Science and Engineering

N. M. Amato, R. Bettati, J. Caverlee, J. Chai, J. Chen, S. B. Childs, Y. Choe, C. K. T. Chui, G. Dos Reis, D. K. Friesen, R. Furuta, P. Gratz, G. Gu, R. Gutierrez-Osuna, T. A. Hammond, T. R. Ioerger, J. Järvi, A. Jiang, A. Kerne, J. C. Keyser, E. J. Kim, A. Klappenecker, J. C. Liu, W. M. Lively, D. Loguinov, R. Mahapatra, R. R. Murphy, P. Nelson, Jr., E. Nikolova, S. M. Pike, M. S. Pilant, U. W. Pooch, L. Rauchwerger, W. Rundell, V. Sarin, S. Schaefer, D. Shell, F. M. Shipman, D. B. Simmons, D. Song, P. F. Stiller, R. Stoleru, B. Stroustrup, S. Sze, V. E. Taylor, J. S. Vitter, R. A. Volz, D. M. H. Walker (Head), J. L. Welch, G. N. Williams, T. L. Williams

The Department of Computer Science and Engineering offers graduate studies leading to the degrees of Master of Computer Science, Master of Science in computer science and Doctor of Philosophy. In computer engineering, the Departments of Computer Science and Engineering and Electrical and Computer Engineering offer a joint program leading to the degrees of Master of Engineering, Master of Science and Doctor of Philosophy.

Advanced study in computer science is designed to provide the skills to design and utilize modern computer systems. The field of computer science is rapidly changing and expanding, generating a need for computer scientists in the burgeoning industry. The Department of Computer Science and Engineering is meeting these needs with advanced study in computer science.

Areas of study in computer science and engineering include five core areas and six multi-disciplinary areas. The five core areas include foundations of systems, software, theoretical foundations, human-centered systems and intelligent systems. The five multi-disciplinary areas include bioinformatics, brain networks, computational science and engineering, digital humanities, security and emergency informatics.

Special laboratory facilities are available to graduate students in artificial intelligence, software engineering, graphics, robotics, distributed systems, real time computing, software, multimedia, computer architecture, and hypertext. The department houses several super minicomputers and a network of microcomputer systems and workstations for individual student use.

There is no foreign language requirement for the PhD program in computer science.

Computer Science and Engineering (CSCE)

- 601. Programming with C and Java. (3-0). Credit 3.** Survey of the C and Java programming languages, including principles of procedural and object-oriented languages; multi-disciplinary applications including business, Internet and engineering problems. Prerequisite: Graduate classification.
- 602. Object-Oriented Programming, Development and Software Engineering. (3-0). Credit 3.** Teaches students Object-Oriented Programming in C++; software engineering techniques presented to teach how to build high quality software; semester project gives quasi-real-world experience with issues such as requirements capture and object-orient development. Prerequisites: CSCE 601 or approval of instructor; graduate classification.
- 603. Database Systems and Applications. (3-0). Credit 3.** Introduction to the concepts and design methodologies of database systems for non-computer science majors; emphasis on E. F. Codd's relational model with hands-on design application. Prerequisites: CSCE 601; graduate classification. Credit will not be given for both CSCE 310 and CSCE 603.
- 604. Programming Languages. (3-0). Credit 3.** Study in the design space of programming languages, covering language processing, formalisms to describe semantics of programming languages, important concepts found in current programming languages, and programming paradigms. Prerequisite: Graduate classification.
- 605. Compiler Design. (3-0). Credit 3.** Advanced topics in compiler writing; parser generators and compiler-compilers; dynamic storage and scope resolution; data flow analysis and code optimization. Prerequisite: CSCE 434.
- 606. Software Engineering. (3-0). Credit 3.** Development of advanced concepts in software engineering; software development environments as a mechanism for enhancing productivity and software quality; the classification, evaluation and selection of methodologies for environments; rapid prototyping and reusability concepts; artificial intelligence techniques applied to software engineering. Prerequisite: CSCE 431 or approval of instructor.
- 608. Database Systems. (3-0). Credit 3.** Database modeling techniques; expressiveness in query languages including knowledge representation; manipulation languages data models; physical data organization; relational database design theory; query processing; transaction management and recovery; distributed data management. Prerequisite: CSCE 310 or CSCE 603.
- 610. Hypertext/Hypermedia Systems. (3-0). Credit 3.** Comprehensive coverage of Hypertext/Hypermedia; basic concepts and definitions; fundamental components, architectures and models; problems and current solutions; design and implementation issues; and research issues. Prerequisites: CSCE 310 or CSCE 603; CSCE 313.
- 611. Operating Systems and Applications. (3-0). Credit 3.** Review of computer architecture hardware/software evolution leading to contemporary operating systems; basic operating systems concepts; methods of operating systems design and construction; algorithms for CPU scheduling memory and general resource allocation; process coordination and management; case studies of several operating systems; quality-of-services of operating systems and their impact on applications. Prerequisites: CSCE 313; graduate classification. Credit will not be given for both CSCE 410 and CSCE 611.
- 612. Applied Networks and Distributed Processing. (3-0). Credit 3.** Fundamentals, including network design and protocol analysis, in the context of computer communications; the course mixes fundamentals with both programming and pragmatic views of engineering issues; it includes network architecture as well as principles of network engineering; focus is on applying principles of layered architecture to analyzing real networks; lab exercises focus on protocol understanding and programming; knowledge of UNIX and C programming helpful, but not required. Prerequisite: Graduate classification. Credit will not be given for both CSCE 463 and CSCE 612.
- 613. Operating Systems. (3-0). Credit 3.** Analysis of algorithms in computer operating systems; sequencing and control algorithms supporting concurrent processes; scheduling algorithms to minimize execution times and mean flow times; algorithms for allocating tasks to processors; allocation of memory (virtual and real); direct access device schedules; auxiliary and buffer storage models. Prerequisite: CSCE 313 or CSCE 611.

- 614. Computer Architecture. (3-0). Credit 3.** Reviews of von Neumann architecture and its limitations; parallel computer structures and concurrent computation; pipeline computers and vectorization methods; array processors, multiprocessor architectures and programming; dataflow computers. Prerequisite: CSCE 350/ECEN 350.
- 617. Co-Design of Embedded Systems (CODES). (3-0). Credit 3.** Co-design methodologies of hardware-software systems; models of computation (MOC), system specification, co-simulation, synthesis, and verification; hardware-software implementation; core-based systems and interfaces, performance analysis and optimization; system on chip, power aware design. Prerequisites: CSCE 462 or equivalent, CSCE 410 and graduate classification.
- 619. Networks and Distributed Computing. (3-0). Credit 3.** Computer network concepts including network architecture, layering, protocols, packet switching and virtual circuits; performance evaluation and design considerations for local area networks; packet distributed networks; satellite networks. Prerequisite: CSCE 463 or CSCE 612.
- 620. Computational Geometry. (3-0). Credit 3.** Design and analysis of algorithms for solving geometrical problems; includes convex hull problems, Voronoi diagrams, range searching and proximity problems. Prerequisite: CSCE 311. Cross-listed with VIZA 670.
- 622. Generic Programming. (3-0). Credit 3.** The generic programming approach to design and systematic classification of software components, techniques for achieving correctness, efficiency, and generality of algorithms, data structures, and memory management, methods of structuring a library of generic software components for maximum usability are practiced in a significant design and implementation project. Prerequisite: CSCE 221.
- 624. Sketch Recognition. (3-0). Credit 3.** Analysis, implementation, and comparison of sketch recognition algorithms, including feature-based, vision-based, geometrical, timing-based, and path-based recognition algorithms. Methods for combining these recognition methods for greater accuracy, using known AI techniques, are also examined. Prerequisite: Graduate classification.
- 625. Artificial Intelligence. (3-0). Credit 3.** Basic concepts and methods of artificial intelligence; Heuristic search procedures for general graphs; game playing strategies; resolution and rule based deduction systems; knowledge representation; reasoning with uncertainty. Prerequisite: CSCE 221.
- 626. Parallel Algorithm Design and Analysis. (3-0). Credit 3.** Design of algorithms for use on highly parallel machines; area-time complexity of problems and general lower bound theory; application (of these concepts) to artificial intelligence, computer vision and VLSI design automation. Prerequisite: CSCE 221.
- 627. Theory of Computability. (3-0). Credit 3.** Formal models of computation such as pushdown automata; Turing machines and recursive functions; unsolvability results; complexity of solvable results. Prerequisite: CSCE 433.
- 628. Computational Biology. (3-0). Credit 3.** Introduction to computational biology; formulations of biology problems as computational problems; computational approaches to solve problems in genomics and proteomics. Prerequisite: Graduate classification or approval of instructor. Cross-listed with BICH 628.
- 629. Analysis of Algorithms. (3-0). Credit 3.** Concrete algorithm design and analysis; abstract models to analyze the complexity of problems; NP-Completeness; approximation and probabilistic algorithms. Prerequisite: CSCE 411.
- 631. Intelligent Agents. (3-0). Credit 3.** On the design and implementation of Intelligent Agents and coordination mechanisms among multiple agents, ranging from theoretical principles to practical methods for implementation. Prerequisite: CSCE 420 or CSCE 625.
- 633. Machine Learning. (3-0). Credit 3.** Machine learning is the study of self-modifying computer systems that can acquire new knowledge and improve their own performance; survey machine learning techniques, which include induction from examples, conceptual clustering, explanation-based learning, exemplar learning and analogy, discovery and genetic algorithms. Prerequisite: CSCE 420 or CSCE 625.
- 634. Intelligent User Interfaces. (3-0). Credit 3.** Intersection of artificial intelligence and computer-human interaction: emphasis on designing and evaluating systems that learn about and adapt to their users, tasks, and environments. Prerequisites: Graduate classification and approval of instructor.
- 635. AI Robotics. (3-1). Credit 3.** Introduction and survey of artificial intelligence methods for mobile robots (ground, aerial, or marine) for science and engineering majors; theory and practice of unmanned systems, focusing on biological and cognitive principles which differ from control theory formulations.

- 636. Neural Networks. (3-0). Credit 3.** Basic concepts in neural computing; functional equivalence and convergence properties of neural network models; associative memory models; associative, competitive and adaptive resonance models of adaptation and learning; selective applications of neural networks to vision, speech, motor control and planning; neural network modeling environments. Prerequisites: MATH 304 and MATH 308 or approval of instructor.
- 637. Complexity Theory. (3-0). Credit 3.** Deterministic, non-deterministic, alternating and probabilistic computations; reducibilities; P, NP and other complexity classes; abstract complexity; time, space and parallel complexity; and relativized computation. Prerequisite: CSCE 627 or approval of instructor.
- 639. Fuzzy Logic and Intelligent Systems. (3-0). Credit 3.** Introduces the basics of fuzzy logic and its role in developing intelligent systems; topics include fuzzy set theory, fuzzy rule inference, fuzzy logic in control, fuzzy pattern recognition, neural fuzzy systems and fuzzy model identification using genetic algorithms. Prerequisite: CSCE 625 or approval of instructor. Cross-listed with MEEN 676.
- 640. Quantum Algorithms. (3-0). Credit 3.** Introduction to the design and analysis of quantum algorithms; basic principles of the quantum circuit model; gives a gentle introduction to basic quantum algorithms; reviews recent results in quantum information processing. Prerequisite: CSCE 629 or approval of instructor.
- 641. Computer Graphics. (3-0). Credit 3.** Representations of 3-dimensional objects, including polyhedral objects, curved surfaces, volumetric representations and CSG models; techniques for hidden surface/edge removal and volume rendering; illumination and shading; anti-aliasing; ray tracing; radiosity; animation; practical experience with state-of-the-art graphics hardware and software. Prerequisite: CSCE 441. Cross-listed with VIZA 672.
- 643. Seminar in Intelligent Systems and Robotics. (3-0). Credit 3.** Problems, methods and recent developments in intelligent systems and robotics. This course may be taken at multiple times for credit as content varies. Prerequisite: Approval of instructor.
- 644. Cortical Networks. (3-0). Credit 3.** The architecture of the mammalian cerebral cortex; its modular organization and its network for distributed and parallel processing; cortical networks in perception and memory; neuronal microstructure and dynamical simulation of cortical networks; the cortical network as a proven paradigm for the design of cognitive machines. Prerequisites: CSCE 420 or CSCE 625 and CSCE 636 and graduate classification.
- 645. Geometric Modeling. (3-0). Credit 3.** Geometric and solid modeling concepts. Freeform curves and surfaces (splines and Bezier) with their relational, intersectional and global mathematical properties. Parametric representation of solids, topology of closed curved surfaces, boundary concepts and Boolean/Euler operators. Construction and display of curves and surfaces, and solid models. Prerequisites: CSCE 441 and CSCE 442 or equivalent. Cross-listed with VIZA 675.
- 646. The Digital Image. (3-2). Credit 4.** Tools and techniques for generation, handling and analysis of two dimensional digital images; image representation and storage; display, media conversion, painting and drawing; warping; color space operations, enhancement, filtering and manipulation. Prerequisite: VIZA 653, graduate classification or approval of instructor. Cross-listed with VIZA 654.
- 647. Image Synthesis. (3-2). Credit 4.** Principles of image synthesis from 3-D scene descriptions; includes local and global illumination, shading, shadow determination, hidden surface elimination, texturing, raster graphics algorithms, transformations and projects. Prerequisite: VIZA 653 or approval of instructor. Cross-listed with VIZA 656.
- 648. Computer Aided Sculpting. (2-3). Credit 3.** Mathematical and artistic principles of 3-D modeling and sculpting; includes proportions, skeletal foundation, expression and posture, line of action; curves, surfaces and volumes, interpolation and approximation, parametric and rational parametric polynomials, constructive solid geometry, and implicit representations. Prerequisite: Approval of instructor. Cross-listed with VIZA 657.
- 649. Physically-Based Modeling. (2-2). Credit 3.** Physical simulation as used in choreography, geometric modeling, and the creation of special effects in computer graphics: a variety of problems and techniques explored which may include particle-methods, modeling and simulation of flexible materials, kinematics and constraint systems. Prerequisite: Approval of instructor. Cross-listed with VIZA 659.

- 653. Computer Methods in Applied Sciences. (3-0). Credit 3.** Classical and modern techniques for the computational solution of problems of the type that traditionally arise in the natural sciences and engineering; introductions to number representation and errors, locating roots of equations, interpolation, numerical integration, linear algebraic systems, spline approximations, initial-value problems for ordinary differential equations and finite-difference methods for partial differential equations. Prerequisite: CSCE 442 or MATH 417; graduate classification.
- 654. Supercomputing. (3-0). Credit 3.** Principles of high-performance scientific computing systems, vectorization, programming on supercomputers, numerical methods for supercomputers, performance measuring of supercomputers, multitasking. Prerequisite: CSCE 614.
- 655. Human-Centered Computing. (3-0). Credit 3.** A foundation course in human centered systems and information; understanding and conceptualizing interaction; design and prototyping methodologies; evaluation frameworks; visual design using color, space, layering, and media; information structuring and visualization; animation and games; individual and team programming projects. Prerequisite: Graduate classification or CSCE 436 or CSCE 444 or approval of instructor.
- 656. Computers and New Media. (3-0). Credit 3.** This class investigates the potential and realized impact of computers in the design of new media, explores the variety of relationships between authors and readers of interactive materials, and explores the influence of media design and content expressed. Prerequisite: Graduate classification.
- 658. Randomized Algorithms. (3-0). Credit 3.** This course gives an introduction to randomized algorithms; selected tools and techniques from probability theory and game theory are reviewed, with a view towards algorithmic applications; the main focus is a thorough discussion of the main paradigms, techniques, and tools in the design and analysis of randomized algorithms; a detailed analysis of numerous algorithms illustrates the abstract concepts and techniques. Prerequisite: Graduate classification.
- 659. Parallel/Distributed Numerical Algorithms and Applications. (3-0). Credit 3.** A unified treatment of parallel and distributed numerical algorithms; parallel and distributed computation models, parallel computation of arithmetic expressions; fast algorithms for numerical linear algebra, partial differential equations and nonlinear optimization. Prerequisites: CSCE 653; MATH 304. Cross-listed with ECEN 659.
- 660. Computational Linear Algebra. (3-0). Credit 3.** Techniques in matrix computation: elimination methods, matrix decomposition, generalized inverses, orthogonalization and least-squares, eigenvalue problems and singular value decomposition, iterative methods and error analysis. Prerequisite: CSCE 442 or equivalent or MATH 417 or equivalent. Cross-listed with MATH 660.
- 661. Integrated Systems Design Automation. (3-0). Credit 3.** VLSI design systems and their levels of abstracting; algorithms for general VLSI design and implementation; computer aided design tools and principles; physical and logical models. Prerequisite: Graduate classification.
- 662. Distributed Processing Systems. (3-0). Credit 3.** Principles and practices of distributed processing; protocols, remote procedure calls; file sharing; reliable system design; load balancing; distributed database systems; protection and security; implementation. Prerequisite: CSCE 313 and 463 or CSCE 612.
- 663. Real-Time Systems. (3-0). Credit 3.** Taxonomy of real-time computer systems; scheduling algorithms for static and dynamic real-time tasks; hard real-time communications protocols; programming languages and environments for real-time systems; case studies of real-time operating systems. Prerequisites: CSCE 313, and CSCE 463 or CSCE 611, or approval of instructor.
- 664. Wireless and Mobile Systems. (3-0). Credit 3.** Wireless and mobile systems; wireless communication fundamentals; wireless medium access control design; transmission scheduling; network and transport protocols over wireless design, simulation and evaluation; wireless capacity; telecommunication systems; vehicular, adhoc, and sensor network systems; wireless security; mobile applications. Prerequisite: CSCE 463 or CSCE 464 or approval of instructor.
- 665. Advanced Networking and Security. (3-0). Credit 3.** Security aspects of various network protocols including investigation and tool development using “live” machines and networks. Prerequisites: Graduate classification and approval of instructor.
- 666. Pattern Analysis. (3-0). Credit 3.** Introduction to methods for the analysis, classification and clustering of high dimensional data in Computer Science applications. Course contents include density and parameter estimation, linear feature extraction, feature subset selection, clustering, Bayesian and geometric classifiers, non-linear dimensionality reduction methods from statistical learning theory and spectral graph theory, Hidden Markov models, and ensemble learning. Prerequisites: MATH 222, MATH 411 (or equivalent) and graduate classification.

- 667. Seminar in Human-Centered Computing. (3-0). Credit 3.** Problems, methods and recent developments in human-centered computing and information. May be repeated for credit as content varies. Prerequisites: Graduate classification.
- 668. Distributed Algorithms and Systems. (3-0). Credit 3.** Introduction to fundamental algorithmic results in distributed computing systems; leader election, mutual exclusion, consensus, logical time and causality, distributed snapshots, algorithmic fault tolerance, shared memory, clock synchronization. Prerequisites: CSCE 411 or equivalent or approval of instructor.
- 669. Computational Optimization. (3-0). Credit 3.** Combinatorial theory of polytopes as a tool for the solution of combinatorial optimization problems; applications to max flow, matching and matroids; geometric interpretation of the results indicating the profound role that polyhedral combinatorics play in the design and complexity of approximation algorithms. Prerequisite: CSCE 629.
- 670. Information Storage and Retrieval. (3-0). Credit 3.** Representation, storage, and access to very large multimedia document collections; fundamental data structures and algorithms of information storage and retrieval systems; techniques to design and evaluate complete retrieval systems, including cover of algorithms for indexing, compressing, and querying very large collections. Prerequisites: CSCE 310 or CSCE 603 or approval of instructor; graduate classification.
- 671. Computer-Human Interaction. (3-0). Credit 3.** Comprehensive coverage of Computer-human Interaction (CHI) including history, importance, design theories and future direction; modeling computer users and interfaces, empirical techniques for task analysis and interface design, and styles of interaction. Prerequisite: Graduate classification.
- 672. Computer Supported Collaborative Work. (3-0). Credit 3.** Covers design, implementation and use of technical systems that support people working cooperatively; draws from the research area of Computer Supported Cooperative Work (CSCW) and includes current theoretical, practical, technical and social issues in CSCW and future directions of the field. Prerequisite: CSCE 671 or CSCE 610 or approval of instructor.
- 673. Information, Secrecy and Authentication I. (3-0). Credit 3.** Preliminaries; probability, information, entropy, signals, channels; group-theoretic view of messages; contemporary secrecy and digital signature systems; one-time pads, DES, RSA, DSS, wheels, LFSR-based systems; analog scramblers; key exchange, key management, secret sharing, access structures; measures of security. Prerequisites: Graduate classification and approval of instructor. Cross-listed with MATH 673.
- 674. Information, Secrecy and Authentication II. (3-0). Credit 3.** Classical and recent attacks; login, compression, error control and genetic codes; finite and infinite codes; matrices, graphs, duals, groups, morphisms, composites, products, rates and classification of codes; the confusion/diffusion/arithmetic/calculus extension of Shannon's two design primitives. Prerequisites: MATH 673; graduate classification or approval of instructor. Cross-listed with MATH 674.
- 675. Digital Libraries. (3-0). Credit 3.** Surveys current research and practice in Digital Libraries, which seek to provide intellectual access to large-scale, distributed digital information repositories; current readings from the research literature which covers the breadth of this interdisciplinary area of study. Prerequisite: Graduate classification in computer science.
- 680. Testing and Diagnosis of Digital Systems. (3-0). Credit 3.** The theory and techniques of testing VLSI-based circuits and systems, and design for testability. Prerequisites: CSCE 321 or ECEN 350 or equivalent; ECEN 220 or ECEN 248 or equivalent. Cross-listed with ECEN 680.
- 681. Seminar. (1-0). Credit 1.** Reports and discussion of current research and of selected published technical articles. May not be taken for credit more than once in master's degree program nor twice in PhD program.
- 684. Professional Internship. Credit 1 to 16.** Training under the supervision of practicing computer professionals in settings appropriate to the student's professional objectives, away from the Texas A&M University campus. Prerequisites: Approval of department head and one semester of graduate work completed.
- 685. Directed Studies. Credit 1 to 12.** Research problems of limited scope designed primarily to develop research technique.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of computer science. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more** Research for thesis or dissertation.

Department of Construction Science

D. L. Bilbo, J. A. Bryant, K. Choi, I. M. Choudhury, L. H. Feigenbaum, J. L. Fernandez-Solis, M. E. Haque, N. L. Holland, J. P. Horlen (Head), J. Kang, S. Lavy-Leibovich*, J. M. Nichols, Z. K. Rybkowski, B. Y. Ryoo, R. O. Segner, J. C. Smith, K. C. Williamson III, P. K. Woods

* Graduate Program Coordinator

The Master of Science in Construction Management program is an advanced curriculum comprised of a core of study in management of construction operations; legal aspects of construction; and research methodology. Students will develop a specialization through theses/professional studies and coursework in their fields of interest. The program is augmented with classes in business administration, engineering, architecture, and other support areas as appropriate for specialization development.

A minimum body of knowledge is required as a prerequisite of admission for students without an appropriate degree or substantial professional experience.

The program offers a 32-hour thesis and a 36-hour non-thesis option.

Because of the important role of computing in the disciplines housed within the College of Architecture, all entering students are required to possess a portable, network-ready personal computer capable of running software appropriate to their academic program. Financial aid is available to assist students in their computer purchases. No student will be denied admission to Texas A&M University based on inability to purchase a computer. Additional information is available on the college website at arch.tamu.edu.

This program offers a dual master's degree program with the graduate programs in Construction Management and in Land and Property Development that enables students to graduate with a Master of Science in Construction Management and a Master of Science in Land and Property Development upon completion of the combined 68 credit hour (with thesis) or 72 credit hour (without thesis) core curriculum. A student must be admitted into both the graduate program in Construction Management and the graduate program in Land and Property Development before completion of this dual degree program.

Construction Science (COSC)

- 601. Construction Practices. (3-0). Credit 3.** Construction materials and processes from inception to completion; alternative construction delivery processes; code standards and safety aspects related to buildings; various contemporary/innovative building systems.
- 602. Construction Estimating. (3-0). Credit 3.** A graduate level course designed to provide the student with a comprehensive introduction to the principles, techniques, technologies, and basic concepts involving construction management's methodology and strategy used in the preparation of construction estimate and bid.
- 603. Construction Scheduling. (2-3). Credit 3.** Construction scheduling process utilizing current techniques including critical path method, precedence method, program evaluation and review techniques, and probabilistic method; development of parameter estimates for activities that relate to the construction of a building project; work packages sequenced, planned and leveled to develop a working project execution document; development of procedures to monitor actual field progress; computer application in project scheduling.
- 606. Mechanical and Electrical Construction. (3-0). Credit 3.** Selection of mechanical and electrical equipment to support construction operations; design, construction and costs of building mechanical/electrical subsystems; energy, operating and maintenance costs.
- 608. Structural Principles and Practices. (3-0). Credit 3.** Investigations into practical applications of structural design; surveys and studies of various structural systems.
- 620. Construction Operations. (3-0). Credit 3.** Theory and case studies related to the management of construction business operations; investigation of current business practices employed by construction firms.
- 621. Advanced Topics in Construction Project Scheduling and Project Management. (3-0). Credit 3.** Advanced techniques used in scheduling and evaluating progress in construction project control; development of strategies for overcoming overruns; resource allocations; case studies. Prerequisites: COSC 602 and COSC 603 or equivalent; STAT 651.
- 622. Construction Resources. (3-0). Credit 3.** Identification and analysis of the factors affecting resources of the construction industry on a local, regional, national and international level.

- 624. Project Acquisition and Control. (3-0). Credit 3.** Acquisition of new work in the construction industry; overview of organizational theory, strategic planning and business planning in the construction industry; acquisition procedures including response techniques for complex requests for proposals; understanding concepts of sales and marketing, backlog, and business development budgeting in construction.
- 627. Construction Dispute Resolution Alternatives. (3-0). Credit 3.** Introduces students to theories used to resolve claims and disputes arising during the construction process, including negotiation, mediation, arbitration and litigation; emphasizes alternatives to litigation and principles of negotiation useful in construction management.
- 628. Applications of Construction Law. (3-0). Credit 3.** Review of most common areas of law applied to the industry; application of this law to case studies; introduction to analytical processes needed to argue legal issues and claims; review of dispute resolution methods and ethics in the construction industry.
- 631. Supervision of the Construction Workforce. (3-0). Credit 3.** Individual and group workforce behavior as it affects construction productivity; unique motivational and demotivational behavior characteristics; models of supervisory practice; effect of goal setting, management participation, work incentives and other reinforcers on construction workers.
- 633. International Construction Contracting. (3-0). Credit 3.** Special problems, opportunities and procedures related to international construction projects; impact of social, cultural, legal and financial aspects of international contracting; logistics of labor, materials and equipment in a foreign environment; recent construction activity, past trends and future developments for selected countries.
- 641. Construction Management Communications. (3-0). Credit 3.** Current theory and practice of voice and data communications technology applicable to the construction industry; digital communications tools used by construction managers to facilitate the understanding of roles, relationships and processes of construction project constituents.
- 642. Web-Based Construction Data Management. (3-0). Credit 3.** A comprehensive introduction to the principles and techniques of information systems and data communication within the construction industry; a technical overview of the concepts of information systems, data transmissions and network-based technologies employed in the design and management of construction communication networks.
- 644. Systems Approach to Construction Management. (3-0). Credit 3.** Concepts, relationships and techniques of decision analysis; application of methodology and techniques to major decisions faced by construction managers.
- 648. Design-Build Project Delivery. (3-0). Credit 3.** Overview and analysis of the design-build project delivery process utilizing case studies; emphasis on understanding alternative project delivery systems evolving in the design and construction industries.
- 650. Introduction to Construction Visualization. (2-2). Credit 3.** Introduction to the theory and application of 3-D computer models in the design/build construction process; creation, positioning in 3-D space, and linking of building components to a database record; creation of a wide range of construction related information useful in controlling project quality.
- 662. Contemporary Housing Production: Theory and Practice. (3-0). Credit 3.** Introduction to the contemporary housing production system and to the social and economic forces upon which it must rely to be successful; consumer preference, technological innovation and quality control.
- 663. Sustainable Construction. (3-0). Credit 3.** How sustainable construction materials and methods contribute to meeting the needs of the present without compromising the ability of future generations to meet their own needs; identifies and analyzes those international, national and local programs promoting sustainable construction; characterizes the components of successful sustainable construction projects.
- 664. Construction Safety Management. (3-0). Credit 3.** Safety management process and the development of a comprehensive safety program to include hazard recognition, field safety meetings, OSHA documentation requirements, accident investigation and analysis, coordination of the contractor and subcontractor relationship, and the development of OSHA teaching modules for field use; opportunities to obtain an OSHA 30 Hour Certification, a CPR Certification and a First Aid Certification.
- 665. Earth Construction. (3-0). Credit 3.** Introduces students to use of earth as a construction material; earth construction techniques; the classification and identification of soil for construction use; field and laboratory tests for construction soils; the properties of earth masonry units; simple field and laboratory tests for masonry units; construction using compressed soil blocks.

- 670. Facilities Management. (3-0). Credit 3.** Fundamentals of facilities management including concepts, theories, and principles of construction, architecture, design, accounting, finance, management and behavioral sciences of facilities management.
- 672. Introduction to Facility Management Data Systems. (3-0). Credit 3.** Introduction to data management system concepts and applications as they relate to facility management operations; system design, implementation and management; case studies of practice; application of theory to practical problems.
- 674. Facility Energy Management. Credit 3 to 6.** Introduces major technologies, including human comfort, Heating Ventilating and Air Conditioning (HVAC), and piping systems; review of system terminology, engineering design characteristics, components and materials; stresses construction and installation methods and procedures; covers contractual relationships and coordination requirements during project execution between owners, design firms, and general, as well as specialty, contractors; assessment of operation and maintenance criteria for facility energy systems; evaluation of operating and life-cycle costs of facility energy systems.
- 681. Seminar. Credit 1 each semester.** Discussion and review of degree requirements and current practices in construction management.
- 684. Professional Internship. (3-0). Credit 3.** Internship consisting of 400-600 hours with a construction or construction related company; work experience must expose student to construction activities; pre-approval required; internship report required; post-approval by industry representative and internship advisor.
- 685. Directed Studies. Credit 1 to 6.** Individual problems in the area of building construction involving the application of theory and practice. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified field of construction management. May be repeated for credit. Prerequisite: Approval of instructor.
- 690. Theory of Research in Construction Management. (3-0). Credit 3.** Introduction to research, research tools, proposal writing and research reports; emphasis placed on research planning and design; review of literature through qualitative and quantitative research methodologies; emphasis on defining research problems in construction science and the development of research proposals. Prerequisite: Graduate classification.
- 691. Research. Credit 1 or more each semester.** Research for thesis.
- 693. Professional Study. Credit 1 to 6.** Approved professional study of project undertaken as terminal requirement for Master of Science, non-thesis option. Preparation of a record of study summarizing the rationale, procedure and results of the completed study. Prerequisite: Approval of major advisor. May be repeated for credit.

Counseling Psychology

(faculty, see [page 392](#))

(CPSY)

- 612. Planning and Organizing Comprehensive Guidance Programs. (3-2). Credit 4.** Purposes and functions of a guidance program; components of a comprehensive guidance program; systems approach to implementing a comprehensive guidance program for elementary and secondary students and adults. Prerequisite: Approval of department head.
- 626. Psychopathology. (3-0). Credit 3.** Causes, course, outcomes and treatment of abnormal and maladaptive behavior; degrees of variation possible from normal adaptive behavior; biological, developmental, social, cultural and psychological perspective on abnormal behavior. Prerequisite: Graduate classification.
- 630. Foundations of Counseling. (4-0). Credit 4.** Philosophical, psychological and sociological concepts fundamental to counseling and related helping professions in public and mental health settings. Prerequisite: Graduate classification; Approval of department head.
- 631. Techniques of Counseling. (3-0). Credit 3.** Methods and procedures descriptive of the counseling process; dynamics of counselor-counselee relationship; interviewing techniques; use of test results in counseling. Prerequisites: CPSY 630; approval of department head.

- 632. Career Counseling. (3-0). Credit 3.** Theories of career development; sources, classification and analysis of educational, occupational and social information including occupational trends, post-secondary programs and financial planning; use of occupational-educational information, appropriate psychological measures and computerized guidance systems. Prerequisite: CPSY 679.
- 633. Introduction to Group Process. (2-3). Credit 3.** Principles, procedures and processes of group approaches to assisting individuals in their personal growth and development in education, public and mental health settings; participation as member of a personal growth required. Prerequisites: CPSY 630; approval of department head.
- 634. Group Counseling and Psychotherapy. (3-0). Credit 3.** Major contemporary approaches to group counseling and psychotherapy in mental and public health settings; experiential learning in a simulated group process; integration of theory and practical applications. Prerequisites: CPSY 631; CPSY 633 or equivalent; approval of department head.
- 635. Social Counseling Psychology Interface. (3-0). Credit 3.** Provides a foundation in theory and research at the interface of social and counseling psychology; fundamentals of social psychology theories, methodologies and perspectives; understanding the relevance to counseling psychology practice; focus on social and cognitive theories, concepts, and processes rather than specific psychological disorders. Prerequisite(s): Doctoral student in good standing in counseling, clinical, school or social psychology.
- 636. Psychological Consultation to Organizations. (3-0). Credit 3.** Focuses on organizations as the target of analysis, intervention, and change; established social science concepts and principles; consideration of concepts, intervention strategies, and skills that extend beyond those used in counseling and psychotherapy; highlights consultation as a mode of change agency; considerable attention given to putting theory into practice. Prerequisites: Graduate classification; approval of department head; approval of instructor.
- 639. Counseling Practicum I. (2-3). Credit 3.** Supervised experience in individual counseling; cases engaged in the counseling laboratory on campus; off-campus counseling in schools and various public and mental health settings also assigned at supervisor's discretion. May be taken for credit 2 times as content varies. Prerequisites: CPSY 631 and CPSY 632; approval of instructor six weeks prior to registration; approval of department head.
- 662. Professional Issues in Counseling Psychology. (3-0). Credit 3.** Legal, ethical, economic and practical issues that impact the training, credentialing, placement and marketing of counseling psychologists and their services. Prerequisite: Approval of department head.
- 664. Counseling Practicum II. (1-6). Credit 3.** Supervised experience in individual and group counseling requiring advanced technical skills; continuing counseling relationships with various, selected subjects. Prerequisites: CPSY 639; approval of department head six weeks prior to registration.
- 666. Practicum in Counselor Supervision. (1-6). Credit 3.** Supervised experience in directing counseling and guidance activities of students involved in practicum and field experiences; intended for individuals preparing to become counselor educators or supervisors. Prerequisites: CPSY 664; approval of department head; application six weeks prior to registration.
- 671. Dying and Bereavement. (3-0). Credit 3.** Exposure to experiences of others on the topic of dying and loss both through readings and through class presentations and discussions; offers new ways to think about death in general, as well as one's own death and those of one's loved ones; provides mental health provider a foundation in concepts/process of death, loss and bereavement. Prerequisites: Graduate classification and approval of department head.
- 672. Theories of Counseling and Psychotherapy. (3-0). Credit 3.** Comprehensive and intensive study of major theoretical positions in counseling and psychotherapy; implications for research and practice in public and mental health settings. Prerequisites: CPSY 631; approval of department head.
- 673. Advanced Psychotherapeutic Skills. (3-0). Credit 3.** Didactic/experiential course, designed for students in professional psychology programs; variety of psychotherapeutic interventions in short and long term counseling with adults in public and mental health settings; ways to access affective process. Prerequisites: Practicum; approval of instructor and department head.
- 676. Family Counseling and Psychotherapy. (3-0). Credit 3.** Basic concepts and techniques in marriage and family counseling in public and mental health settings; marital communication and growth relationships. Prerequisites: CPSY 631 and CPSY 633; approval of instructor and department head.

- 677. Practicum in Clinical Geropsychology. (1-6). Credit 3.** Practicum in theory and strategies for providing mental health services to the elderly; training and supervision of individual counseling and community mental health approaches in a variety of settings. Prerequisites: Human service experience; approval of instructor and department head.
- 678. Couples Therapy. (3-0). Credit 3.** Theory and practice of marital therapy emphasizing systems and communication approaches; effective strategies and techniques for use in public and mental health settings; therapy with specific marital problems and obstacles to effective therapy. Repeatable to 6 hours. Prerequisites: CPSY 631 and CPSY 639 or equivalent; approval of instructor. Cross-listed with PSYC 678.
- 679. Multicultural Counseling. (3-0). Credit 3.** Effective communication skills in cross-cultural counseling or helping relationships in public and mental health settings; integration of theoretical knowledge with experiential learning; psychosocial factors and lifestyles of cultural groups; effect on counseling relationships. Prerequisites: Graduate classification and approval of department head.
- 683. Field Practicum in... Credit 1 to 15.** Supervised experience in professional public and mental health settings in counseling psychology. Wide range of practical experiences and activities that are closely supervised by departmental faculty. Repeatable to 15 hours. Prerequisite: Graduate classification; approval of department head.
- 684. Professional Internship. Credit 1 to 4 each semester.** Limited to advanced doctoral students; faculty supervised experience in approved professional public and mental health employment settings; application for September assignments must be approved the previous October. May be repeated up to 9 hours. Prerequisites: Completion of required coursework except CPSY 684 and CPSY 691; approval of department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems. Prerequisite: Approval of department head.
- 688. Research Proposal Development. (3-2). Credit 4.** This seminar models the processes of developing and defending research proposals. Prerequisites: EPSY 640 and EPSY 641 or approval of instructor; approval of department head. Cross-listed with EPSY 688.
- 689. Special Topics in... Credit 1 to 4 each semester.** Selected topic in an identified area of counseling psychology. May be repeated for credit. Prerequisite: Approval of department head.
- 690. Theory of Counseling Psychology Research. (3-0). Credit 3.** Theory and design of research problems and experiments in counseling psychology; communication of research proposals and results; evaluation of current research of faculty and students and review of current literature. May be repeated for credit. Prerequisite: Approval of instructor and department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of department head.

Dairy Science

(faculty, see [page 308](#))

(DASC)

- 606. Microbiology of Foods. (3-0). Credit 3.** II Nature and function of beneficial and defect-producing bacteria in foods; food-borne illness, effects of processing, storage and distribution; techniques for isolation and identification from foods. Cross-listed with FSTC 606.
- 685. Directed Studies. Credit 1 to 4 each semester.** I, II, S Research methods and review of scientific literature dealing with individually selected problems in production or manufacturing and not pertaining to thesis or dissertation.
- 691. Research. Credit 1 or more each semester.** I, II, S Research leading to thesis or dissertation in respective fields of dairy production and dairy manufacturing.

Econometrics

(faculty, see [page 373](#))

(ECMT)

- 660. Mathematical Economics I. (3-0). Credit 3.** Use of selected types of mathematical tools in economic theory.
- 669. Fundamental Mathematics for Economists. (2-0). Credit 2.** Mathematics of nonlinear programming; applications to micro-theoretic models of demand and production; fundamental results from matrix theory and multivariate differential calculus; systems of differential equations and stability analysis and their economic applications.
- 675. Econometrics I. (3-0). Credit 3.** Empirical distributions of economic variables; elementary discrete and continuous distributions expressing econometric hypotheses, distributions of estimators and test statistics. Prerequisites: MATH 151 and MATH 152 or approval of instructor.
- 676. Econometrics II. (3-0). Credit 3.** Use of statistics in economic theory as device for testing hypotheses, formulation of concepts and economic forecasting; regression analysis in economics problems, heteroskedasticity, autocorrelation, distributed lags, regressions with lagged dependent variable, dummy variables and in introduction to multi-equations economics models. Prerequisite: ECMT 675 or equivalent.
- 677. Applied Microeconometrics. (3-0). Credit 3.** Estimation methods applied to economic problems; techniques include single and simultaneous equations models; general linear model in matrix form; tests of linear restrictions; Wald, Likelihood Ratio and Lagrange Multiplier tests; seemingly unrelated regressions, simultaneous equations identification and estimation; missing observations, errors in variables and non-linear estimation in economics problems. Prerequisites: ECMT 675 and ECMT 676; STAT 610 or approval of instructor.
- 678. Nonparametric Econometrics. (3-0). Credit 3.** Continuation of ECMT 677. Estimation methods applied to economic problems; techniques include qualitative limited dependent variables; pooled time-series and cross-section data; instrumental variables in economics problems. May repeated for credit. Prerequisite: ECMT 677.
- 679. Time Series Econometrics. (3-0). Credit 3.** Advanced topics in time series econometrics, including ARMA models, unit roots and cointegration. Prerequisite: ECMT 677.
- 680. Financial Econometrics. (3-0). Credit 3.** Basic concepts of financial engineering and elementary theory of stochastic processes and continuous time models; selected topics related to current financial econometrics research.

Department of Economics

J. W. Allen, R. K. Anderson, A. L. Brown, C. Eckel, L. Gan, A. J. Glass, T. J. Gronberg (Head), J. R. Hanson II, M. Hoekstra*, S. A. Houghton, H. S. Hwang, D. W. Jansen, R. Jinnai, S. Krasteva, Q. Li, J. Meer, J. R. Moroney, S. L. Puller, R. Sarin, T. R. Saving, G. Tian, M. Ureta, J. B. Van Huyck, R. Velez, F. R. Welch, S. N. Wiggins, K. Xu, A. Zervou, Y. Zhang

* Graduate Advisor

Graduate study in economics leads to the degrees of Master of Science and Doctor of Philosophy. The graduate program develops theoretical and quantitative skills and analyzes a broad range of contemporary policy issues in order to prepare students for careers in teaching, research, business and government.

Both MS and PhD degrees are offered. It is not necessary to have a master's degree before beginning a doctoral program. To enter the doctoral program in economics, the student should present undergraduate credits in economics, although an undergraduate major in economics is not necessary. Additional preparation should include work in mathematics and statistics. The department has no foreign language requirement for a graduate degree in economics.

Economics (ECON)

- 603. Public Economics I. (3-0). Credit 3.** Economics of taxation and public spending; theoretical and empirical analysis of the shifting and incidence of income, commodity and property taxes; models of optimal taxation and public spending; analysis of taxation and spending in a federal system of government. Prerequisite: Approval of instructor.
- 604. Public Economics II. (3-0). Credit 3.** Economics of collective action; theoretical and empirical analysis of externalities; externalities and public policy; the demand and supply of public goods; economic analysis of alternative systems of public choice; models of bureaucratic behavior. Prerequisite: ECON 629 or approval of instructor.
- 607. Foundations of Microeconomic Theory. (3-0). Credit 3.** Examination of positive and normative analysis in economic theory; emphasis on policy applications of the theory. Prerequisites: MATH 131 or equivalent; ECON 323 or equivalent; or approval of instructor.
- 609. Human Resource Economics I. (3-0). Credit 3.** Valuation and allocation of human resources; labor supply of households, labor supply over the life-cycle, determination of wages, human capital, migration, education, labor markets and population; use of the testable implications of theory and of evidence to explain observed labor market behavior. Prerequisite: ECON 629 or equivalent.
- 610. Human Resource Economics II. (3-0). Credit 3.** Selected topics in labor markets; unemployment, earnings differentials, effects of occupational licensing, trade unions, income distribution, military manpower and the draft, effects of minimum wage and equal pay provisions, effects of welfare programs, the professional athlete's labor market and others; developing and analyzing empirical problems. Prerequisite: ECON 629 or equivalent.
- 611. Foundations of Macroeconomic Theory. (3-0). Credit 3.** Development of modern static national income analysis from general equilibrium system; roles of fiscal and monetary policy in promoting economic stability. Prerequisites: ECON 323 and ECON 410; MATH 131 or equivalent.
- 629. Microeconomic Theory I. (3-0). Credit 3.** Core ideas in theoretical microeconomics; theory of consumer and firm; theory of competitive output and factor markets. Prerequisite: Approval of instructor.
- 630. Microeconomic Theory II. (4-0). Credit 4.** Advanced treatment of consumer and production theory; game theory; general equilibrium and welfare analysis. Credit 4 hours. Prerequisites: ECON 629; ECMT 660.
- 631. Microeconomic Theory III. (3-0). Credit 3.** Advanced theoretical microeconomics; comprehensive study of consumer and producer theory, general equilibrium and welfare, and failures of the competitive model. Prerequisites: ECON 629 and ECON 630.
- 633. Energy Markets and Policy. (3-0). Credit 3.** Economics of energy markets and energy regulation with emphasis on implications for optimal energy policy; sectors include gasoline, oil, electricity, natural gas, renewables, nuclear; economic theory integrated with empirical applications from American and international experience; new energy markets, energy trading, and interaction with environmental policy. Prerequisite: Graduate classification.
- 635. Monetary Theory. (3-0). Credit 3.** Traditional and modern theories of money; general equilibrium systems and role of money in determination of prices, interest rate, income and employment. Prerequisite: ECON 636.
- 636. Macroeconomic Theory I. (3-0). Credit 3.** Theory of consumption, investment, money, interest, inflation and employment. Prerequisite: ECON 410 or ECON 611.
- 637. Monetary Policy. (3-0). Credit 3.** Effect of monetary policy on aggregate economic activity and distribution of resources; effectiveness of various policies; optimal policy in light of various institutional restrictions that exist. Prerequisite: ECON 635.
- 646. Macroeconomic Theory II. (3-0). Credit 3.** Dynamic models, open economies, disequilibrium analysis, unemployment and inflation; traditional macro models and recent developments in macro theory. Prerequisite: ECON 636.
- 647. Macroeconomic Theory III. (3-0). Credit 3.** Advanced theory of consumption, investment, money, interest, inflation and employment; most recent developments in macro theory. Prerequisites: ECON 636 and ECON 646.

- 649. Industrial Organization I. (3-0). Credit 3.** Industry structure, conduct and performance described and analyzed with tools of microeconomics. Prerequisite: Approval of instructor.
- 650. Industrial Organization II. (3-0). Credit 3.** Behavior of markets operating under conditions of imperfect information; construction and scientific evaluation of models designed to explain industry performance. Prerequisite: ECON 649 or approval of instructor.
- 651. International Economic Policy. (3-0). Credit 3.** Balance of payments and adjustment to national and international equilibria; determination of exchange rates under various monetary standards, capital movements, exchange controls and international monetary organization. Prerequisite: ECON 611 or equivalent.
- 652. International Trade Theory. (3-0). Credit 3.** Classical and neoclassical models of international trade. International price formation, patterns of trade and gains from exchange; specialization and comparative advantage; factor proportions, factor prices and the Heckscher-Ohlin theorem; foreign trade and growth; tariffs, customs unions and commercial policy. Prerequisite: ECON 630 or approval of instructor.
- 655. Experimental Economics. (3-0). Credit 3.** Experimental methods in choice behavior experiments, survey research, planned economic environments and animal experiments. Prerequisite: Approval of instructor.
- 659. Behavioral Game Theory. (3-0). Credit 3.** Static and dynamic games of complete and incomplete information and other advanced topics in game theory.
- 680. Financial Economics. (3-0). Credit 3.** Advanced theory of dynamic asset pricing utilizing the Economics of risk and uncertainty within a general equilibrium framework; stochastic calculus applications to the analysis of asset markets; theoretical foundations and empirical testing. Prerequisites: ECON 630 and ECON 646.
- 685. Directed Studies. Credit 1 to 6 each semester.** Directed individual instruction in selected problems in economics not related to thesis or dissertation. Prerequisites: Graduate major or minor in economics; approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of economics. May be repeated for credit. Prerequisite: Approval of department head.
- 690. Theory of Economic Research. (3-0). Credit 3.** Design of research experiments in various subfields of economics, and evaluation of research results with the aid of examples taken from the current scientific literature.
- 691. Research. Credit 1 or more each semester.** Thesis research.

Department of Ecosystem Science and Management

R. J. Ansley, Jr., A. R. Armitage, R. D. Baker, D. D. Baltensperger (Interim Head), T. W. Boutton*, D. D. Briske, D. M. Burton, T. D. Byram, J. R. Conner, R. N. Coulson, M. Eriksson, R. A. Feagin, T. D. Forbes, J. Gan, J. H. Gould, W. T. Hamilton, C. W. Hanselka, C. R. Hart, S. L. Hatch, R. W. Knight, M. M. Kothmann, U. P. Kreuter, K. V. Krutovsky, D. K. Loh, C. A. Loopstra, R. K. Lyons, W. A. McGinty, B. P. Mohanty, G. W. Moore, W. E. Pinchak, S. C. Popescu, W. E. Rogers, J. L. Schuster, R. B. Shaw, F. E. Smeins, R. Srinivasan, C. A. Taylor, Jr., R. W. Teague, M. G. Tjoelker, J. Vogel, R. Washington-Allen, J. B. West, S. G. Whisenant, B. P. Wilcox, X. B. Wu

* Graduate Advisor

The Department of Ecosystem Science and Management (ESSM) offers graduate programs leading to the MS and PhD degrees in Rangeland Ecology and Management, the MAgr degree in Rangeland Ecology and Management, and the Master of Natural Resources Development (MNRD) degree in Ecosystem Science and Management. The MS and PhD degrees are intended to educate scientists and professionals in research and management in natural resources and related fields. The MS offers a thesis option for those who desire a serious research experience and a non-thesis option for those who seek a professional career outside of research. The MNRD and MAgr degrees are professional (non-research) degree programs providing advanced training in the science and management of natural resources, including a required internship.

Fields of study are available in (1) Ecosystem Science: biogeochemistry, echohydrology, global change ecology, landscape ecology, ecological restoration, ecophysiology; (2) Ecosystem Management: forest management, rangeland management, watershed management, natural resource economics and policy, human

dimensions of ecosystem management; (3) Genetics, Systematics, Evolution: genetics, molecular biology, genomics, population genetics, tree improvement, plant systematics and evolution; (4) Spatial Sciences: geographic information systems, remote sensing, spatial analysis and statistics.

Facilities within the department include modern teaching classrooms and laboratories. There are fifteen state of the art research laboratories in the department, including the Stable Isotopes for Biosphere Sciences Laboratory, the Spatial Sciences Laboratory and the S.M. Tracy Herbarium. Field sites and facilities are available throughout Texas and many of them are associated with research and extension centers associated with the department. The ESSM faculty acquire external competitive research grants and contracts that provide funding for additional research avenues and graduate student support.

Graduate courses are designed to develop the academic skills of individuals and to advance their knowledge in the professional fields related to ecosystem science and management. Departmental seminars supplement the individual education of graduate students and serve to relate the most recent research findings applicable to the discipline. The department welcomes applications from students with diverse educational backgrounds, experiences and interests. Individually planned graduate programs assure a focused, individualized education for each candidate.

Graduate courses offered in this department are currently listed under ESSM. Additional information on academic programs and faculty may be found at essm.tamu.edu.

Ecosystem Science and Management (ESSM)

- 600. Principles of Ecosystem Science and Management. (3-0). Credit 3.** Ecological foundations for sustained use of natural resources; climatic, edaphic, biotic and cultural factors in land resource allocation; land and cover viewed with respect to population dynamics, succession and climax, gradients and gradation, equilibria and imbalance. Prerequisite: Graduate classification in agriculture or in allied subject.*
- 601. Current Issues in Ecosystem Science and Management. (2-0). Credit 2.** Introduces the social and scientific context for forestry; develops an understanding of current social, economic and environmental issues confronting forested ecosystems and consider implications for renewable natural resource management, research and policy. Prerequisite: Graduate classification.
- 605. The Research Process. (2-0). Credit 2.** Nature and objectives of graduate work, the scientific method and basic and applied research. Introduction to design of experiments and analysis of data; principles of organization of project proposals, theses and scientific reports.
- 610. Rangeland Resource Management. (3-0). Credit 3.** Basic concepts and theories of rangeland resource management; trends in range classification, grazing management and improvement practices. Prerequisite: Graduate classification in agriculture or related subject matter areas.*
- 611. Grazing Management and Range Nutrition. (3-0). Credit 3.** Nutritional ecology of domestic and wild herbivores on rangelands; vegetation and animal response to various grazing management practices; diet selection, quality, intake and supplementation of herbivores.*
- 612. Rangeland Vegetation Management. (3-0). Credit 3.** Principles of rangeland brush and weed control with mechanical, chemical, burning and biological methods; interrelationships of brush management with grazing, wildlife and watershed management; planning and economic analysis of range improvement practices.*
- 615. Advanced Silviculture. (3-0). Credit 3.** Advanced silvicultural methods, techniques and problems; current research and technical literature. Prerequisite: ESSM 319 or equivalent.
- 616. Arboriculture. (3-2). Credit 4.** Tree selection and planting to fit climatic, space and edaphic conditions, diagnosing tree abnormalities, and practicing intensive tree care; frequent field work and demonstrations; includes seminar classes involving discussions and presentations of current arboriculture research from peer-reviewed journals. Prerequisite: Graduate classification.
- 617. Urban Forestry. (4-0). Credit 4.** Conceptual role of trees in improving the urban environment; optimum use of existing forested areas and the establishment of trees in appropriate open spaces; tree ordinances, species evaluation, street tree planning and tree inventory systems; includes seminar classes involving discussions and presentations of current urban forestry research from peer-reviewed journals. Prerequisite: Graduate classification.

- 620. Plant and Range Ecology. (3-0). Credit 3.** Investigation of community/ecosystem/landscape distribution patterns, structure, spatial/temporal organization and function, paleoecology, ecological succession, disturbance regimes, ecological diversity and classification schemes. North American rangelands (grasslands, shrublands, deserts, wetlands, etc.) stressed but world ecosystems reviewed. Prerequisites: RENR 205; RENR 215 or equivalent; graduate classification.*
- 621. Physiological Plant Ecology. (3-0). Credit 3.** Investigation of physiological mechanisms influencing ecological patterns and processes, including plant acclimation and adaptation in contrasting habitats, abiotic controls on species productivity and distribution, relevant conceptual and experimental approaches, and integration among ecological scales. Prerequisites: RENR 205 or MEPS 313 or equivalent; graduate classification.
- 622. Biogeochemistry of Terrestrial Ecosystems. (3-0). Credit 3.** Biogeochemical cycles of carbon, nitrogen, sulfur and phosphorus and their interaction with biotic and abiotic processes; biogeochemical processes investigated at the global level and in several types of terrestrial ecosystems; addressing global climate change, deforestation, acid precipitation, ozone depletion. Prerequisites: RENR 205 or equivalent; graduate classification.
- 624. Terrestrial Ecosystems and Global Change. (3-0). Credit 3.** Identify the physical and biological principles governing the structure and function of terrestrial ecosystems in an earth-system context; analyze how plants and microorganisms respond to environmental change and affect global carbon, nutrient, and water cycles; evaluate ecosystem response to global change, including rising carbon dioxide, climate warming, and human impacts. Prerequisite: Graduate classification.
- 626. Fire and Natural Resources Management. (2-3). Credit 3.** Behavior and use of fire in the management of natural resources; principles underlying the role of weather, fuel characteristics and physical features of the environment related to development and implementation of fire plans. Prerequisites: Graduate classification and approval of instructor.*
- 628. Wetland Delineation. (2-2). Credit 3.** Application of the 1987 Wetland Delineation Manual in use by the Army Corps of Engineers; field indicators of hydrophytic vegetation, hydric soils, wetland hydrology, methods for making jurisdictional determination in non-disturbed and disturbed areas, recognition of problem wetlands and technical guidelines for wetlands. Prerequisite: Graduate classification or approval of instructor.
- 630. Restoration Ecology. (3-0). Credit 3.** Review and discuss fundamental concepts, current literature, and contemporary topics relating to ecological restoration. This includes the theoretical development of restoration ecology and its application. The relationship with conservation biology will be explored. The goal is to inform, exchange views, and develop critical thinking skills through case studies. Prerequisite: Graduate classification.*
- 631. Ecological Restoration of Wetland and Riparian Systems. (2-2). Credit 3.** How wetland and riparian areas link terrestrial and aquatic systems and function hydrologically and ecologically within watersheds; integrated approaches for restoration of degraded wetland and riparian systems; improving water resources through vegetation management with a special interest in rangelands. Prerequisites: RENR 205 or equivalent and WFSC 428 or equivalent.
- 635. Ecohydrology. (3-0). Credit 3.** This course will provide a framework for understanding how plants and animals affect the water cycle; the water cycle in all of its aspects will be examined and explored with the idea of understanding how changes in land cover may influence the water cycle; implications for both upland and riparian systems will be examined. Prerequisite: Graduate classification. Cross-listed with GEOG 623.
- 636. Range and Forest Watershed Management. (3-0). Credit 3.** Management of range and forest watersheds; influence of range and forest practices on runoff, interception, infiltration, erosion and water quality; current literature and research advances.*
- 644. Plant Cell Culture in Genetic Improvement and Conservation. (3-1). Credit 3.** Focus on techniques in plant cell culture, which can be applied to all plants, including agronomic, horticultural and forestry crops for genetic improvement; and for the conservation of genetic diversity and endangered species. Prerequisites: MEPS 313; CHEM 101. Cross-listed with MEPS 650.
- 647. Range Grasses and Grasslands. (2-3). Credit 3.** Basic concepts of grass structure and classification, recent advances in agrostological research, genetic and ecological basis for patterns of variation and evolution in grasses. Offered Spring Semester of even numbered years.*

- 648. Wetland Plant Taxonomy. (1-4). Credit 3.** Interpretation of plant morphologies for keying and the identification of wetland plants from prime habitats; plant communities including the plant's adaptation to variation in salinity and soils; identification of inconspicuous flowered plant species including sedges, rushes and grasses. Prerequisite: RLEM 304 or approval of instructor. Offered Fall Semester of even numbered years.*
- 651. Geographic Information Systems. (2-2). Credit 3.** Design, planning and implementation of geographic information systems; computer hardware and software evaluation; practical experience in data entry, analysis and update of spatial and characteristic data; linkages of GIS and artificial intelligence; use of maps and remotely sensed data as data inputs. Prerequisites: GEOG 398 and RENR 444 or approval of instructor. Cross-listed with BAEN 651.
- 652. Advanced Topics in Geographic Information Systems. (2-2). Credit 3.** Advanced GIS topics with a focus on modeling actual GIS applications including relational and database theory, design and implementation and its connection to GIS; surface analysis with digital terrain models; and an introduction to spatial statistics. Prerequisite: ESSM 651 or BAEN 651.
- 655. Remote Sensing of the Environment. (2-2). Credit 3.** Remote sensing for the management of renewable natural resources; use of aerial photography and satellite imagery to detect, identify and monitor forest, range and agricultural resources; utilize remotely sensed data as input to computerized information management systems. Prerequisite: Graduate classification.
- 656. Advanced Remote Sensing. (2-2). Credit 3.** Advanced techniques for information extraction using airborne and satellite imagery; active and passive sensors characteristics; customizing and developing image processing tools for remote sensing applications for a broad range of sensors and applications. Prerequisites: ESSM 655, RENR 444, GEOG 651, GEOG 661.
- 660. Landscape Analysis and Modeling. (2-2). Credit 3.** Introduction to quantitative methods of landscape analysis and modeling for applications in natural resource conservation and management; quantification of landscape composition and configuration; spatial statistical methods for characterizing landscape pattern; methods for hypothesis testing with spatial data; landscape modeling approaches and applications; current literature and software. Prerequisite: Approval of instructor.*
- 663. Applied Spatial Statistics. (3-2). Credit 4.** An introduction to the theory and practice of spatial statistics as applied to the natural resources. Spatial analyses focusing primarily on ordinary kriging, point processes, and lattice data. Prerequisites: MATH 141, MATH 142; STAT 651; or equivalents; ESSM 651 preferred. Cross-listed with SCSC 663.
- 665. Computer Programming for Natural Resources Applications. (2-2). Credit 3.** An introduction to programming concepts and applications; elements of Visual Basic programming including data types, control and program structure; introduction to objects and object-oriented programming; macro and applications development; automation of GIS programming through the use of macros. Prerequisites: Approval of instructors.
- 670. Ecosystems and Markets. (3-0). Credit 3.** Concepts and analysis of supply chains for natural resource commodities and ecosystem services. Exploration of the economic uses of goods and services from ecosystems. Prerequisite: Graduate classification.
- 671. Ecological Economics. (3-0). Credit 3.** Study of the relationships between ecosystems and economic systems; understanding the effects of human economic endeavors on ecological systems and how the ecological benefits and costs of such activities can be quantified and internalized. Prerequisite: Graduate Classification. Cross-listed with AGEC 659 and RENR 659.
- 672. Environmental Impact Analysis for Renewable Natural Resources. (3-0). Credit 3.** Analysis and critique of contemporary environmental analysis methods in current use; environmental impact statements; national policies; political, social and legal ramifications as related to development and use of renewable natural resources. Prerequisite: Graduate Classification. Cross-listed with RENR 660.
- 675. International Sustainable Community Development. (3-0). Credit 3.** Depicting global trends, paradigms and a comparative framework on sustainable community development; visioning, design, planning and developmental processes; leadership and management skills; marketing and promotion of sustainability concepts and practices; efficacies, indicators, analytic methods and case analyses; platforms for international cooperation; opportunities and careers in pertinent fields.

- 676. Leadership, Development and Management of Environmental NGOs. (3-0). Credit 3.** Trends and increasing power of NGOs in environment and sustainable development; understanding of the organizational structures, functions, planning and management processes of environmental NGOs; technical skills and leadership qualities for careers with environmental NGOs. Prerequisite: Graduate Classification. Cross-listed with RENR 650.
- 681. Seminar. Credit 1 each semester.** Reviews and discussions of current topics and advances in Ecosystem Science and Management. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 to 4.** On-the-job training in fields of ecosystem science and management. Prerequisite: Graduate classification in an ecosystem science and management major.
- 685. Directed Studies. Credit 1 to 9 each semester.** Investigations not included in student's research for thesis or dissertation. Prerequisite: Graduate majors or minors in Ecosystem Science and Management.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of ecosystem science and management. May be repeated for credit. Prerequisite: Graduate classification.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Graduate majors in Ecosystem Science and Management.

*Field trips required for which departmental fees may be assessed to cover costs.

College of Education and Human Development (CEHD)

- 600. Education and Human Development Study Abroad. Credit 1 to 18.** For students in approved programs to study abroad. May be repeated for credit. Prerequisite: Approval of department head.
- 603. Writing for Publication in Education and Human Development Research. (3-0). Credit 3.** Course will assist students with a) writing and submitting research findings for publication and b) managing contingencies for becoming productive scholars in their field. Prerequisite: Graduate student.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of education and human development. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.

Department of Educational Administration and Human Resource Development

M. Alfred, P. T. Beatty, F. A. Bonner, II, J. Callahan, D. Chlup, M. C. Clark, B. R. Cole, E. J. Davis, L. M. Dooley, T. M. Egan, D. A. Erlandson, R. Goddard, D. Hinojosa, J. R. Hoyle, L. J. Korhonen, V. M. Lechuga, Y. S. Lincoln, S. Lynham, J. A. Madsen, K. B. McKenzie, G. N. McLean, J. F. McNamara, F. M. Nafukho (Head), K. Peck Parrott, R. A. Rolle, J. Scheurich, D. F. Seaman, L. Skrla, G. P. Slattery, D. L. Smith, C. A. Stanley, S. L. Stark, W. F. Stenning, M. S. Torres, T. T. Venzant Chambers, R. Walker, J. Wang, G. Webb-Hasan

The Department of Educational Administration and Human Resource Development prepares students to be leaders in school settings as well as non-school settings. Students receive a master's or doctorate degree in either Educational Administration or Educational Human Resource Development, depending on the area of specialization. These areas include adult education; human resource development; higher education administration, and public school administration.

The adult education area of study prepares students to be successful in various teaching related positions in business and industry, health care institutions, government agencies, and postsecondary education. In the higher education administration specialization, students will be prepared for leadership roles in higher education administration, teaching and research. Emphases in a wide range of areas are provided to enable students to achieve desired professional goals. Through formal and informal interactions with faculty, students in the human resource development area will gain the knowledge and skills needed to be successful leaders in this field. The public school administration specialization is designed to enhance the students' leadership skills to manage complex educational systems and to train and supervise personnel.

Prospective students should contact the department's academic advisors and request a copy of the pertinent program brochure, departmental application forms and appropriate deadlines.

Educational Administration (EDAD)

- 601. College Teaching. (3-0). Credit 3.** Initial preparation for instruction at the college level; focuses on the basic skills, strategies and issues common to university teaching. Course is open to graduate students committed to teaching in any area at the college level.
- 602. The Community College. (3-0). Credit 3.** Theoretical and practical knowledge of the American community college with emphasis on the history, purposes, programs, and personnel within these institutional contexts. Prerequisite: Graduate Classification.
- 603. Advanced Student Development Theory. (3-0). Credit 3.** Advanced study of the nature, needs and characteristics of American college students; developmental tasks, peer group relations and impact of college environment on student development; research from behavioral sciences. Prerequisites: EDAD 669; graduate classification.
- 604. The Elementary School Principalship. (3-0). Credit 3.** Role of elementary school principal in organization and administration of elementary schools; management of instruction, educational program planning, legal problems, evaluation and reading programs. Prerequisites: Graduate classification.
- 605. The Secondary School Principalship. (3-0). Credit 3.** Role of principal in the organization of junior and senior high schools; preparation for instructional management, program planning, evaluation and scheduling. Prerequisites: Graduate classification.
- 606. Instructional Leadership Development Training. (3-0). Credit 3.** Using an interactive format and data from a simulated Texas school, students will become adept in basic tenets and requirements of the principalship: 1) data-driven decision-making; 2) curriculum, instruction, and assessment; 3) supervision; 4) professional development; 5) organizational management; and 6) community partnerships and communication. Prerequisite: Graduate classification.
- 607. Strategic Management of Technology in Educational Systems. (3-0). Credit 3.** Provides a systemic approach to leadership in the management of technology for school districts and campuses and enables them to model effective utilization of technology. Prerequisite: Graduate classification.
- 608. K-12 School Finance and Budgeting. (3-0). Credit 3.** Language of education finance and budgeting; purposes and uses of policy and management strategies; traditions of framing research questions and designing studies; accepted procedures for generating, analyzing, and interpreting issues related to school finance and budgeting administration. Prerequisite: Graduate classification.
- 609. Public School Laws. (3-0). Credit 3.** Constitutional provisions, statutory laws, court decisions and regulations governing public schools with special reference to Texas and federal relationships.
- 610. Higher Education Law. (3-0). Credit 3.** Legal aspects of administration in institutions of higher education; statutes and case law related to liability, due process, student rights, admission, employee relations and property use. Prerequisite: Graduate classification.
- 611. Higher Education Business and Finance. (3-0). Credit 3.** Business management and financial aspects of administration in higher education; federal and state funding, institutional planning, budgeting and controlling, sources of financial support and business operations in higher education. Prerequisite: Graduate classification.
- 612. Policy Issues in the Administration of Higher Education. (3-0). Credit 3.** Examination of conflicting positions on policy issues of importance in higher education and their direct implications for participants. Prerequisite: Graduate classification.
- 613. Educational Facilities Planning. (1-6). Credit 3.** Present and future building and equipment needs of school units; efficiency of present plant, operation and maintenance, planning building program; field work as part of a group school plant study.
- 615. School Superintendency. (3-0). Credit 3.** Examination of the role of the superintendent of schools as the chief educational officer of the local school district; major emphasis on the functions and relationships of the superintendent. Prerequisite: EDAD 604 or EDAD 605 or approval of instructor.
- 616. Administration of Staff Personnel. (3-0). Credit 3.** Personnel organization and administration in school systems; relationship of individual to organization; organizational health, staffing, remuneration, appraisal, ethics, security, inservice and negotiations.

617. **African American School Desegregation. (3-0). Credit 3.** History of African American education through the lens of school desegregation; Brown v. Board of Education decision, including the conditions and actions that led to the ruling; the ensuing era of implementation; relevance of Brown for our schools today. Prerequisite: Graduate classification.
618. **Educational Administration in Cross Cultural Environments. (3-0). Credit 3.** Designed to provide educational administrators insights and background into the life styles, values and aspirations of minority Americans as related to the administrative process.
619. **Contemporary Dimensions of Administering Urban Schools. (3-0). Credit 3.** Causes and consequences of racial and socio-economic isolation, impact of school desegregation, urban school politics, alternatives for urban schools, decentralization, community control, urban population trends and housing patterns.
620. **Educational Program Evaluation. (3-0). Credit 3.** Theory and practice of evaluation of instructional programs including research methods and design strategies to measure program outcomes; skills to evaluate personnel and projects included as components of evaluation models and management of educational evaluation functions. Open to all graduate students in education.
621. **Futurism and Global Change. (3-0). Credit 3.** Intriguing ideas, concepts and challenges for the field of futurism and planning in a global setting; community and social educational planning techniques and future methodologies.
622. **Designing and Managing Quality Educational Systems. (3-0). Credit 3.** Fundamental theory and principles of quality in the design and management of educational systems; the role of processes in improving educational organizations and in process-based management; principles and techniques of continuous quality improvement and the use of quality tools to understand, analyze and improve educational systems and processes. Prerequisite: Graduate classification.
623. **Advanced Fieldwork Methods. (3-0). Credit 3.** To explore by conducting exemplary field examples, qualitative methods, their strengths and weaknesses; to learn how to keep and utilize ethnographic reflexive journals and methodological logs; and to understand the methodological decision points which indicate one method which may be preferable to another. Prerequisite: EDAD 690 or approval of instructor.
624. **Administration of Special Populations and Special Programs. (3-0). Credit 3.** Administration of special educational programs for special populations of students originating at the national, state and local levels of PreK-12 educational settings. Prerequisite: Graduate classification.
625. **Personnel Law. (3-0). Credit 3.** Legal aspects of personnel administration, personal and academic freedoms, and administration of student discipline in public schools; statutes and case law related to due process, liability, employee rights, student rights and governance. Prerequisite: Graduate classification.
626. **Advanced Models for Managing High Performing Educational Systems. (3-0). Credit 3.** Systems approach to designing and managing quality/high performing educational organizations with emphasis on systems theory, system dynamics and systems modeling; application of the Malcolm Baldrige National Quality Criteria for Performance Excellence as a systemic framework for managing change and achieving high performance in educational organizations. Prerequisite: EDAD 622.
627. **Case Studies in Higher Education Administration. (3-0). Credit 3.** Management of institutions of higher education through case studies, simulations, problem solving exercises, and in-basket activities; analysis, synthesis and evaluation of variables and decisions in administering the academic enterprise; understanding of process and content issues in administering higher education institutions. Prerequisite: Graduate classification.
630. **Site-Based Management of Schools. (3-0). Credit 3.** Examination of theory and social forces leading to site-based management of schools, establishment of campus leadership teams; setting and monitoring campus goals; interaction with community and social agencies. Prerequisite: Graduate classification.
631. **Student Affairs Functions. (3-0). Credit 3.** Introductory course in student affairs administration in higher education programs; includes the history of student affairs administration and the philosophical foundations of student affairs work.
635. **Administration for Special Services. (3-0). Credit 3.** To help administrators, counselors, supervisors and teachers develop an understanding of functions, operation and evaluation of special services which support the educational program; individual study of content and on-site evaluations of organization and administration of school services programs.

- 637. Administration of Change in Educational Organizations. (3-0). Credit 3.** Relationships among individual and group behaviors; roles of administrators; on-site analysis of educational organizations and change principles.
- 638. Developing School-Community Partnerships. (3-0). Credit 3.** Current educational issues affecting public education; merging and alternative models of community education.
- 639. Foundations of Educational Administration. (3-0). Credit 3.** Selected historical, philosophical and sociological foundations and developmental dimensions of educational administration.
- 641. Community Education. (3-0). Credit 3.** Structure, purpose and strategies of community education as they relate to public school administration.
- 650. Professional Development in Higher Education. (3-0). Credit 3.** An introduction to organizational, faculty and instructional development in higher education; emphasis on research and theoretical foundations and major issues connected with teaching and learning in higher education. Prerequisite: Graduate classification.
- 651. Education Finance and Economics. (2-2). Credit 3.** Interdisciplinary applications of historical and current education finance and economics of education research principles and procedures as a means to improve development, analysis, administration evaluation, and improvement of educational programs; policy and organizations. Prerequisite: EDAD 608 or approval of instructor.
- 652. Politics of Education. (3-0). Credit 3.** Interdisciplinary survey course using various fields in political science, comparative government, and American and state history; interrelationships of educational administration to political organizations.
- 653. Organizational Theory and Leadership in Education. (3-0). Credit 3.** Course is designed to analyze the relationship between administrative theory and practice by utilizing the literature in organizational theory and administrative leadership behavior and applying the concepts to administrative practice in PreK-higher educational settings. Case studies, debates, simulations and role playing will be utilized to supplement lectures and discussions. Prerequisite: Master's degree or approval of instructor.
- 654. Organizational Learning. (3-0). Credit 3.** Focuses on developing the abilities of professionals in educational institutions and other organizations to analyze learning as an organizational function and to develop strategies to enhance organizational learning in those organizations.
- 655. Administration of Higher Education. (3-0). Credit 3.** Survey of management principles in higher education; functions in delegation, direction, operation, governance and financing applied to postsecondary institutions.
- 657. Financial Resource Development in Higher Education. (3-0). Credit 3.** Complete survey of the field of fund raising in higher education in the United States; examination of approaches to annual, capital and planned giving; the administration and public relations aspect of educational fund raising. Prerequisite: Graduate classification.
- 658. Assessment and Intervention in Student Affairs. (3-0). Credit 3.** Understanding of assessment, evaluation and research in student affairs; familiarity with existing assessment instruments for students, services, programs and facilities; understanding importance of maintaining high standards of ethics and integrity in assessment of student affairs. Prerequisite: Graduate classification or approval of instructor.
- 669. The College Student. (3-0). Credit 3.** Nature, needs and characteristics of American college students; developmental tasks, peer group relations and impact of college environment on student development. Research from behavioral sciences.
- 670. Student Affairs Administration in Higher Education. (3-0). Credit 3.** Student affairs administration in higher education; principles, philosophy and major theoretical issues; organization and administration theory.
- 671. Research in Student Affairs. (3-0). Credit 3.** To be the capstone of two years of study and practice in the area of student affairs administration; to integrate the courses already taken and emphasize the role of research and evaluation in professional practice; to explore research methods, exemplary research published in journals and books. Prerequisite: Graduate classification.
- 683. Field Practicum in Student Affairs Administration in Higher Education. Credit 1 to 6.** Supervised experience in professional employment settings in educational administration; practical experiences and activities in student affairs administration in higher education supervised by departmental faculty. Prerequisite: Approval of instructor.

- 684. Internship. Credit 1 to 6.** Designed to give the prospective educational administrator job related experience under supervision in an educational setting appropriate to the selected roles in administration indicated below. Prerequisites are determined by each specific degree, certification or program requirements. A maximum of 6 hours credit may be earned in each internship. Prior approval required. Selected roles include:
- a. Community Educator
 - b. College Administrator
 - c. Middle Administrator
 - d. School Superintendent
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of elected problem in field of educational administration. Prerequisite: Prior approval required.
- 687. Proseminar: Principles of Professional Practice in Education. (3-0). Credit 3.** Exploration of major principles and hallmarks of professional practices in the field of education; foundations for effective decision making and leadership in diverse settings examined; team taught.
- 688. Proseminar: Analysis of Critical Issues in Education. (3-0). Credit 3.** Exploration of a critical issue in the field of education from an interdisciplinary perspective; skills developed in analyzing an issue, exploring its impact upon diverse educational settings, formulating positions and seeking alternative solutions; team taught.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of educational administration. May be repeated for credit.
- 690. Theory of Educational Administration Research. Credit 3 to 6.** Theory and design of research and inquiry in various applications of models and research procedures including quantitative analyses, naturalistic inquiry, research design and preparation of research proposals, as they relate to the discipline of educational administration. Prerequisite: EHRD 651 or equivalent.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 692. Professional Study. Credit 1 or more each semester.** Approved professional study of project undertaken for doctor of education degree. Preparation of a record of study summarizing the rationale, procedure and results of the completed project. Prerequisite: Approval of major advisor.

Department of Teaching, Learning and Culture

L. M. Burlbaw, M. M. Capraro, R. M. Capraro, B. S. Carpenter, II, N. P. Carter, F. E. Clark, Q. Dixon, Z. R. Eslami, D. S. Goldsby, J. P. Helfeldt, V. L. Hill-Jackson, R. M. Joshi, D. S. Kaplan, L. J. Kelly, J. B. Kracht, G. O. Kulm, P. J. Larke, C. W. Lewis, Y. Li (Head), C. C. Loving, R. E. McBride, E. M. McTigue, R. Rackley, W. H. Rupley, M. C. Sadoski, J. F. Schielack, V. P. Schielack, Jr., D. C. Simmons, G. P. Slattery, Jr., S. W. Slough, D. L. Smith, C. L. Stuessy, L. M. Walters, H. C. Waxman, G. Webb-Hasan, V. L. Willson, B. Yalvac

The Department of Teaching, Learning and Culture offers two degrees at the master's level: the Master of Science (MS) in Curriculum and Instruction (thesis option only) and the Master of Education (MEd) in Curriculum and Instruction (non-thesis). The department offers the Doctor of Philosophy (PhD) degree in Curriculum and Instruction. This program is offered to those with an interest in the philosophical, theoretical and methodological constructs of both applied and basic quantitative and qualitative research. The acquisition of knowledge evolves from conceptualizing the procedures of educational inquiry as they relate to both the consumer and the practitioner. Specializations within this research-based program are designed to encompass the original independent research interests of the individual. The program affords the opportunity for specialized study in the following areas: Culture and Curriculum, Mathematics Education, Reading/Language Arts, Science Education; English as a Second Language (ESL); and Urban Education.

The Department of Teaching, Learning and Culture also offers an Executive Online Doctor of Education (EdD) degree in Curriculum and Instruction. The program requires a minimum of 64 semester credit hours beyond the master's degree, all of which is presented through a Web-based delivery system. Students have the choice of one emphasis: Educational Leadership. Students will be admitted to this program and progress only as members of a cohort.

The admission deadlines for the Master of Science (MS) degree and Master of Education (MEd) degree are listed below.

	Admission Deadline
Summer Admission	March 1
Fall Admission	March 1
Spring Admission	October 1

Admission to the Doctor of Philosophy (PhD) degree program requires an interview. The admission deadline for the Doctor of Philosophy (PhD) degree is listed below.

	Admission Deadline
Fall Admission	December 1

Admission to the Executive Online Doctor of Education (EdD) degree program is once a year.

	Admission Deadline
Spring Cohort Admission	August 1

The Department of Teaching, Learning and Culture also offers an online post-baccalaureate certification program for individuals who have completed a bachelor's degree and desire initial certification at the secondary level. The certification program requires the completion of twenty-one (21) graduate semester credit hours and the successful completion of the appropriate State certification examinations. Participants may apply the graduate certification coursework toward the Master of Education (MEd) degree in Curriculum and Instruction. In addition, program participants will serve a full public school year internship either in a salaried or non-salaried position. The admission deadline for the post-baccalaureate certification program is mid-December.

The Department of Teaching, Learning and Culture also offers programs at the graduate level that lead to endorsements or certifications in the following areas: Master Reading Teacher Certification and Reading Specialist Certification. PhD students may also seek an Advanced Research Certificate.

In order to be eligible for all forms of University-based financial assistance, applicants interested in fall admission should apply prior to January 15. For additional information on the programs offered by the Department of Teaching, Learning and Culture or for more information on the application process and admission deadlines, contact the Department of Teaching, Learning and Culture by telephone at 979-862-8032 or visit the department on the website at tlac.tamu.edu.

Educational Curriculum and Instruction (EDCI)

- 601. Disciplinary Knowledge and Research in Curriculum and Instruction. (3-0). Credit 3.** Emphasizes key research and researchers, discipline-specific information, and the initial identification of researchable questions in the field of curriculum and instruction. Prerequisite: Ph.D. classification in TLAC.
- 602. Cultural Foundations of Education. (3-0). Credit 3.** Contributions of behavioral sciences applied as analytic tools in solving problems of curriculum and instruction.
- 603. Professional Development: Strategies for Teachers. (3-0). Credit 3.** Principles of organizational management, instructional design, and change theory in framing professional development programs. Prerequisite: Graduate classification.
- 604. E-Learning Classroom Management. (3-0). Credit 3.** Focuses on the development of effective management skills crucial to successful instruction and student achievement; application of theory and research to practice and establish oneself as a professional in the area of classroom management; applicable to elementary, middle level, and secondary school settings. Prerequisite: Graduate classification.
- 605. Qualitative Research Methods in Curriculum and Instruction. (3-0). Credit 3.** Theoretical and methodological issues related to qualitative inquiry; discussion of qualitative paradigm's ontological, epistemological, and axiological stances; review and implementation of commonly used qualitative research methods and approaches in curriculum and instruction, including narrative, phenomenology, ethnography, grounded theory, and case study approaches. Prerequisite: Graduate classification.
- 607. Programs and Procedures in Supervision. (3-0). Credit 3.** Designed for teachers, supervisors and administrators; philosophy, organization and administration of supervision of both elementary and secondary schools. Required for mid-management and supervisor's certificate.
- 610. Second Language Assessment and Development. (3-0). Credit 3.** Second language assessment and development stressing classroom situations to teach second language acquisition. Prerequisite: Graduate classification.
- 611. Teaching English as a Second Language. (3-0). Credit 3.** Translation of theory into practice stressing various methods and techniques in ESL; relationship of language development, culture and conceptual processes to language teaching. Prerequisite: Graduate classification.

612. **Bilingual/ESL Content-Area Instruction. (3-0). Credit 3.** Integrating English language instruction with content-based ESL instruction in science, mathematics and social sciences for non-English speaking students. Prerequisite: Graduate classification.
614. **ESL for International and Intercultural Settings. (3-0). Credit 3.** International and intercultural teaching practices with major emphasis on second language instruction in an international setting. Prerequisite: Graduate classification.
615. **Classroom Practice in Adult ESL. (3-0). Credit 3.** Literacy practice issues in adult ESL literacy leading to assessment, instructional planning, curriculum development and program evaluation. Prerequisite: Graduate classification.
617. **Early Childhood Mathematics. (3-0). Credit 3.** Development of mathematical concepts in young children from developmental and mathematical perspectives. Prerequisite: Graduate classification.
619. **Teaching and Learning Number and Quantity Concepts. (3-0). Credit 3.** Examination of the content, pedagogy, technology, and research on teaching and learning concepts on number and quantity concepts; discussion of contemporary issues in K-12, standards and assessment.
621. **Teaching and Learning Space, Dimension, and Measurement Concepts. (3-0). Credit 3.** Examination of the content, pedagogy, technology, and research on teaching and student learning concepts on space, dimension, and measurement concepts. Discussion of contemporary issues in K-12, standards and assessments.
622. **Theories of Learning and Teaching Mathematics. (3-0). Credit 3.** Theoretical bases of the learning and teaching of mathematics, including an examination of the research which supports the theoretical bases.
623. **Teaching and Learning Pattern and Change Concepts. (3-0). Credit 3.** Examination of the content, pedagogy, technology, and research on teaching and learning concepts on skills in algebra, functions and calculus. Discussion of contemporary issues in K-12, standards and assessment.
624. **Assessing Cognitive, Conceptual, and Fluency Structures Related to Learning and Teaching Mathematics. (3-0). Credit 3.** Examines diagnostic and assessment procedures in mathematics and their potential for identifying problem areas related to children's acquisition of mathematical skills; number and quantity concepts. Prerequisite: Graduate classification.
625. **Teaching and Learning Mathematics with Diverse Learners. (2-2). Credit 3.** Examining diagnostic and assessment procedures in mathematics and their potential for identifying problem areas related to children's acquisition of mathematical skills; number and quantity concepts. Prerequisite: EDCI 624.
627. **Teaching and Learning Data Analysis and Uncertainty Concepts. (3-0). Credit 3.** Examination of the content, pedagogy, technology, and research on teaching and student learning of concepts and skills in probability, statistics, and discrete mathematics; discussion of contemporary issues and K-12 curriculum, standards and assessment. Prerequisite: Graduate classification.
628. **Analyzing and Reporting Field Based Research. (3-0). Credit 3.** Analyze data from classroom observation, empirical tests and interviews; link theoretical and practical mathematics education to analysis of qualitative and quantitative data; equip teacher-leaders and researchers with the resources to interpret classroom phenomena from the research perspective using research-based theories of teaching and learning. Prerequisite: Graduate classification.
629. **Benchmarks in Urban Education. (3-0). Credit 3.** Identifies, analyzes, and applies benchmarks in urban education using research findings. Prerequisites: Doctoral classification; urban education emphasis or approval of instructor; concurrent enrollment in EDCI 637.
630. **Urban Education. (3-0). Credit 3.** Supports students in developing a knowledge base in urban education; share and discuss theoretical and conceptual frameworks that permeate city schools; examines historical perspective, pedagogical knowledge and insights of urban educational experiences. Prerequisites: Graduate classification; urban education emphasis; concurrent enrollment in EDCI 648; or approval of instructor.
631. **Mentoring the Novice Educator. (3-0). Credit 3.** To prepare the "teaching" graduate student to observe, evaluate, and reflect upon teaching, mentoring, communication, and supervision skills that support the novice or pre-service teacher with tools necessary to be successful. Examine research related to effective mentoring and supervising strategies and behaviors in environments which support mentoring behavior. Prerequisite: Graduate classification.

- 632. Program Evaluation in Curriculum and Instruction. (3-0). Credit 3.** Program evaluation, investigating its purposes and procedures, with attention to settings, personnel and performance; review of standards, principal theories and models; study of histories, political contexts, ethics and the nature of evidence. Prerequisite: Graduate classification.
- 633. Educator as Learner. (3-0). Credit 3.** Designed to challenge the graduate learner as one who studies metacognition, working to understand how self and others process learning, maximize application of learning and evaluate the meaning of learning; for students working with others in a role of mentor, supervisor, administrator or coach in a PK-12 setting. Prerequisite: EDCI 631.
- 634. Reflective Inquiry. (3-0). Credit 3.** Explores the differences and unique characteristics of moral, multi-perspective, collaborative, deliberative, autobiographical, and critical inquiries, and reflective practice related to all forms of inquiry; analyzes the implications of educator growth through reflective practices and the part that reflection plays in developmental growth and professional development. Prerequisite: Graduate classification.
- 636. Educator as Researcher. (3-0). Credit 3.** Course will help students develop action research skills to enable them to critically analyze insights into the historical, philosophical and social foundations of reflective teaching and leadership in educational environments. Course will include an analysis of theories, methodologies, implications and actions related to educational action research. Prerequisite: Graduate classification.
- 637. Urban Education: Policy and Analysis. (3-0). Credit 3.** Urban education policy making processes, emphasis on interaction between politics and educational policy. Prerequisites: Doctoral classification; emphasis in urban education or approval of instructor; concurrent enrollment in EDCI 629.
- 638. Trends in Curriculum and Instruction. (3-0). Credit 3.** Recent research and development in theories and practices of curriculum and instruction; curriculum innovations, school organization and new instructional media.
- 640. Language/Literacy for Bilingual/Multicultural Young Learners. (3-0). Credit 3.** Critical multicultural perspectives on the acquisition and development of communication skills by young children who represent bilingual and multicultural backgrounds; critique of language development practices as applied in education settings with young children. Prerequisite: Graduate classification.
- 641. The African American Learner in Urban Settings. (3-0). Credit 3.** Supports graduate level students in locating, reviewing, synthesizing, and analyzing research on the African American learner in urban settings. Prerequisites: Doctoral classification; urban education emphasis; or approval of instructor.
- 642. Multicultural Education: Theory, Research and Practice. (3-0). Credit 3.** Theory and research that undergirds the discipline of multicultural education by exploring the philosophical, anthropological and psychological theoretical frameworks. Prerequisite: Graduate classification.
- 643. Teaching in Urban Environments. (3-0). Credit 3.** Provide educators with historical perspectives, pedagogical knowledge and insights concerning educational experience of teachers and learners in urban environments. Will address cognitive, psychomotor and affective aspects of teaching and learning in urban environments. Prerequisite: Graduate classification.
- 644. Curriculum Development. (3-0). Credit 3.** Curriculum development; bases of curriculum design; problems of balance, scope, organization, sequence, selection and articulation.
- 645. Society and Education in World Perspective. (3-0). Credit 3.** Comparative education; interrelationships among societal institutions and particular roles that education plays in different cultures and political systems.
- 646. Instruction Theory. (3-0). Credit 3.** Theoretical basis for research and training in instruction; systematic study of existing research on key factors influencing instructional effectiveness. Exploration of interaction among variables of instruction. Doctoral level only.
- 647. Curriculum Theory. (3-0). Credit 3.** Theoretical basis for curriculum conceptualization, development, evaluation and implementation; value and empirical basis of curriculum decision-making strategies for curriculum change. Doctoral level only.
- 648. Urban Schools and Communities. (3-0). Credit 3.** Sociological, historical, philosophical, anthropological, and political dimensions of urban schools and community change; issues and contexts grounded in core disciplines of social sciences. Prerequisites: Graduate classification, emphasis in urban education or approval of instructor; concurrent enrollment in EDCI 630.

- 650. The Bilingual/Multicultural Young Child in Family and Culture. (3-0). Credit 3.** Bilingual/multicultural notions of family/culture as foundations for learning/anthropological investigation including cross-cultural comparisons of western concepts of “child” and “parenting;” critique of various constructions of child as learner within family context and monocultural perspectives of “developmentally appropriate” educational practice. Prerequisite: Graduate classification.
- 651. Bilingual/Multicultural Early Childhood Education. (3-0). Credit 3.** Historical/current models of early childhood curriculum/methodology as a foundation for the more critical analysis of curriculum as social construction, grounded within values of a particular society or culture; bilingual/multicultural views of early childhood education, curriculum and teaching strategies requiring constant examination. Prerequisite: Graduate classification.
- 652. Parental Involvement in Early Childhood Education. (3-0). Credit 3.** Dynamics of the family unit, school-home communication systems, legalities of parent participation in the school, parent involvement, parent training and home bound programs; development of programs with parents.
- 653. Education Policy for Language-Minority Children. (3-0). Credit 3.** Analysis of language planning, educational policies and instructional models in the U.S. and internationally for the education of young language-minority students. Prerequisite: Graduate classification.
- 654. Organization and Operation of Early Childhood Education Programs. (3-0). Credit 3.** Comprehensive survey of the various types of preschool centers serving the needs of young children; operating procedures, programs and services provided; experimental educational research projects now being conducted with young children.
- 655. Contemporary Visual Culture. (3-0). Credit 3.** Interdisciplinary investigation of visual culture and related cultural, social, political, digital, ontological, and educational issues, theories, and production and consumption practices in the postmodern era; examination of contemporary visual culture as a site of critical inquiry that promotes social justice, cultural work, and democratic pedagogy. Prerequisite: Graduate classification.
- 656. Learning Theories for Teachers of Young Children. (3-0). Credit 3.** Educational applications developed from theory and research of young learners, specifically the processes of learning. Prerequisite: Graduate classification.
- 658. History of Education. (3-0). Credit 3.** The genesis of formal education in the Western world beginning with the ancient Greeks and working through the Enlightenment; tracing the idea that schooling is a fundamental part of human existence and therefore crucial to all questions concerning the human condition. Prerequisite: Doctoral classification or approval of instructor.
- 659. History of American Education. (3-0). Credit 3.** The social and institutional role of public education in the United States from 1789 to the present; including clarification of the political and economic underpinnings that have worked catalytically to change the structure of public education in terms of philosophy, methods and curricula. Prerequisite: Doctoral classification or approval of instructor.
- 660. Research Investigating the Science Teacher Professional Continuum in Texas. (3-0). Credit 3.** Reviews general features and investigates aspects of the science teacher professional continuum (TPC), including recruitment, retention, induction, mentoring, professional development, professional culture, and reformed practice; uses extant data sets in TPC research, including literature review, conceptual framework development, research proposal, IRB approval, data analysis, and making conclusions. Prerequisite: Graduate classification in EDCI or approval of instructor.
- 661. Mixed Methods Research in Curriculum and Instruction. (3-0). Credit 3.** Introduction to mixed methods research, including a brief history of approaches to educational research; comparison of scientific research and educational research; specific designs and methods for mixing qualitative and quantitative approaches in data collection, analysis, and synthesis. Prerequisite: Graduate classification.
- 662. Philosophical Theories of Education. (3-0). Credit 3.** Selected historical theories of education from Plato to Skinner; evaluating educational ends and means; the nature of knowledge, its acquisition and transmission. Doctoral level only.
- 663. Scientific Inquiry in K-16 Classrooms. (3-0). Credit 3.** Theory and research on the integration of scientific inquiry into classroom instruction in K-16 learning environments, emphasizing curriculum decision-making, alignment, and design across the K-16 continuum.
- 664. Advanced Methods of Secondary Science Education. (3-0). Credit 3.** Strategies for teaching secondary school science; design and evaluation of secondary school science instruction; recent developments in secondary school science teaching.

- 665. Science and Mathematics Curricula. (3-0). Credit 3.** Critical exploration of the trends and issues in school science and mathematics programs; consideration of the foundations and strategies for the design, selection, and evaluation of mathematics and science curricula.
- 666. Laboratory Methods and Management in Science Teaching. (3-0). Credit 3.** Foundations, procedures and techniques associated with effective laboratory science teaching; planning, conducting and evaluating laboratory activities, facilities management and safety.
- 667. Research and Foundations of Science Education. (3-0). Credit 3.** Analysis of research in science education which relates the historical and philosophical basis of science and science teaching; emphasis on implications for improved instruction, especially on the nature of science, its relation to other disciplines, and student understanding of the scientific way of knowing.
- 668. History and Culture of Science Education: 1900 to Present. (3-0). Credit 3.** Science education as a discipline, profession, culture and a component in the education of K-16 students during the last 100 plus years in the United States and selected developed nations. Prerequisite: Graduate classification.
- 669. Science Education in Sociological Context. (3-0). Credit 3.** Explores science and its endeavors from a sociological perspective in order to make inferences on school science practice and science teaching; discusses the social context of disciplinary knowledge, problems of experimentation and scientific measurement, originality, cognitive particularism, collectivization of science, and peer review. Prerequisite: Graduate classification.
- 670. Social Studies in Elementary and Secondary Education. (3-0). Credit 3.** Methodology course focusing upon the implementation, both practical and theoretical, of the objectives of social studies: current trends, resource materials, demonstrations of teaching methods.
- 671. How People Learn Science. (3-0). Credit 3.** The study of science learning and epistemology, centered upon the essays "How People Learn and How Students Learn Science;" reviewing and discussing learning science design strategies and theories of learning science in light of understanding and advancing students' learning, classroom interactions, and the organization of schools. Prerequisite(s): Graduate classification.
- 673. Analysis of Teaching Behavior. (3-0). Credit 3.** Identification of beliefs and assumptions regarding teaching; review of research on teacher effectiveness; alternative methods for gathering data regarding dimensions of teaching behavior; development of teacher analysis systems.
- 675. Teaching Strategies: Patterns of Learning. (3-0). Credit 3.** Learning and teaching theory and research applied to development of teaching strategies appropriate for various contents, objectives and instructional situations; variables influencing learner behavior and approaches to optimization of teacher behavior. Prerequisite: EPSY 602 or EPSY 673 recommended.
- 676. Evaluation and Implementation of Electronic Learning Materials. (3-0). Credit 3.** Principles of instructional design applied to electronic materials adoption and organizational management for implementation of eLearning resources; Emphasis on guidelines for selecting and evaluating eLearning resources addressing individual learner needs using online delivery platforms. Prerequisite: Graduate classification.
- 677. Strategies for Teaching in a Culturally Pluralistic Society. (3-0). Credit 3.** Research concerning the cognitive, psychomotor and affective aspects of learning and teaching among culturally diverse learners; practical applications to curriculum and instruction.
- 680. Proseminar. (1-0). Credit 1.** Structured seminar on major concepts, principles and issues in education drawn and analyzed from various contributing theoretical and research bases. Critical new developments incorporated as they occur. Required of all Ed.D. students. May be repeated for credit. Prerequisite: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Professional roles and responsibilities, research, special topics and other issues relevant to master's and doctoral students in curriculum and instruction.
- 682. Seminar in... (1-0). Credit 1.** Knowledge, skills and attitudes in educational curriculum and instruction. Specific topics will be assigned for each seminar as it is offered. May be repeated for credit.
- 683. Field Practicum. (3-0). Credit 3.** Designed to provide supervised experiences based upon a theoretical framework in profession settings related to the work of teaching, learning and culture; practical experiences closely supervised by the department faculty. Prerequisite: Approval of instructor.

- 684. Professional Internship. Credit 1 to 6 each semester.** On-the-job training for educational curriculum and instruction majors under the supervision of successful, experienced personnel from the University; conducted in a setting appropriate to the student's projected career aspirations and areas of specialization.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems in the field of education.
- 686. Research Methods in EDCI I. (3-0). Credit 3.** Framework for understanding distinctions among research methodologies used in the field of curriculum and instruction; includes classes of research questions, methods of collecting and decisioning evidence, theoretical assumptions, strengths, weaknesses, and the work of major proponents. Prerequisite: Admission into TLAC doctoral program.
- 687. Research Methods in EDCI II. (3-0). Credit 3.** Framework for understanding distinctions among research methodologies used in the field of curriculum and instruction; includes classes of research questions, methods of collecting and decisioning evidence; basic principles of descriptive and inferential statistics and their application in context of various research paradigms. Prerequisite: EDCI 686.
- 688. Research Methods in EDCI III. (3-0). Credit 3.** Framework for understanding distinctions among research methodologies used in the field of curriculum and instruction; includes classes of research questions, methods of collecting and decisioning evidence; basic principles of multivariate statistics and their application in context of various research paradigms. Prerequisite: EDCI 687.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of curriculum and instruction. May be repeated for credit.
- 690. Theory of Curriculum and Instruction Research. (3-0). Credit 3.** Theory and design of research problems and experiments in various subfields of curriculum and instruction; communication of research proposals and results; evaluation of current research of faculty and student and review of current literature. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 692. Professional Study. Credit 1 or more each semester.** Approved professional study of project undertaken as the terminal requirement for doctor of education degree. Preparation of a record of study summarizing the rationale, procedure and results of the completed project. Prerequisite: Approval of major advisor.

Educational Human Resource Development

(faculty, see [page 379](#))

(EHRD)

- 601. Foundations of Human Resource Development. (3-0). Credit 3.** Survey of the set of systematic and planned activities designed by an organization to provide its employees with the necessary skills to meet current and future job demands: learning and human resource development needs assessments, task analysis, designing, implementing and evaluating training programs, career development, organization development. Prerequisite: Doctorate students only.
- 602. Critical Issues in Human Resource Development. (3-0). Credit 3.** Critical issues in human resource development; development of workforce through training and development activities. Prerequisite: Graduate classification.
- 603. Applied Theoretical Foundations of Human Resource Development. (3-0). Credit 3.** Challenges of supervision associated with human resource development settings; how to apply theoretical foundations of human resource development to ensure employees obtain the necessary skills for current and future job demands. Prerequisite: Master's classification only.
- 605. Principles and Practices of Leadership in Human Resource Development. (3-0). Credit 3.** Development and application of leadership models for human resource development settings; introduce and examine historical, philosophical and theoretical aspects of leadership; explore and evaluate the ethical and influence dimensions of leadership; critically examine the contemporary research characteristics of effective leadership. Prerequisite: Graduate classification.
- 606. Project Management in Human Resource Development. (3-0). Credit 3.** The use of established project management theory, tools, practices and technology toward the effective management of organizational processes, projects, and programs in universities, government, business, and industry.

- 607. International Human Resource Development. (3-0). Credit 3.** Organization, delivery, and management of human resource development programs in multinational and global corporate settings. Prerequisite: Graduate classification.
- 612. Training and Development in Human Resource Development. (3-0). Credit 3.** Overview of the process of planning, implementing and evaluation training and development in a variety of settings; includes conceptual tools needed to develop and design training. Prerequisite: Graduate classification.
- 613. Career Development in Human Resource Development. (3-0). Credit 3.** Foundations for developing expertise in the area of career development; content to serve to expand knowledge and prepare individuals for optimizing human resources in human resource development organizations; focusing on programs, methods, practices, and techniques by combining personal and organizational factors. Prerequisite: Graduate classification.
- 614. Strategic Planning for Human Resource Development. (3-0). Credit 3.** Strategic planning in Human Resource Development (HRD); elements for training, career and organizational development; mission, values and culture, vision, audit analysis and modeling. Prerequisite: Graduate classification.
- 616. Methods of Teaching Adults. (3-0). Credit 3.** Selection and use of appropriate instructional design strategies in teaching adults.
- 618. Evaluation Models in Human Resource Development. (3-0). Credit 3.** Providing instruction, insights, and learning experiences regarding educational human resource development applications of and relationships among five leading types of evaluation: needs assessment, program design/delivery, performance outcomes, impact assessment, and efficiency/ROI.
- 620. Emotions in Education and Industry. (3-0). Credit 3.** Exploring and understanding the emotional foundations of effective working relationships among teachers, trainers and trainees in educational, industrial and business settings. Prerequisite: Graduate classification.
- 621. Communication in Human Resource Development. (3-0). Credit 3.** Visual, oral, written and computer-based communication processes and their application in organizations, interpersonal interactions and small group settings in human resources development. Prerequisite: Graduate classification.
- 622. Training Task Analysis. (3-0). Credit 3.** Developing an understanding of the theory and practice of performance and needs analysis as applied in the public and private employment sectors; reviewing of the current issues related to job task analysis. Prerequisite: Graduate classification.
- 624. Change Theory. (3-0). Credit 3.** Conceptual tools needed to understand theories of change and to develop ways of operationalizing change for education and research. Prerequisite: Graduate classification.
- 625. Organization Development and Performance in Human Resource Development. (3-0). Credit 3.** Introduction to major theories, concepts, skills, and techniques for the practice and management of organization change and development in various organizational performance contexts and human resource development settings. Prerequisite: EHRD 601 or EHRD 603 or equivalent.
- 627. Research and Development in Educational Human Resource Development. (3-0). Credit 3.** Methods of conducting research programs in educational human resource development; defining the research problem and overview of quantitative, qualitative, action research, and mixed methods.
- 628. Research and Publishing in Human Resource Development. (3-0). Credit 3.** The role of research in human resource development; emerging the themes in research; criteria for evaluating research; critique of past and future presentations; the role of professionalism and professional organizations in human resource development; offered in association with the annual conference of the Academy of Human Resource Development. Prerequisites: EHRD 601 and EHRD 627 or approval of instructor; graduate classification.
- 630. Adult Learning. (3-0). Credit 3.** Research and theory in adult learning; factors influencing the adult learning process; and how adult development intersects with learning in adulthood.
- 631. Foundations of Adult Education. (3-0). Credit 3.** Fundamental concepts and definitions relating to adult education as a field of study; major historical developments and philosophical roots of adult education from a sociocultural and global perspective; diverse institutional commitments and responses to adult learner needs; administrative, programming, and instructional practices in the field.
- 633. Adult Literacy Education. (3-0). Credit 3.** Important aspects of implementing literacy programs for adults; funding, recruiting, placement, counseling and using community resources.

- 634. Introduction to Gender and Education. (3-0). Credit 3.** Major discussions and debates in the area of gender and education, with particular attention to the role that feminism and feminist theory have played on the intersections of gender, race, class, ethnicity and sexuality. Prerequisite: Graduate classification. Cross-listed with WGST 634.
- 636. Working with Adult Groups. (3-0). Credit 3.** Development of skills for facilitating productivity in task-oriented groups of adults. Issues, problems and concepts frequently encountered, and potential solutions.
- 637. Workforce Development. (3-0). Credit 3.** Evaluation of the workforce and the development of research techniques for identifying, assessing and evaluating the needs of industry for a quality workforce; models for staffing, curriculum needs, and program development designed and evaluated. Prerequisite: Graduate classification.
- 638. Issues in Adult Education. (3-0). Credit 3.** Pressing contemporary issues within the field of adult education; explores issues and their impact on adult education research, theory, and practice. Specific topics addressed each semester offered.
- 641. Evaluation of Adult Teaching and Learning. (3-0). Credit 3.** Introduces a variety of approaches to assessment and provides experience in developing the appropriate materials of adult learning in adult settings. Prerequisite: Graduate classification.
- 642. Program Development in Adult Education. (3-0). Credit 3.** Conceptual tools needed to develop educational programs for adults in a variety of settings; concepts of planning, implementation and evaluation.
- 647. Education for the Older Adult. (3-0). Credit 3.** Older adults as unique learners—defining specific physical and psycho-sociological differences between older adults and other learners; educational implications of specific needs and current educational programs to meet those needs. Prerequisite: Graduate classification.
- 649. Feminist Pedagogy. (3-0). Credit 3.** Explores how educational systems and institutions have regarded women historically and contemporarily; considers practical and theoretical writings on feminist pedagogy. Prerequisites: EHRD 634. Cross-listed with WGST 649.
- 650. Gender and International Education. (3-0). Credit 3.** Explores the intersection of formal and informal education and understandings of gender in countries beyond the United States. Prerequisites: EHRD 634. Cross-listed with WGST 650.
- 651. Models of Epistemology and Inquiry in Educational Human Resource Development. (3-0). Credit 3.** Inquiry in various epistemology paradigms outlined by Habermas and links to the outcomes of the research process.
- 655. Qualitative Research Methods. (3-0). Credit 3.** Introductory course in qualitative research methods; theoretical underpinnings; the research paradigm and applied experience with the methodology. Prerequisite: EHRD 651 or equivalent.
- 656. Narrative Analysis. (3-0). Credit 3.** Analysis of narratives; study of the theory behind “the narrative turn” in qualitative research; explore and apply various approaches to analyzing narratives in terms of both structure and their content. Prerequisite: EHRD 655 or equivalent.
- 657. Life History Research. (3-0). Credit 3.** Examines qualitative research that focuses on life experience both in its entirety (life history; biography and autobiography) and with specificity around a particular event (autoethnography); explores the nature of these types of qualitative research and discussing the methodological issues inherent in each mode. Prerequisite: EHRD 655 or equivalent.
- 670. Women and Education. (3-0). Credit 3.** Critical, theoretical and practical issues related to women and education. Prerequisite: Graduate classification.
- 671. Management of Distance Learning Systems. (3-0). Credit 3.** Organization, management and administration of distance learning systems; funding delivery systems and policy. Prerequisite: EHRD 673 or equivalent.
- 673. Introduction to Distance Learning. (3-0). Credit 3.** Introduction to the field of distance learning; application of distance learning principles to training settings via a variety of distance learning modalities; examination of the concepts surrounding distance learning, the theories that underpin the field, and the impact that they have on practice. Prerequisite: Graduate classification.

- 674. Distance Networking for Training and Development. 3-0). Credit 3.** Development of knowledge towards application of telecommunications networking in corporate training settings; technical alternatives for delivery of subject matter for trainers. Prerequisite: Graduate classification.
- 675. Women and Organizational Leadership. (3-0). Credit 3.** Historical, theoretical, ethical and legal issues relevant to women leaders in organizational contexts; skills development and practical approaches to effective leadership.
- 679. Procurement of Contracts and Grants. (3-0). Credit 3.** Funding sources that support research and development activities; identify methods of securing funding; study state, national and private funding sources and how to become successful in submitting to each; complete a proposal to a funding agency; and a management plan for a funded project. Prerequisite: Graduate classification.
- 681. Seminar. (1-0). Credit 1.** Issues pertinent to adult education and/or educational human resource development and research in appropriate areas. Master of Science students seeking the HRD option will develop a professional portfolio documenting progress through the individual's program, highlighting goals, beliefs, and desires associated with the program.
- 683. Practicum in Educational Human Resource Development. Credit 1 to 6.** Field-based practicum in theory and strategies for researching and delivering programs within a variety of educational human resource development settings. May be taken two times. Prerequisite: Approval of advisor.
- 684. Professional Internship. Credit 1 to 6.** Supervised experiences in performing professional functions appropriate to career goals. Prerequisite: Approval of program coordinator.
- 685. Directed Studies. Credit 1 to 6 each semester.** Directed individual study of selected problems in the field of educational human resource development. Students may register up to but no more than two sections of this course in the same semester.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in adult education. May be repeated for credit.
- 690. Theory of Educational Human Resource Development Research. (3-0). Credit 3.** Theory and design of research and inquiry in various applications of models and research procedures including quantitative analyses, naturalistic inquiry, research design and preparation of research proposals, as they relate to the discipline of educational human resource development. Prerequisite: EHRD 651 or equivalent.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Department of Educational Psychology

M. J. Ash, L. T. Benjamin, Jr., M. R. Benz, J. Blake, F. A. Bonner, II, L. J. Bowman-Perrott, D. F. Brossart, M. D. Burke, L. G. Castillo, L. D. Cifuentes, M. H. Clemens, C. W. Conoley, J. C. Conoley, A. J. Doss, M. Duffy, T. R. Elliott, C. J. Fournier, J. B. Ganz, Y. Goddard, E. T. Goetz, J. E. Gonzalez, S. Hagan-Burke, R. J. Hall, J. N. Hughes, R. M. Joshi, S. L. Knight, O. Kwok, R. Lara-Alecio, J. Liew, P. S. Lynch, J. F. McNamara, K. L. Murphy, W. R. Nash, Y. N. Padron, D. J. Palmer, R. I. Parker, L. H. Parrish, S. J. Pedersen, S. Pollard-Durodola, W. A. Rae, C. R. Reynolds, C. A. Riccio, C. R. Ridley, M. Rispoli, M. C. Sadoski, D. C. Simmons, L. M. Stough, B. Thompson, F. Tong, K. J. Vannest, V. L. Willson (Head)*, R. D. Zellner, D. Zhang

* Graduate Advisor

The Department of Educational Psychology offers study for the PhD degree in educational psychology, counseling psychology and school psychology. Both the counseling and school psychology programs are accredited by the American Psychological Association. Students seeking the PhD in educational psychology may emphasize one of five areas of study: cognition, creativity, instruction and development; educational technology; research, measurement and statistics; special education; or bilingual education (Hispanic emphasis). While each of the areas can prepare students for employment as university teachers and researchers, non-academic careers can also be pursued in areas appropriate to the study programs. For example, the counseling psychology program is designed to prepare students as counseling psychologists in college and university counseling centers, other social service settings, or public or mental health settings. The school psychology program prepares school psychologists to practice in schools and other health care settings. The special education program prepares students for professional leadership positions at universities and in field settings.

A MEd degree is available in Education Technology and Educational Psychology. Students seeking the MEd in educational psychology may emphasize one of the following areas: cognition, creativity, intelligence and development; school counseling; research, measurement and statistics; special education or bilingual education (Hispanic emphasis). Within special education, NCATE/CEC accredited distinct programs are

offered: a) bilingual special education; b) non-categorical special education; c) low incidence disabilities; d) transitional services; and e) high incidence disabilities. The school counseling emphasis prepares students for certification by the Texas Education Agency as school counselors. Students seeking the MS in educational psychology may emphasize one of the following areas: cognition, creativity, intelligence and development; and research, measurement and statistics.

In conjunction with its training in all areas of study, the department operates the Counseling and Assessment Clinic as a vehicle for student preparation and as a service to the University, as well as to the public and its schools. The clinic provides a modern laboratory for practicum experiences in counseling, educational and psychological assessment, and research.

Preparation as a professional in the areas of emphasis offered in the department requires attention to personal characteristics of the individual and his or her socialization into the profession, as well as to successful completion of academic coursework. In particular, students should exhibit an orientation toward fostering human development and possess characteristics conducive to helping relationships. Accordingly, the department requires that students desiring to pursue certification or degree programs satisfy the demands of the screening committee for the area of emphasis desired. These faculty committees require students to submit personal references, complete selected tests, and be interviewed by appropriate faculty members. Formal admission to a degree program, an area of emphasis or a certification program is contingent upon the appropriate screening committee's decision concerning the individual's total fitness and promise as a professional person in the area of emphasis for which application is made. Students in all areas of study will periodically have their total progress in professional development reviewed by a committee of the faculty offering that area of study to determine whether or not they shall be permitted to continue. All PhD students in the counseling and school psychology programs are expected to undertake a series of supervised professional training experiences in addition to formal coursework.

Field experiences in appropriate schools, colleges or social agencies are required in all degree programs. One complete year of full-time, professional internship is required of all doctoral students in the counseling and school psychology programs.

The deadline for Fall admissions to the educational psychology, counseling psychology and school psychology PhD programs is December 1. The Special Education and Bilingual Education programs also have deadlines for doctoral admission on April 1 and July 1. The deadlines for admission to all Master's programs are October 15 and March 15. Prospective students should contact the department's academic advisor to request a copy of the pertinent program information and departmental application procedures.

Because of the professional training involved, enrollment in a number of courses is limited to students majoring in the department. Some courses are limited to students admitted to specific areas of study. Approval by the department head is required for enrollment in courses.

Educational Psychology (EPSY)

- 602. Educational Psychology. (3-0). Credit 3.** Cognitive analysis of academic skills and tests; current cognitive views of learning, memory, problem solving and development of skill and expertise; effects of aptitude, motivation and task environment on academic performance. Implications for assessment and instruction. Prerequisite: Approval of department head.
- 604. Career Assessment and Placement Services. (3-0). Credit 3.** Theory and techniques of selecting and using career assessment instruments in the career development process; planning and operating placement programs for education and employment. Prerequisite: Approval of department head.
- 605. Effects of Culture, Diversity, and Poverty on Children and Youth. (3-0). Credit 3.** Understanding of how the intersecting nature of culture, diversity, and poverty impact adjustment outcomes in children and youth; comprehension of our own belief systems; exploration of disparities in education and mental health across ethnically, culturally and social economically diverse groups; strategies for alleviating educational and mental health disparities. Prerequisite: Graduate classification.
- 618. Neurodevelopment and Genetic Disorders in Children. (3-0). Credit 3.** Comprehensive coverage of a broad array of neurodevelopment and genetic disorders in children; emphasis on cognitive and emotional sequelae of these disorders and their relationship to medical, psychological, and educational interventions. Prerequisite: Graduate classification; approval of department head.

- 619. Nature and Needs of the Gifted and Talented. (3-0). Credit 3.** Psychological characteristics of the gifted and talented; introduction to identification techniques, educational programs, instructional approaches and special problems. Prerequisite: Approval of department head.
- 621. Clinical Neuropsychology. (2-2). Credit 3.** Surveys brain-behavior relationships with an emphasis on understanding the brain as an interdependent, systemic network. Students learn to administer and score the Halstead-Reitan Neuropsychological Test Battery. Prerequisite: Approval of instructor and department head.
- 622. Measurement and Evaluation in Education. (3-0). Credit 3.** Principles of psychological testing applied to education; uses and critical evaluation of achievement and aptitude, interest, and personality tests and performance in educational settings. Prerequisite: Approval of department head.
- 623. Social and Emotional Development of the Gifted and Talented. (3-0). Credit 3.** Theoretical models and patterns of social and emotional development among the gifted and talented through adolescence; implications and strategies for educators. Prerequisite: Approval of department head.
- 624. Creative Thinking. (3-0). Credit 3.** Development of personal creativity across fields of endeavor; analysis of creative potential, including psychometric assessment; experience of methods for stimulating creative processing and productivity. Prerequisite: Approval of department head.
- 625. Advanced Psychometric Theory. (3-0). Credit 3.** Psychometric theory, planning, construction, analysis, and evaluation of written and performance tests; item analysis, norms, reliability, and validity (including factor analytic) studies; item response theory. Prerequisites: EPSY 640; approval of department head.
- 626. At-Risk Hispanic Families and Their Young Children. (3-0). Credit 3.** Provides educational practitioners and related personnel with the conceptual and theoretical foundations for understanding the nature and impact of exposure to childhood risks on literacy, physical and mental health development of Hispanic families and their young children within developmental framework. Prerequisites: Graduate classification; approval of department head.
- 627. Structured Personality Assessment in Counseling. (3-0). Credit 3.** Personality evaluation using structured assessment instruments; variety of self-report personality inventories; the Minnesota Multiphasic Personality Inventory. Prerequisites: EPSY 622; approval of department head.
- 628. The Rorschach Technique with Children and Adolescents. (3-0). Credit 3.** Analysis of the Rorschach Technique; basic issues in projective assessment, scoring, interpreting and analyzing the Rorschach, with an emphasis on its clinical use with children and adolescents. Prerequisite: Approval of instructor and department head.
- 629. Educational Planning for the Gifted and Talented. (3-0). Credit 3.** Theoretical issues confronting educators involved in program development for gifted and talented children and adolescents; analysis of educational perspectives and instructional implications. Prerequisites: Graduate classification and approval of department head.
- 630. Single-Case Research. (3-0). Credit 3.** Provides skills to conduct research with N=1 designs in the area of special education, school counseling and school psychology; provides the procedures and applications to scenarios in classroom and clinic settings; students are required to collect and analyze data in three mini studies. Prerequisite: Approval of instructor and department head.
- 631. Program Evaluation in School and Clinic. (3-0). Credit 3.** Learning of key evaluation skills: establishing focus with client, posing evaluation questions, data collection techniques, designing for internal validity, data aggregation; scenario practice. Prerequisite: Approval of instructor and department head.
- 635. Educational Statistics. (2-3). Credit 3.** Introduction to the theory and application of statistical methods in behavioral science research with emphasis on classroom applications. Prerequisite: Approval of instructor.
- 636. Techniques of Research. (3-0). Credit 3.** Fundamental concepts and tools of research applied to psychological and educational problems; rationale of research, analysis of problems, library skills, sampling, appraisal instruments, statistical description and inference, writing the research report and representative research designs. Prerequisite: Approval of department head.
- 637. Qualitative Methods and Analysis. (3-0). Credit 3.** Methods of collecting qualitative data to answer educational or psychological questions including interviews, participant-observation, focus groups, and stimulated recall procedures; analysis and interpretation of data using Grounded Theory, case studies, and qualitative software. Prerequisites: Graduate classification; introductory course in qualitative methods; and approval of instructor.

640. **Experimental Design in Education I. (3-0). Credit 3.** Preparation in experimental research design in educational studies; application of statistical methods in these designs. Prerequisites: EPSY 636 or equivalent; approval of department head.
641. **Experimental Design in Education II. (3-0). Credit 3.** Preparation in research design in educational studies; application of statistical methods in these designs. Prerequisites: EPSY 640; approval of instructor and department head.
642. **Meta-Analysis of Behavioral Research. (3-0). Credit 3.** Principles and use of quantitative techniques for research integration in education and other behavioral disciplines; computer-based and branching literature searches, coding protocols, theory of effect size estimation, analysis and reporting. Prerequisites: EPSY 435 or STAT 651; EPSY 636 or equivalent; approval of department head.
643. **Applied Multivariate Methods. (3-0). Credit 3.** This seminar presents various techniques for applied multivariate modeling of phenomena in educational psychology. Prerequisites: EPSY 640 and EPSY 641 or approval of instructor; approval of department head.
645. **Creative Genius. (3-0). Credit 3.** Analysis of patterns of development among highly creative individuals; required dramatic presentation on the life and accomplishments of a selected individual through the use of the soliloquy stage technique. Prerequisite: Graduate classification; approval of department head.
646. **Issues in Child and Adolescent Development. (3-0). Credit 3.** Theoretical orientations, issues, research strategies and empirical findings of developmental psychology relevant to education. Prerequisites: PSYC 634 or equivalent; approval of department head.
647. **Adult Development and Aging. (3-0). Credit 3.** Issues and models of studying adult development and aging; research and theory of adult development; and the effect our aging population has on society. Prerequisite: Graduate classification; approval of department head.
648. **Intelligence and Creativity. (3-0). Credit 3.** Considers theory, research, methodologies and issues related to the definition, identification and assessment of intelligence, and assessment of intelligence and creativity; addresses theories of intelligence and creativity; methodologies and issues related to assessment of both; relationship between them; and frameworks for fostering creativity; considers implications/applications of theory and research on effective teaching practices for creativity. Prerequisite: Graduate classification; approval of department head.
651. **Theory of Structural Equation Modeling. (2-3). Credit 3.** Introduction to the theory and application of structural equation modeling. Prerequisites: EPSY 640 and EPSY 641 or STAT 650 and STAT 651; graduate classification; approval of department head.
652. **Theory of Hierarchical Linear Models. (3-0). Credit 3.** Introduction to the theory and application of hierarchical linear models. Prerequisite: EPSY 640-EPSY 641 or STAT 651-STAT 652, or any equivalent courses; some knowledge on ANOVA and Multiple Regression; graduate classification; approval of department head.
653. **Advanced Structural Equation Modeling. (3-0). Credit 3.** Advanced topics of structural equation models; includes exploratory factor analysis under the structural equation modeling framework, testing factorial invariance, structural equation models with categorical observed variables, multilevel structural equation models, latent growth models, and growth mixture models. Prerequisites: EPSY 651 and EPSY 652.
654. **Longitudinal Data Analysis. (3-0). Credit 3.** Review of traditional approaches to longitudinal data analysis (e.g., MANOVA); consideration of newer approaches including multilevel modeling (MLM) and latent growth modeling (LGM) and their advantages in analyzing longitudinal data. Prerequisite: EPSY 651 and EPSY 652.
655. **Item Response Theory. (3-0). Credit 3.** Advanced measurement topics in item response models; theoretical foundations and practical applications of IRT models; dichotomous and polytomous IRT models including Rasch model (IPL model), 2-PL model, 3-PL model, rating scale model, partial credit model, and graded response model; analysis based on each model illustrated using BILOG-MG, PARSCALE, and M-plus. Prerequisite: EPSY 625.
659. **Practicum in Educating the Gifted and Talented. (1-6). Credit 3.** Theory and strategies for instruction and guidance of the gifted and talented through a supervised experience in a laboratory setting with gifted and talented children and/or adolescents. May be taken three times for credit. Prerequisite: Approval of instructor and approval of department head.
673. **Learning Theories. (3-0). Credit 3.** Comprehensive study of classical and current learning theories; their significance to modern education. Prerequisite: Approval of department head.

- 679. Research on Teacher Effectiveness. (3-0). Credit 3.** Considers theory, research and methodologies related to the definition and identification of effective teaching practices; practice, implications and applications of theory and research in educational psychology on effective teaching practices. Prerequisites: Graduate classification; approval of department head.
- 682. Seminar in... (1-0). Credit 1.** Knowledge, skills and attitudes in special education, counseling, psychological foundations of education and school psychology. Specific topics are announced for each seminar offered. May be taken more than once but not to exceed 6 hours of credit. Prerequisite: Approval of department head.
- 683. Field Practicum in... Credit 1 to 15.** Supervised experience in professional employment settings in educational psychology. Wide range of practical experiences and activities as listed below that are closely supervised by departmental faculty. Repeatable to 15 hours total. Prerequisite: Approval of instructor and department head.
- 684. Professional Internship. Credit 1 to 4 each semester.** Limited to advanced doctoral students; University-directed experience in a professional employment setting; full-time participation and responsibility in experiences related to career specializations in counseling or school psychology. Repeatable to 9 hours total. Prerequisites: Approval of department head six weeks prior to registration; approval of department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems. Prerequisite: Approval of department head.
- 688. Research Proposal Development. (3-2). Credit 4.** This seminar models the processes of developing and defending research proposals. Prerequisites: EPSY 640 and 641 or approval of instructor; approval of department head. Cross-listed with CPSY 688.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of educational psychology. May be repeated for credit. Prerequisite: Approval of department head.
- 690. Theory of Educational Psychology Research. (3-0). Credit 3.** Theory and design of research problems and experiments in various subfields of educational psychology; communication of research proposals and results; evaluation of current research of faculty and students and review of current literature. May be repeated for credit. Prerequisite: Approval of instructor and department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of department head.

Educational Technology

(faculty, see [page 392](#))

(EDTC)

- 602. Educational Technology: Field, Theory, Profession. (3-0). Credit 3.** Introduces the student to the educational technology profession and provides a conceptual map of the theory, research and practice of the field; a historical overview of the field aids in bringing current educational technology practices into perspective. Prerequisite: Approval of department head.
- 608. Foundations of Distance Learning. (3-0). Credit 3.** Communication theory, learning theories, and systems theory related to distance learning; application of effective and efficient instructional methodologies to educational/instructional settings via multiple distance education technologies and techniques. Prerequisites: EDTC 645 or approval of instructor; approval of department head.
- 613. Integrating Technology in Learning Environments. (2-2). Credit 3.** Students develop a broad understanding of what is involved in designing technology rich environments to support active learning. They examine the integration of human learning theories with instructional design and development practices in the selection, preparation, evaluation, and ethics of instructional technology implementation.
- 621. Graphic Communication and Interface Design. (3-0). Credit 3.** Application of research findings and design principles to the critical analysis of the interfaces of everyday objects, print materials, and Web sites; effective design of graphical displays to communicate functionality and structure; issues related to flawed interfaces, elegant design solutions, user-centered design, usability testing, and Web site accessibility. Prerequisite: Approval of department head.

- 631. Educational Video. (3-0). Credit 3.** Design and development of educational video programs using an effect-to-cause model: message definition, scriptwriting, storyboarding, production, post-production editing and evaluation; topics include lighting, sound, the operation of digital video cameras, the use of digital editing software, visual effects, compression, video sharing websites, copyright law, production personnel, medium requirements. Prerequisite: Approval of Instructor.
- 645. Instructional Applications of Computer Technologies I. (3-0). Credit 3.** Introduction to the integration of computers, telecommunications, and related technologies into educational practice; resources for personal productivity and development/delivery of instructional materials; applications for both educators and students (word processing, databases, etc.); projects include hands-on development of HyperText, MultiMedia, and Internet (web-based) resources in participant's own area of study. Prerequisite: Approval of department head.
- 646. Instructional Applications of Computer Technologies II. (3-0). Credit 3.** Issues (social, educational, etc.) and techniques associated with educational applications of computers and related resources and techniques (graphics, multimedia, etc.); relationship of course activities and products to individual educational/instructional philosophies; web-supported. Prerequisites: Graduate classification; approval of department head.
- 651. Tutorials and Simulations. (3-0). Credit 3.** Application of theory to the design and development of two types of computer-based instructional programs: tutorials and simulations; critique of existing instructional software for K-12 students and adult training programs; guidelines for design decisions related to rich media, navigation, learner/program control, practice, interactivity, and feedback. Prerequisite: Approval of instructor.
- 654. Instructional Design: Techniques in Educational Technology. (3-0). Credit 3.** Introduces systems approach to instructional design with focus on the functions of systems models in planning, developing and evaluating instruction; use of instructional development models which systematically assure proper instructional design; participants will develop instructional products individually and in groups; a strong theoretical foundation utilized. Prerequisite: Approval of instructor and department head.
- 655. Instructional Design II. (3-0). Credit 3.** Preparation for leadership in instructional design through exploration of project management, needs assessment, goal analyses, rapid prototyping, problem-based learning, case-based learning, design of learning objects, ID for international audiences, instructional materials and program evaluation; theories that contribute to the field. Prerequisites: Graduate classification; approval of department head; EDTC 654.
- 656. Computer Graphics: Educational Applications and Production Techniques. (2-2). Credit 3.** Computer graphics production used in the development of educational materials; acquired skills and knowledges applied to the student's interest area with respect to theoretical and research issues relating to the effective instructional use of print and computer-based instructional materials; techniques include digitizing, image-processing and animation. Prerequisites: EDTC 645 or approval of instructor; approval of department head.
- 660. Interactive Video/Multimedia: Production and Utilization. (3-0). Credit 3.** Principles and techniques of interactive video/multimedia design and production; practical applications of media (video, digitized video and audio) production techniques and instructional control programs utilizing authoring software; produce materials for interactive instructional programs involving features such as: CD-ROM video and audio, simulations, interactive digital movies, web-based delivery, etc. Prerequisites: EDTC 645 or approval of instructor; approval of department head.
- 662. Computer Utilization in Educational Research and Practice. (3-0). Credit 3.** Use of computers for application in educational and research settings; activities include student/subject monitoring, hardware use and design, automatic data collection; data storage, retrieval, transmission and analysis; web-based research formats are included; projects will relate to student's major area of study. Prerequisites: EDTC 645 or approval of instructor; approval of department head.
- 664. Management of Instructional Telecommunication Systems. (2-2). Credit 3.** Management of Instructional Telecommunication Systems. Analysis of instructional telecommunications needs associated with educational and training programs; analysis, design, development, implementation and evaluation of computer-based management systems. Prerequisites: EDTC 645 or approval of instructor; approval of department head.

- 668. Applications of Telecommunications in Education. (2-2). Credit 3.** Instructional applications of telecommunications; analysis of characteristics of varied systems, both dedicated and public networks, and design of appropriate strategies and methods using those systems. Prerequisites: EDTC 645 or approval of instructor; approval of department head.
- 683. Practicum in Educational Technology. Credit 1 to 3.** Supervised experience in applied area of educational technology; student will plan and develop an integrative product relating to educational technology theory, practice and equipment. Prerequisite: Approval of instructor and department head.
- 684. Professional Internship. Credit 1 to 6.** Supervised experiences in performing professional functions appropriate to career goals. Prerequisites: Application one month prior to registration; approval of instructor and department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems in instructional technology not within thesis research and not covered by any other course. Prerequisite: Approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of educational technology. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of major advisor and department head.

Department of Electrical and Computer Engineering

A. D. Ames, R. S. Balog, S. P. Bhattacharyya, U. Braga-Neto, K. L. Butler-Purry, P. E. Cantrell, J-F. Chamberland, A. K. Chan, K. Chang, X. Cheng, S. G. Choi, S. Cui, A. Datta, E. R. Dougherty, M. Ehsani, O. Eknayan, P. Enjeti, K. Entesari, C. N. Georghiadis (Head), P. Gratz, C. R. Haden, D. R. Halverson, A. Han, H. R. Harris, P. R. Hemmer, J. W. Howze, S. Hoyos, J. Hu, G. M. Huang, G. H. Huff, I. V. Ivanov, J. X. Ji, J. Kameoka, A. I. Karsilayan, M. Kezunovic, S. Khatri, L. B. Kish, P. R. Kumar, D. Kundur, P. Li, T. Liu, M. Lu, C. K. Madsen, T. A. Maldonado, M. P. McDougall, M. R. Mercer, K. A. Michalski, S. L. Miller, K. R. Narayanan*, R. D. Nevels, C. Nguyen, S. Palermo, A. D. Patton, H. D. Pfister, A. L. N. Reddy, R. Righetti, B. D. Russell, E. Sanchez-Sinencio, S. A. Savari, J. M. Seminario, E. Serpedin, S. Shakkottai, W. Shi, J. Silva Martínez, C. Singh, A. Sprintson, C. B. Su, H. A. Toliyat, H. Wang, K. L. Watson, M. H. Weichold, S. M. Wright, L. Xie, Z. Xiong, B. Yoon, X. Zhang, J. Zou, T. Zourntos

* Graduate Advisor

The Department of Electrical and Computer Engineering offers programs for graduate study leading to the research-oriented Master of Science and Doctor of Philosophy degrees and to the professional Master of Engineering degree in Electrical and Computer Engineering. Courses in the department may also be applied to the interdisciplinary Doctor of Engineering degree. The MS and PhD programs provide specialization in-depth and include a research (thesis or dissertation) requirement. The MEng and DEng programs are designed to provide the depth and breadth necessary for the practice of engineering at advanced levels.

Current areas of study include analog and mixed signal, biomedical imaging and genomic signal processing, computer engineering, control systems, electromagnetic and microwaves, electric power and power electronics, solid state electronics, photonics and nano-engineering, telecommunications and signal processing. Interdisciplinary engineering programs are available in other areas.

Well equipped laboratories are available for work in all of these areas. Special laboratory facilities are available to graduate students in telecommunications, solid-state electronics, integrated circuit design, electromagnetics, microwave microelectronics, electrotropics, computer vision and electric power systems. The department has many workstations and high end PCs in general access laboratories and excellent computing facilities available in the individual research laboratories. The workstations are supported by a large Sun file-servers and two computational servers, and the PCs are supported by a Novell network.

There is no foreign language requirement for the PhD or DEng programs in electrical and computer engineering.

Electrical and Computer Engineering (ECEN)

- 600. Experimental Optics. (3-2). Credit 4.** Hardware, electronic interfaces, and experimental techniques for optics including optical mechanics, component mounting techniques, passive optical components, interferometers and precision alignment, basic electronics including op amps, active optical elements such as acousto-optics, servos in optics, laser intensity stabilization, lock-in amplifier and frequency stabilization. Prerequisite: Approval of instructor.
- 601. Linear Network Analysis. (3-0). Credit 3.** Signal theory treatment of continuous and discrete signals and systems; vector spaces, projection and sampling theories, Fourier, Laplace and Z Transforms.
- 602. Computer Communication and Networking. (3-0). Credit 3.** Computer communication and computer networks; use of the International Standards Organization (ISO) seven-layer Open Systems Interconnection model as basis for systematic approach; operational networks to be included in the study of each layer; homework assignments to make use of a campus computer network. Prerequisite: ECEN 646 or equivalent probability background.
- 603. Time-frequency Analysis and Multirate Signal Processing. (3-0). Credit 3.** Basic functions; short-time Fourier transform; Gabor transform; linear time-scale/time-frequency analysis; time-frequency resolution; Wigner-Ville distribution; Ambiguity function; wavelet series; multi-rate filter bank; orthogonality and biorthogonality; subband coding and pattern recognition.
- 604. Channel Coding for Communications Systems. (3-0). Credit 3.** Channel coding for error control, finite field algebra, block codes, cyclic codes; BCH codes; and convolutional codes; Trellis coded modulation, including ungerboeck codes and coset codes; performance on gaussian and rayleigh channels; applications to communications systems. Prerequisites: Approval of instructor and graduate classification.
- 605. Linear Control Systems. (3-3). Credit 4.** Application of state variable and complex frequency domain techniques to analysis and synthesis of multivariable control systems. Prerequisite: ECEN 420 or equivalent.
- 606. Nonlinear Control Systems. (3-0). Credit 3.** Techniques available to analyze and synthesize non-linear and discontinuous control systems. Modern stability theory, time-varying systems, DF, DDF, Lyapunov Theory, adaptive control, identification and design principles for using these concepts; examples from a variety of electronic and electromechanical systems. Prerequisite: ECEN 605.
- 607. Advanced Analog Circuit Design Techniques. (3-2). Credit 4.** Design of analog circuits using conventional and non-conventional voltage techniques, including floating gate, bulk driven and enhanced wide swing structures. Prerequisite: ECEN 474 or approval of instructor.
- 608. Modern Control. (3-0). Credit 3.** Vector Norms; Induced Operator Norms; Lp stability; the small gain theorem; performance/robustness trade-offs; L1 and Hoo optimal P control as operator norm minimization; H2 optimal control. Prerequisite: ECEN 605 or equivalent. Cross-listed with MEEN 674.
- 609. Adaptive Control. (3-0). Credit 3.** Basic principles of parameter identification and parameter adaptive control; robustness and examples of instability; development of a unified approach to the design of robust adaptive schemes. Prerequisite: ECEN 605 or approval of instructor. Cross-listed with MEEN 675.
- 610. Mixed - Signal Interfaces. (3-2). Credit 4.** Analog-to-digital and digital-to-analog converter architectures including Nyquist rate and oversampled converters; definition of basic data converter specifications and figures of merit; background and foreground calibration techniques to improve performance of data converters; low-power (green topologies) data converters design; state of the art mixed-signal interfaces such as transmitters and receivers front-ends in wireless and wireline communications transceivers; introduction to calibration techniques for digitally-assisted transceivers. Prerequisite: ECEN 474 or approval of instructor.
- 611. General Theory of Electromechanical Motion Devices. (3-0). Credit 3.** Winding function theory; inductances of an ideal doubly cylindrical machine; inductances of salient-pole machines, reference frame and transformation theory; dynamic equations of electric machines; steady-state behavior of electric machines. Prerequisite: Approval of instructor or graduate classification.

- 612. Computer Aided Design of Electromechanical Motion Devices. (3-1). Credit 4.** Magnetic circuits and field distribution of electric machines; main flux path calculation; calculation of magnetizing and leakage inductance; calculation of electric machine losses; principle of design of various electric machines; finite element design of electromechanical motion devices. Prerequisite: Approval of instructor or graduate classification.
- 613. Rectifier and Inverter Circuits. (3-0). Credit 3.** Analysis/design of single phase, three phase rectifiers; phase control and PWM rectifiers; line harmonics; power factor; harmonic standards; passive and active correction methods; inverters; PWM methods; effect of blanking time; zero voltage switching and multilevel inverter; application of these systems in UPS and AC motor drives. Prerequisite: ECEN 438 or approval of instructor.
- 614. Power System State Estimation. (3-0). Credit 3.** The large electric power system state estimation problem; issues of network observability; bad measurements detection/identification; sparse matrix vector techniques for computational efficiency. Prerequisite: ECEN 460.
- 615. Methods of Electric Power Systems Analysis. (3-0). Credit 3.** Digital computer methods for solution of the load flow problem; load flow approximations; equivalents; optimal load flow. Prerequisite: ECEN 460 or approval of instructor.
- 616. Power System Electromagnetic Transients. (3-0). Credit 3.** Modeling of power system components for electromagnetic transient studies; digital computer methods for computation of transients. Prerequisites: ECEN 459 and ECEN 460.
- 617. Advanced Signal Processing for Medical Imaging. (3-0). Credit 3.** This is a graduate-level course covering several advanced signal processing topics in medical imaging: multi-dimensional signal sampling and reconstruction, bio-signal generation and optimal detection, Fourier imaging, Radon transform-based tomographic imaging, multi-channel signal processing, as well as constrained reconstruction, rapid imaging, image segmentation, registration and analysis. Prerequisite: Approval of the instructor.
- 618. Resilient Computer Systems. (3-0). Credit 3.** Impact of reliability on computer and network systems design; stochastic models of reliability and availability in fault-tolerant systems; hardware, software and system interaction, system design for testability, isolation and recovery. Prerequisite: ECEN 350 or CSCE 410.
- 619. Internet Protocols and Modeling. (3-0). Credit 3.** Wide spectrum of Internet protocols that make it work; analytical capabilities to evaluate the performance of complex Internet protocols; aspects of the Internet protocols, including principles, design and implementation, and performance modeling and analysis; core components of Internet protocols such as transport (TCP, UDP), network and routing (IP, RIP, OSPF, EGP, BGP-4, etc.) Prerequisite: Approval of instructor.
- 620. Network Theory. (3-0). Credit 3.** Development and application of advanced topics in circuit analysis and synthesis in both the continuous and discrete time and frequency domains. Prerequisite: ECEN 326 or equivalent.
- 621. Mobile Wireless Networks. (3-0). Credit 3.** Foundations of advanced mobile wireless networks, how they are designed, and how well they perform. Topics include fundamentals on mobile wireless networks, TCP/IP over wireless links, fading-channel modeling, CDMA, OFDM, MIMO, error control, IEEE 802.11 protocols, cross-layer optimization, wireless QoS, mobile multicast, VANETs, wireless-sensor networks, wireless networks security. Prerequisites: Basic-level "Computer Networks" class or consent of instructor.
- 622. Active Network Synthesis. (3-0). Credit 3.** Methods of analyzing and synthesizing active networks; sensitivity analysis, methods of rational fraction approximation, OP AMP modeling and stability. Prerequisite: ECEN 457 or equivalent.
- 623. Parallel Geometric Computing. (3-0). Credit 3.** Parallel computer architectures and algorithms for solving geometric problems raised in VLSI design, pattern recognition and graphics; advanced research results in computational geometry including convexity, proximity, intersection, geometric searching and optimization problems. Prerequisite: CSCE 311 or ECEN 350.
- 624. IC Design Tools. (3-0). Credit 3.** Use of several CAD tools, not covered in other classes, oriented towards the solution of more advanced IC design task; the underlying theoretical principles, problem solved and basic solution methods. Prerequisite: Approval of instructor.

- 625. Millimeter-wave Integrated Circuits. (3-0). Credit 3.** Applications of millimeter-wave integrated circuits for wireless transceiver; principles of operation, modeling, design and fabrication of the most common millimeter-wave CMOS, SiGe and RF MEMS circuits. Prerequisite: Graduate classification; approval of instructor.
- 626. Antenna Theory and Technique. (2-3). Credit 3.** Applied electromagnetics and physical layer concepts for modern communication systems; topics include: advanced antenna theory and analytical techniques (e.g., variational and perturbational); full-wave tools for complex radiating structures and fading environments; reconfigurable antennas and device integration; multiple antenna techniques; and fabrication, measurement, and calibration methods. Prerequisite: Approval of instructor.
- 627. Multimedia Systems and Networks. (3-0). Credit 3.** Research topics in multimedia storage and delivery; real-time scheduling (processor, disk, network); guaranteed service, statistical guarantees, best-effort, IP-Multicast audio/video compression standard, multicast applications, congestion control. Prerequisite: ECEN 602 or CSCE 619.
- 628. Linear System Theory. (3-0). Credit 3.** Application of functional analysis and geometric concepts to the analysis and synthesis of control systems. Prerequisite: ECEN 605.
- 629. Convex Optimization for Electrical Engineering. (3-0). Credit 3.** Introduction of convex optimization including convex set, convex functions, convex optimization problems, KKT conditions and duality, unconstrained optimization, and interior-point methods for constrained optimization; specific application examples in communication/information theory, signal processing, circuit design, and networking, which are based on state-of-art research papers. Prerequisites: Linear Algebra (familiar with operations over vectors and matrices).
- 630. Analysis of Power Electronic Systems. (3-0). Credit 3.** Analysis and control of semiconductor switching power converters using specialized methods such as Fourier series, state-space averaging, time domain transfer functions, sliding mode, quadrometrics and other discontinuous orthogonal functions; application of the above techniques in practice; selected research publications. Prerequisite: Approval of instructor.
- 631. Fiber-Optic Devices. (3-0). Credit 3.** Fiber optic waveguides; directional couplers; polarization; poincare sphere fractional wave devices; PM fiber; interferometric devices and sensors fiber gyroscope; faraday effect devices; multiplexing techniques. Prerequisite: Approval of instructor.
- 632. Motor Drive Dynamics. (3-0). Credit 3.** Mathematical analysis of adjustable speed motor drive dynamics; direct torque control in dc and ac machines; the theory of field orientation and vector control in high performance ac motor drives; motion control strategies based on the above theories; microcomputer, signal and power circuit implementation concepts. Prerequisite: Approval of instructor.
- 633. Optimum Control Systems. (3-0). Credit 3.** Variational approach to the development of algorithms for the solution of optimum control problems; necessary and sufficient conditions, numerical methods, and analysis and comparison of optimal control results to classical theory. Prerequisite: ECEN 605.
- 634. Morphological Methods in Image and Signal Processing. (3-0). Credit 3.** Image analysis and signal processing; feature extraction based upon geometrical shape; morphological filtering for image analysis; computer simulation of filter types. Prerequisites: ECEN 447 and ECEN 601.
- 635. Electromagnetic Theory. (3-0). Credit 3.** Maxwell's equations, boundary conditions, Poynting's theorem, electromagnetic potentials, Green's functions, Helmholtz's equation, field equivalence theorems; applications to problems involving transmission scattering and diffraction of electromagnetic waves. Prerequisites: ECEN 322; ECEN 351 or equivalent.
- 636. Phased Arrays. (3-0). Credit 3.** Theory and application of phased array antennas, radiators and sensors; spatial and spectral domain analysis of phased arrays including element-by-element, infinite array and Fourier methods; applications will include phased arrays, adaptive arrays, and synthesis array antennas; for use in radar, imaging and biomedical treatment and diagnosis. Prerequisite: ECEN 322 or equivalent.
- 637. Numerical Methods in Electromagnetics. (3-0). Credit 3.** Numerical techniques for solving antenna, scattering and microwave circuits problems; finite difference and finite element differential equation methods with emphasis on the method of moments integral equation technique. Prerequisites: ECEN 351 or ECEN 635; CSCE 203 or equivalent.
- 638. Antennas and Propagation. (3-0). Credit 3.** Application of Maxwell's equations to determine electromagnetic fields of antennas; radiation, directional arrays, impedance characteristics, aperture antennas. Prerequisite: ECEN 351.

- 639. Microwave Circuits. (3-0). Credit 3.** Introduction to high frequency systems and circuits; provides background information needed to understand fundamentals of microwave integrated circuits; includes usage of S-parameters, Smith Charts, stability considerations in designing microwave circuits; utilizes CAD program "Super Compact" demonstrating design synthesis optimization and analysis of monolithic devices and circuits. Prerequisite: Graduate classification.
- 640. Thin Film Science and Technology. (3-0). Credit 3.** The course focuses on the thin film technology in semiconductor industry. Topics include the basic growth mechanisms for thin films (growth models, lattice matching epitaxy and domain matching epitaxy), the instrumental aspects of different growth techniques and advanced topics related to various applications. Prerequisite: Graduate standing.
- 641. Microwave Solid-State Integrated Circuits. (3-0). Credit 3.** Microwave two-terminal and three-terminal solid-state devices; waveguide and microstrip solid-state circuits; theory and design of microwave mixers, detectors, modulators, switches, phase shifters, oscillators and amplifiers. Prerequisite: ECEN 351.
- 642. Digital Image Processing. (3-0). Credit 3.** Digital Image Processing techniques; stresses filtering, transmission and coding; fast transform techniques; convolution and deconvolution of model noise. Prerequisites: ECEN 447 and ECEN 601.
- 643. Electric Power System Reliability. (3-0). Credit 3.** Design and application of mathematical models for estimating various measures of reliability in electric power systems. Prerequisite: ECEN 460 or approval of instructor.
- 644. Discrete-Time Systems. (3-0). Credit 3.** Linear discrete time systems analysis using time domain and transform approaches; digital filter design techniques with digital computer implementations. Prerequisite: ECEN 601.
- 645. Pattern Recognition by Neural Networks. (3-0). Credit 3.** Feedforward and feedback paradigms; training algorithms; supervised and unsupervised learning; associative networks; self-clustering networks; stability and convergence; comparison with statistical pattern recognition. Prerequisite: ECEN 649 or approval of instructor.
- 646. Statistical Communication Theory. (3-0). Credit 3.** Concepts of probability and random process theory necessary for advanced study of communications, stochastic control and other electrical engineering problems involving uncertainty; applications to elementary detection and estimation problems. Prerequisite: Registration in ECEN 601 or approval of instructor.
- 647. Information Theory. (3-0). Credit 3.** Definition of information; coding of information for transmission over a noisy channel including additive gaussian noise channels and waveform channels; minimum rates at which sources can be encoded; maximum rates at which information can be transmitted over noisy channels. Prerequisite: ECEN 646 or equivalent probability background.
- 648. Principles of Magnetic Resonance Imaging. (3-0). Credit 3.** Introduction to the theory and design of magnetic resonance imaging systems; fundamental physical and mathematical introduction to image acquisition and reconstruction using magnetic resonance; overview of imaging system design, including magnets, imaging gradients and radio-frequency systems, contrast mechanisms, resolution. Prerequisite: ECEN 314 or ECEN 322 or approval of instructor.
- 649. Pattern Recognition. (3-0). Credit 3.** Introduction to the underlying principles of classification, and computer recognition of imagery and robotic applications. Prerequisites: MATH 601 and/or STAT 601 and approval of instructor.
- 650. High Frequency GaAs/SiGe Analog IC Design. (3-0). Credit 4.** High frequency integrated circuit design using non-conventional technologies such as GaAs and SiGe, with the emphasis on wireless and broadband communication circuits. Device operation, basic building blocks and typical applications. Prerequisite: ECEN 474 or approval of instructor.
- 651. Microprogrammed Control of Digital Systems. (3-3). Credit 4.** Hardware and software concepts involved in the design and construction of microprocessor-based digital systems; microprocessor architecture; bussing; interfacing; data input/output; memories; and software development for operation and testing; design projects with microprocessors and related components. Prerequisites: ECEN 350 and ECEN 449 or approval of instructor.
- 652. Switching Theory. (3-0). Credit 3.** Digital systems design; introduction to switching algebras, overview of integrated circuit technologies, analysis and synthesis of combinational circuits, special properties of selected switching functions, sequential circuits, fundamental mode analysis, pulse mode analysis, and sequential circuit synthesis. Prerequisite: Graduate classification.

- 653. Computer Arithmetic Unit Design. (3-0). Credit 3.** Digital computer arithmetic unit design, control and memory; microprocessor arithmetic logic unit (ALU) design. High-speed addition, subtraction, multiplication and division algorithms and implementations; design and simulation with integrated circuit components and VLSI circuits. Prerequisite: ECEN 651.
- 654. Very Large Scale Integrated Systems Design. (3-3). Credit 4.** Design and fabrication of microelectronic circuits such as registers, selectors, PLAs, sequential and microprogrammed machines via large scale integrated circuitry with emphasis on high-level, structured design methods for VLSI systems. Students design small to medium scale integrated circuits for fabrication by industry. Prerequisites: ECEN 454 or equivalent undergraduate VLSI course.
- 655. Advanced Topics in Channel Coding. (3-0). Credit 3.** Advanced topics in Channel Coding including turbo codes, low density parity check codes, iterative decoding and applications of iterative decoding principles. Prerequisite: ECEN 604 or graduate classification.
- 656. Physical Electronics. (3-0). Credit 3.** Elementary quantum theory; statistical mechanics; Lattice dynamics; semiconductor theory; dielectrics; magnetic materials; quantum electronics; introduction to quantum devices, such as the laser. Prerequisite: Graduate classification or approval of instructor.
- 657. Quantum Electronics. (3-0). Credit 3.** Application of principles of quantum mechanics to problems in optics including emission, absorption and amplification of light; optical resonators and lasers; optical modulation; nonlinear optics; photodetectors and optical receivers. Prerequisites: PHYS 412 and PHYS 606 or approval of instructor.
- 658. Low-Noise Electronic Design. (3-0). Credit 3.** Low-noise design; surveying the subject of handling electronic noise from theory to measurement, design, research and developments. Prerequisite: Approval of instructor.
- 659. Parallel/Distributed Numerical Algorithms and Applications. (3-0). Credit 3.** A unified treatment of parallel and distributed numerical algorithms; parallel and distributed computation models, parallel computation or arithmetic expressions; fast algorithms for numerical linear algebra, partial differential equations and nonlinear optimization. Prerequisite: MATH 304 or equivalent. Cross-listed with CSCE 659.
- 660. BioMEMS and Lab-on-a-Chip. (3-0). Credit 3.** Introduction to lab-on-a-chip technology; microfabrication techniques commonly used in BioMems device fabrication; microfluidics miniaturized systems for chemical and biomedical applications such as separation, diagnosis tools, implantable devices, drug delivery, and microsystems for cellular studies and tissue engineering; will gain a broad perspective in the area of miniaturized systems for biomedical and chemical applications. Prerequisite: Approval of instructor.
- 661. Modulation Theory. (3-0). Credit 3.** Optimum receiver principles and signal selection for communication systems with and without coding; system implementation, and waveform communication using realistic channel models. Prerequisite: ECEN 646.
- 662. Estimation and Detection Theory. (3-0). Credit 3.** Probabilistic signal detection theory and parameter estimation theory; Neyman-Pearson, UMP, and locally optimal tests; discrete time Markov processes and the Kalman and Wiener filters; bayesian, maximum likelihood and conditional mean estimation methods. Prerequisite: ECEN 646.
- 663. Data Compression with Applications to Speech and Video. (3-0). Credit 3.** Characterization and representation of waveforms; digital coding of waveforms including PCM, delta modulation, DPCM, tree/trellis coding, runlength coding, sub-band coding and transform coding; rate distortion theoretic performance bounds. Prerequisites: ECEN 601 and ECEN 646.
- 664. Nanotechnology Fabrication. (3-0). Credit 3.** Cutting edge nanostructure fabrication techniques for both top-down and bottom up approaches. Prerequisite: Instructor approval.
- 665. Integrated CMOS RF Circuits and Systems. (3-2). Credit 4.** Introduction to wireless communication systems at the theoretical, algorithmic and circuit levels; emphasis on simulation at the architecture, transistor levels of the communication systems; focus on circuits implementable on CMOS and BiCMOS technologies. Prerequisites: ECEN 453, ECEN 456, ECEN 474.
- 666. Power System Faults and Protective Relaying. (3-0). Credit 3.** Calculation of power system currents and voltages during faults; protective relaying principles, application and response to system faults. Prerequisite: ECEN 460 or approval of instructor.

- 667. Power System Stability. (3-0). Credit 3.** Steady-state, dynamic and transient stability of power systems; solution techniques; effect of generator control systems. Prerequisite: ECEN 460 or approval of instructor.
- 668. High Voltage Direct Current (HVDC) Transmission. (3-0). Credit 3.** Overview of HVDC systems; comparison of AC and DC power transmission; study of six-pulse and twelve-pulse power converters; analysis and control of HVDC systems; harmonics and power factor effects; system faults and misoperations; state of the art and future developments in HVDC technology; inspection trips. Prerequisite: Approval of instructor.
- 669. Engineering Applications in Genomics. (3-0). Credit 3.** Tutorial introduction to the current engineering research in genomics. The necessary Molecular Biology background is presented and techniques from signal processing and control are used to (i) unearth intergene relationships (ii) model genetic regulatory networks and (iii) alter their dynamic behavior. Prerequisite: ECEN 605 or approval of instructor.
- 670. Fiber Optic Networks. (3-0). Credit 3.** Components, topologies and architecture for communication networks based on the optical fiber transmission medium; examples based on recent publications in technical literature. Prerequisite: Graduate classification.
- 671. Solid State Devices. (3-0). Credit 3.** Development of mathematical analysis and systematic modeling of solid state devices; relationships of measurable electrical characteristics to morphology and material properties of solid state devices, p-n junction, bipolar and unipolar transistors. Prerequisite: ECEN 656 or approval of instructor.
- 672. Semiconductor Lasers and Photodetectors. (3-0). Credit 3.** III-V compound semiconductor material, spontaneous and stimulated emission in lasers; optical wave guiding, rate equation solutions, quantum noise and spectral linewidth properties of lasers; principle and structure of photodetectors; III-V compound material technology. Prerequisite: ECEN 370.
- 673. Fundamentals of Microelectronics. (3-0). Credit 3.** Microelectronic systems and fabrication technologies; methods of engineering analysis and device characterization. Junction diodes, Schottky diodes, bipolar transistors, junction and MOS field-effect devices, solar cells, light emitting diodes, charge coupled devices, magnetic bubbles, liquid crystal displays and other newly developed devices and circuits. Prerequisite: Graduate classification or approval of instructor.
- 674. Introduction to Quantum Computing. (3-0). Credit 3.** Introduces the quantum mechanics, quantum gates, quantum circuits and quantum hardware of potential quantum computers; algorithms, potential uses, complexity classes, and evaluation of coherence of these devices. Prerequisites: MATH 304, PHYS 208. Cross-listed with PHYS 674.
- 675. Integrated Optoelectronics. (3-0). Credit 3.** Light propagation and interactions in anisotropic media; electrooptic and acoustooptic effects; passive and active guided-wave devices; fabrication and characterization. Prerequisite: ECEN 464 or equivalent.
- 676. Advanced Computer Architecture. (3-0). Credit 3.** Design of advanced computers for parallel processing; emphasis on the overall structure; interconnection networks; including single-stage and multi-stage structures; shared memory and message passing architectures; control-flow and demand-driven programming; multithreaded architectures; fine-grain and coarse-grain parallelism; SIMD and MIMD; processor designs for parallel operation. Prerequisite: ECEN 651 or CSCE 614 or approval of instructor. Cross-listed with CSCE 676.
- 677. Control of Electric Power Systems. (3-0). Credit 3.** Modeling, analysis and real-time control of electric power systems to meet the requirements of economic dispatch of voltage and power. Prerequisite: Approval of instructor.
- 678. Statistical Optics. (3-0). Credit 3.** Statistics of laser and thermal light; partial polarization; Jones and coherency matrices; Temporal coherence; spatial coherence; mutual coherence; optical noise; detection noise. Prerequisite: ECEN 464.
- 679. Computer Relays for Electric Power Systems. (3-0). Credit 3.** Real-time digital computer application to protective relaying; extensive overview of digital protection algorithms; latest technological advancements as microprocessor-based relays, fiber-optic communication systems, unconventional instrument transformers, dynamic testing tools and methodologies. Prerequisite: Approval of instructor.
- 680. Testing and Diagnosis of Digital Systems. (3-0). Credit 3.** The theory and techniques of testing VLSI-based circuits and systems, and design for testability. Prerequisites: ECEN 220 or ECEN 248 or equivalent; ECEN 350 or CSCE 321 or equivalent. Cross-listed with CSCE 680.

- 681. Seminar. (1-0). Credit 1.** Reports and discussion of current research and of selected published technical articles. May not be taken for credit more than once in master's degree program nor twice in PhD program. Prerequisite: Graduate classification in electrical engineering.
- 682. Spread Spectrum and CDMA. (3-0). Credit 3.** Spread spectrum communication systems including direct-sequence; multicarrier, and frequency hopped spread spectrum, pseudo-random sequences, code acquisition and tracking; CDMA, multi-user detection; RAKE receivers, and CDMA standards. Prerequisite: ECEN 646, ECEN 661 or approval of instructor.
- 683. Wireless Communication Systems. (3-0). Credit 3.** Wireless applications, modulation formats, wireless channel models and simulation techniques, digital communication over wireless channels, multiple access techniques, wireless standards. Prerequisite: ECEN 646 or approval of instructor.
- 684. Professional Internship. Credit 1 to 4.** Engineering research and design experience at industrial facilities away from the Texas A&M campus; design projects supervised by faculty coordinators and personnel at these locations; projects selected to match student's area of specialization. Prerequisites: Graduate classification and one semester of coursework completed.
- 685. Directed Studies. Credit 1 to 12 each semester.** Research problems of limited scope designed primarily to develop research technique.
- 686. Electric and Hybrid Vehicles. (3-0). Credit 3.** Fundamental concepts of electric and hybrid-electric vehicles introduced, component requirements and system design methodologies discussed; vehicle system analysis and simulation methods presented. Prerequisite: Graduate classification or approval of instructor.
- 687. VLSI Physical Design Automation. (3-0). Credit 3.** The course is on algorithms for VLSI physical design automation, which include partitioning, floor planning, placement, and routing. Technical papers on the above topics will be chosen from premier CAD, conference proceedings, journals and presented in class. Prerequisite: ECEN 248, CSCE 311 knowledge in logic design and computer algorithms.
- 688. IC MEMS and Sensor Fabrication. (3-3). Credit 4.** Fundamental unit processes for the fabrication of silicon IC's and extension of these processes to the specialized micro-machining operations used for MEMS and sensor fabrication; basic process operations used in the laboratory to build simple IC structures; devices then characterized. Prerequisite: ECEN 325, ECEN 370, or approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Advanced topics of current interest in electrical engineering. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 694. Nanobiotechnology. (3-0). Credit 3.** Introduction to advances in nanobiotechnology; includes fabrication of micro or nano structures, molecular manipulation, medical diagnostic and treatment options, nano scale machines such as molecular motors for drug delivery. Prerequisite: Graduate classification; approval of instructor.
- 696. Erbium-Doped Amplifier: Technology and Applications. (3-0). Credit 3.** Rate equations and modeling of rare-earth transitions. Spontaneous stimulated emission. Pump requirement for erbium-doped fiber. Erbium-doped fiber design and simulation using commercial dispersion compensation issues, polarization effects, self-phase modulation, cross-phase modulation. Raman and Brillouin effects in optical fibers. Prerequisite: ECEN 370 or approval of instructor.
- 698. Analog To Digital Converters. (3-3). Credit 4.** The data conversion metrics to evaluate performance is presented, the design and classification of data converters are introduced, discussion on practical applications are given. Prerequisite: Advanced analog or approval of instructor.
- 699. Advances in VLSI Logic Synthesis. (3-0). Credit 3.** Logic representation, manipulation, and optimization; combinational and sequential logic; Boolean function representation schemes; exact and heuristic two-level logic minimization; multi-valued logic representation and manipulation; multi-level logic representation and minimization; testing; technology mapping. Prerequisites: Approval of instructor and graduate classification.
- 710. Switching Power Supplies. (3-0). Credit 3.** This course deals with operating principles of switching power supplies. Analysis and in-depth design of several types of switching regulators including buck, boost, forward, flyback, half and full bridge switching regulator analysis will be examined. Elements of transformer and magnetic design will be introduced. State space analysis and feedback loop stabilization principles will be explored. Application of these in the industry will be explained. Prerequisites: ECEN 438 or equivalent, approval of instructor.

- 711. Sustainable Energy and Vehicle Engineering. (3-0). Credit 3.** Forms of sustainable and unsustainable energy resources and the basic system engineering limits of each; specific problems of sustainable transportation energy on the bases of vehicle and power engineering; issues related to energy efficiency, life cycle analysis, global warming, pollution, economic and social considerations. Prerequisite: Graduate classification in engineering.
- 720. High-Speed Links Circuits and Systems. (3-3). Credit 4.** System and circuit design of high-speed electrical and optical link systems; includes channel properties, communication techniques, and circuit design of drivers, receivers, equalizers, and synchronization systems; project consists of link design with a statistical bit error rate simulator and interface circuit design. Prerequisite: ECEN 474.
- 730. CMOS RFIC Engineering. (3-0). Credit 3.** Introduction to CMOS radio-frequency integrated circuits (RFICs) and wireless systems and networks; theory, analysis and design of RFICs using CMOS technologies; CMOS fundamentals (device, principle, models); scattering parameters, transmission lines, distributed structures, lumped elements, impedance matching, RFIC layout, processing, test, amplifiers, oscillators, mixers; CAD programs for CMOS RFIC design. Prerequisites: ECEN 322 and graduate classification.
- 750. Design and Analysis of Communication Networks. (3-0). Credit 3.** Analytical approach to understanding resource allocation on the Internet; study the system in a global sense, and use a deterministic approach to study congestion control protocols; study individual queues and routers, and use a stochastic approach to understanding system performance. Prerequisite: ECEN 646 or some probability background.
- 760. Introduction to Probabilistic Graphical Models. (3-0). Credit 3.** Broad overview of various probabilistic graphical models, including Bayesian networks, Markov networks, conditional random fields, and factor graphs; relevant inference and learning algorithms, as well as their application in various science and engineering problems will be introduced throughout the course. Prerequisites: Undergraduate level probability theory; basic programming skill in any programming language (C, C++, Python, Matlab, etc.).
- 761. Biosensors Lab. (2-2). Credit 3.** Biosensors Lab is a hands on experience in basic concepts of biosensing and how to make miniaturized biosensors; various application examples associated with these sensing principles. Prerequisite: Approval of instructor.
- 762. Ultrasound Imaging. (3-0). Credit 3.** Covers mathematical analysis of wave propagation, scattering of ultrasound in biological tissues, electronic transducer arrays for the beam forming, models of the received signals and signal processing methods for medical ultrasound imaging of tissues. Research papers related to fundamental ultrasound imaging concepts are discussed throughout the course. Prerequisite: Approval of instructor.
- 763. Magnetic Resonance Engineering. (2-3). Credit 3.** Design, construction and application of instrumentation for MR Imaging; fundamentals of the architecture of an MR spectrometer and the gradient subsystem used for image localization; emphasis on the radiofrequency sensors and systems used for signal generation and reception. Prerequisite(s): ECEN 410, or ECEN 411, BMEN 420, or equivalent, or approval of instructor. Cross-listed with BMEN 627.
- 770. Organic Semiconductor. (3-0). Credit 3.** Organic semiconductors are new semiconducting materials with huge application potentials; designed to help students understand the material properties of organic semiconductors and the operation principles of organic electronic devices; gain broad knowledge in organic semiconductors, from the structure-property relationship to the design and optimization of organic devices and systems. Prerequisite: Approval of instructor.
- 771. Fluctuations and Noise Electronics. (3-0). Credit 3.** This course is introducing the students to the research of Noise and Fluctuations. Noise and Fluctuations in electronics and other systems include virtually all scientific fields, including secure and non-secure communications, microprocessors, quantum information, mesoscopic systems, chemical sensing, corrosion diagnostics, neuro- and membrane-biology, biomedicine, etc. Prerequisite: Approval of Instructor.

- 772. Introduction to Microelectromechanical Devices and Systems. (3-0). Credit 3.** The goal of this course is to provide the students with a broad overview of the past and current developments in the emerging area of MEMS (microelectromechanical systems). The first part of this course will discuss the fundamental working principles, designs and fabrication techniques. The second part will consist of several special topics, discussing the latest important applications in different fields. Prerequisite: Consent of instructor.

Dwight Look College of Engineering

The courses which carry the ENGR designation are offered in support of graduate programs throughout the college, especially the Doctor of Engineering degree. The Doctor of Engineering degree and Interdisciplinary Engineering degrees (see specific degree) are administered through the respective departments.

(ENGR)

- 600. Engineering Graduate Study Abroad. Credit 1 to 15.** For students in approved study abroad and reciprocal educational exchange programs. May be taken two times for credit. Prerequisites: Graduate classification in engineering; admission to approved program abroad; approval of study abroad coordinator.
- 681. Professional Development Seminar. (1-0). Credit 1.** Topics of interest related to the professional practice of engineering.
- 684. Professional Internship. Credit 1 or more each semester.** Supervised experience of one academic year in industry where students can learn to apply their textbook-based skills to problems in the real-world environment. Prerequisites: Admission to the Doctor of Engineering program and graduate classification.
- 685. Directed Studies. Credit 1 to 6.** Design or research problems executed either individually or as a team. Prerequisites: Graduate classification; approval of graduate advisor.
- 689. Special Topics in... Credit 1 to 4.** Advanced topics of current interest in engineering. May be repeated for credit. Prerequisite: Approval of instructor.
- 698. Writing for Publication. (3-0) Credit 3.** Writing in academic disciplines and settings. Writing for different audiences and purposes. Style; planning and development of academic journal articles; grant proposals; correspondence; oral presentations; technical reports. Permission of departmental/college graduate advisor. Prerequisite: advanced standing in master's/doctoral programs.

Department of Engineering Technology and Industrial Distribution

J. A. Alvarado, R. A. Beasley, W. W. Buchanan (Head), I. Capar, P. J. Catala, G. Fang, J. L. Fike, R. J. Fink, A. E. Goulart, R. A. Hartman, S. Hsieh, W. N. P. Hung, D. F. Jennings, M. D. Johnson, F. B. Lawrence, V. J. Leon, J. E. Mayer, Jr., J. A. Morgan, A. Narayanan, M. Natarajarathinam, B. P. Nepal, J. R. Porter, A. H. Price, D. A. Rice, N. P. Robson, S. Song, M. Vanajakumari, J. Wang, M. E. Workman, W. Zhan, B. B. Zoghi

Engineering Technology (ENTC)

- 615. Communications Networks. (3-0). Credit 3.** Review of typical telecommunications networks (public and private); types of equipment and architectures used; transmission techniques. Prerequisite: Graduate classification.
- 625. Telecommunications Management. (3-0). Credit 3.** Evaluation of different tariffs and services offered by local and long distance carriers; cost analysis; use of software and data bases; bypass techniques and issues; procurement of telecom equipment; contract issues; international circuits. Prerequisite: Graduate classification.
- 630. Network Management. (3-0). Credit 3.** Management of communications network; traffic engineering; performance indicators; technical control; facility management; reliability issues; security methods. Prerequisites: ENTC 615 and ENTC 625.

- 665. International Telecommunications. (3-0). Credit 3.** Management, policy and technology issues in planning and operating corporate voice, data, and image networks worldwide. Prerequisites: ENTC 615 and ENTC 625. Cross-listed with INFO 665.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of engineering technology. May be repeated for credit.

Department of English

J. J. Alonzo, H. Andreadis, V. M. Balester, A. Bendixen, D. A. Berthold, N. Bhattacharya*, R. E. Boenig, K. N. Brown, P. N. Christensen, W. B. Clark, M. Collins, A. Cruz, G. P. Del Negro, D. R. Dickson, Q. Driskill, A. E. Earhart, S. B. Egenolf, M. Eide, M. J. M. Ezell, C. L. Gibson, J. B. Gibson, R. J. Griffin, J. R. Hannah, J. L. Harner, T. A. Hoagwood, L. Hodgson, M. C. Ives, S. Jackson, E. Johansen, C. W. Kallendorf, K. E. Kelly, S. Kendall, M. J. Killingsworth, J. M. Loving, C. J. Machann, L. C. Mandell, P. R. Matthews, J. P. McCann, D. B. McWhirter, J. L. Mitchell, B. Mize, A. M. Morey, P. K. Muana, C. B. Nelson, M. A. O'Farrell, L. J. Oliver, P. A. Parrish, N. L. Perry, M. A. Portales, V. D. Reddy, L. J. Reynolds, S. A. Robinson, C. H. Rowell, S. M. Stabile, G. A. Stringer, C. J. Swearingen, C. B. Taylor, Jr., E. D. Tebeaux, J. Troxell, M. Tuhkanen, L. M. Vallone, N. B. Warren (Head), J. G. Wollock

* Graduate Advisor

The graduate program in English offers courses leading to the degrees of Master of Arts and Doctor of Philosophy. The department offers training that features a range of methods and approaches to English-language literature and culture while emphasizing skills in written and oral communication, critical investigation and analysis, and mastery of both traditional and emerging areas within the area of English. Graduate work in English prepares students for teaching careers in universities and community colleges, and potentially also for careers in writing, editing and other professional and business fields.

The MA degree, thesis option, requires 24 hours of coursework and 6 hours of research (ENGL 691). The non-thesis option requires 36 hours of coursework, the preparation of a portfolio, and a 90-minute oral examination. All MA students must take ENGL 603 and complete a distribution requirement, consisting of at least one course in each of the following areas: One course in any literature, pre-1660; one course in any literature, 1660-1900; one course organized around concepts, issues, or themes, rather than chronologically; one course in theory; one course in English without Borders (transnational and/or diasporic literatures/cultures/theory; interdisciplinary or transdisciplinary study; cultural studies of film, digital technologies, new media, popular culture).

A minimum of 64 credit hours beyond the MA (36 of which must be in coursework), or 96 hours beyond the BA (54 hours of which must be in coursework), is required for the PhD degree in English. If the above course distribution requirement was not completed in an MA program, the PhD student must complete it in the first year of the program, along with ENGL 602. PhD students must undergo a review at the end of the first year. The review is conducted by the graduate faculty in English. A preliminary exam is required before work on the dissertation may begin.

To be admitted to the MA program, a student should have a BA in English. Students who hold BA degrees in other fields may be admitted if the application shows evidence of the applicant's readiness for graduate work in English. To be admitted to the PhD program, a student should hold a BA or MA in English; applicants with other degrees will be evaluated for evidence of readiness to do doctoral work in English. For further information concerning requirements for the MA or PhD, please contact the graduate advisor.

Both MA and PhD students must demonstrate competency in a minimum of one language. They can do so by 1) completing the Old English/Beowulf sequence of ENGL 610 (Topics in the History of the English Language); 2) passing a translation examination; or 3) earning an A in a graduate reading course. MA students may also demonstrate competency by having a B or better in 12 hours of undergraduate language coursework completed no more than four years prior to entering the program.

English (ENGL)

- 602. First Year Seminar. (3-0). Credit 3.** Comprehensive introduction to theory, method, and practice of graduate scholarship in English. Students will develop familiarity with goals and practices of English studies, enhance research skills, formulate and articulate scholarship goals and projects, and practice writing genres within the field. Prerequisite: Enrollment as a first-year PhD student.
- 603. Bibliography and Literary Research. (3-0). Credit 3.** Introduction of basic techniques of research and scholarly procedure in literature; research reports.

- 607. Topics in Medieval Literature and Culture. (3-0). Credit 3.** Topics in history, theory, and interpretation of Medieval Literature and culture; may cover Old or Middle English; may include study of varied cultural forms, manuscript or editing problems, genres, and themes. May be taken three times for credit as content varies.
- 608. Readings in Medieval Literature. (3-0). Credit 3.** Wide reading in English literature of the Medieval period; introduction of major figures, genres, and issues in the period; introduction to current critical conversations in Medieval literary studies.
- 610. Topics in the History of the English Language. (3-0). Credit 3.** Topics in the development of the English language; may include phonological, grammatical and lexical histories; study of social and political contexts; relationships between English and other languages. Cross-listed with LING 610. May be taken three times for credit as content varies. Credit cannot be given for both ENGL 610 and LING 610 in the same semester.
- 611. Topics in Early Modern Literature and Culture. (3-0). Credit 3.** Topics in the history, theory, interpretation of Early Modern literature and culture; may focus on authors, groups of authors, themes, movements, genres, cultural contexts and/or theoretical framing. May be taken three times for credit as content varies.
- 613. Readings in Early Modern Literature. (3-0). Credit 3.** Wide reading in English literature of the Early Modern period; introduction of major figures, genres, and issues in the period; introduction to current critical conversations in Early Modern literary studies, including historical and social contexts.
- 618. Readings in Eighteenth-Century British Literature. (3-0). Credit 3.** Wide reading in British literature of the 18th Century; introduction of major figures, genres, and issues in the period; introduction to current critical conversations in 18th Century literary studies, including historical and social contexts.
- 622. Elements of Creative Writing. (3-0). Credit 3.** Creative writing in major forms; students produce original work while reading models by masters; may include performance, group work, written and peer critiques.
- 623. Topics in Creative Writing. (3-0). Credit 3.** Topics in the theory and practice of creative writing; may focus on writing techniques; theories of composition in the major genres; theory, history, and interpretation of literary forms and composition. May be taken three times for credit as content varies.
- 624. Advanced Creative Writing Workshop. (3-0). Credit 3.** Writing workshop, with peer critique; may include discussion of literary and critical texts; major genres. May be taken three times for credit as instructor varies. Prerequisite: ENGL 622 or approval of instructor.
- 634. Readings in Nineteenth-Century British Literature. (3-0). Credit 3.** Wide reading in British literature of the 19th Century; introduction of major figures, genres, and issues in the period; introduction to current critical conversations in 19th Century literary studies, including historical and social contexts.
- 638. Topics in 18th and 19th Century British Literature and Culture. (3-0). Credit 3.** Topics in the history, theory, interpretation of 18th and/or 19th Century British literature and culture; may focus on authors, groups of authors, themes, movements, genres, cultural contexts and/or theoretical framing. May be taken three times for credit as content varies.
- 640. Topics in Children's Literature and Culture. (3-0). Credit 3.** Topics in the history, theory, and interpretation of children's literature and other cultural forms; may focus on genres, critical and theoretical methods, social and historical contexts. May be taken three times for credit as content varies.
- 642. Topics in Genre. (3-0). Credit 3.** Topics in selected genres and subgenres of literary and cultural production; may focus on historical development and/or context, generic conventions, theoretical approaches. May be taken three times for credit as content varies.
- 645. Topics in Gender, Literature, and Culture. (3-0). Credit 3.** Topics in literature (especially women's writing), culture, and gender; may include issues such as feminism, masculinities, race, and sexualities; may be taken up to three times for credit.
- 650. Readings in 20th and 21st Century Literature and Culture. (3-0). Credit 3.** Wide reading in 20th and 21st Century literature; introduction of major figures, genres, and issues in the period; introduction to current critical conversations in modern and postmodern literary studies, including historical and social contexts.

- 653. Topics in 20th and 21st Century Literature and Culture. (3-0). Credit 3.** Topics in the history, theory, interpretation of 20th and 21st Century literature and culture; may focus on authors, groups of authors, themes, movements, genres, cultural contexts and/or theoretical framing. May be taken three times for credit as content varies.
- 654. History and Theory of Rhetoric to 1800. (3-0). Credit 3.** Emphasis on interactions between rhetorical theory and practices; includes Sophists, Stoic logic and rhetoric, poetics and stylistics from Plato through Cicero, semiotics and hermeneutics in medieval rhetoric, Enlightenment rhetoric and moral philosophy, literary. Cross-listed with COMM 654.
- 655. History and Theory of Rhetoric since 1800. (3-0). Credit 3.** Major figures and movements in rhetorical theory; revisionist effect of psychology, linguistics, and romanticism upon classical rhetorics; associationist psychology; belles lettres movement, twentieth-century linguistic turn; current-traditional rhetoric and its successors; rhetorical critical theory. Cross-listed with COMM 655.
- 656. Topics in Composition Theory and Practice. (3-0). Credit 3.** Topics in composition from theoretical, pedagogical, and administrative perspectives; may focus on first-year composition programs, technical writing, writing centers. May be taken three times for credit as content varies.
- 658. Topics in Film History. (3-0). Credit 3.** Topics in the history of the production, reception, and institutional contexts of cinema; may focus on national cinemas, genres, movements, styles, film industries, film's relation to other media. May be taken three times for credit as content varies.
- 659. Topics in Film Theory. (3-0). Credit 3.** Topics in theory of film production, reception, and interpretation; may focus on film's relation to other media, on film theory's relation to other theoretical areas, on the interdisciplinary nature of film theory and film studies. May be taken three times for credit as content varies.
- 665. Topics in Cultural/Interdisciplinary Studies. (3-0). Credit 3.** Topics in history, theory, and practice of cultural studies and/or interdisciplinary studies; may focus on authors, schools, methods, genres, themes, or problems in rhetoric, discourse, and cultural studies. May be taken three times for credit as content varies.
- 666. Topics in Textual Studies and Book History. (3-0). Credit 3.** Topics in the theory and practice of textual studies and book history; may focus on the book as material object, histories of printing and other technologies, digital humanities, book production and distribution, research methodologies. May be taken three times for credit as content varies.
- 667. Topics in the History and Theory of Rhetoric. (3-0). Credit 3.** Issues and topics in the history and theory of rhetoric; may focus on rhetorical analysis of literature and other written and oral texts; theoretical issues in rhetoric and culture; social and historical contexts for rhetorical analysis; historical periods, themes, methods or genres. May be taken three times for credit as content varies.
- 669. Topics in African American and Africana Literature and Culture. (3-0). Credit 3.** Topics in the history, theory, interpretation of African American and African literature and culture; may focus on authors, groups of authors, themes, movements, genres, cultural contexts and/or theoretical framing. May be taken three times for credit as content varies.
- 670. Topics in Latino/a Literature and Culture. (3-0). Credit 3.** Topics in the history, theory, interpretation of Latino/a literature and culture; may focus on authors, groups of authors, themes, movements, genres, cultural contexts and/or theoretical framing. May be taken three times for credit as content varies.
- 671. Readings in American Literature to 1900. (3-0). Credit 3.** Wide reading in American literature from its beginnings through the 19th Century; introduction of major figures, genres, and issues in the period; introduction to current critical conversations in pre-1900 American literary studies, including historical and social contexts.
- 672. Topics in American Literature and Culture to 1900. (3-0). Credit 3.** Topics in the history, theory, interpretation of American literature and culture before 1900; may focus on authors, groups of authors, themes, movements, genres, cultural contexts and/or theoretical framing. May be taken three times for credit as content varies.
- 673. Topics in Transnational Literature and Culture. (3-0). Credit 3.** Topics in theory and interpretation of transnational literature and culture; may focus on definitions of the transnational; on the relationships between the transnational and the global; on methods for study; on new configurations of literature and culture. May be taken three times for credit as content varies.

- 680. Theories of Gender. (3-0). Credit 3.** Theories of gender, sexualities, feminism, embodiment, and difference with particular focus on their relationship to literary and cultural studies; emphasis on contemporary theoretical positions, discourses, and debates. Cross-listed with WGST 680.
- 681. Seminar in English. (1-0). Credit 1.** Presentations by faculty, students and visiting scholars based on current research. May be repeated for credit. Prerequisite: Graduate classification in English.
- 683. Topics in Theory. (3-0). Credit 3.** Critical theory for English Studies; may focus on history, themes, methods, issues, new developments, interdisciplinary contexts. May be taken three times for credit as content varies.
- 685. Directed Studies. Credit 1 to 6 each semester.** Readings to supplement the student's knowledge of English or American literature or of the English language in areas not studied in other courses; research papers. Prerequisites: Graduate classification and approval of department head.
- 688. Introduction to Comparative Literature. (3-0). Credit 3.** Introduction to the discipline of Comparative Literature by examples of specific area studies or by an overview of the field; introduction to the pedagogical practices of teaching Comparative Literature and Culture. Cross-listed with COML 603.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of English. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 695. Publication and Professionalization. (3-0). Credit 3.** For advanced PhD students in English. Discussion of publication and professionalization; standards and practices of publication in academic journals; academic job market; writing, revision, and submission of scholarly articles. To be taken as S/U only. Prerequisite: Must have completed coursework in English.
- 697. Pedagogy. (3-0). Credit 3.** Theories of teaching literature, composition, or rhetoric; pedagogical approaches and methods; supervised teaching; evaluation of current research and its relation to pedagogical practice; designed to assist students in their first teaching experience. Prerequisite: Approval of instructor.

Department of Entomology

D. E. Bay, S. T. Behmer, J. S. Bernal, M. J. Brewer, C. J. Coates, R. N. Coulson, B. M. Drees, M. D. Eubanks, R. E. Gold, M. K. Harris, K. M. Heinz, J. S. Johnston, A. E. Knutson, R. F. Medina, M. E. Merchant, G. J. Michels, Jr., F. L. Mitchell, A. Mulenga, J. D. Oswald, M. N. Parajulee, P. V. Pietrantonio, D. W. Ragsdale (Head), M. A. Slotman, G. Sword, C. Tamborindeguy, A. M. Tarone, P. D. Teel*, J. K. Tomberlin, S. B. Vinson, M. O. Way, R. A. Wharton, L. T. Wilson, J. B. Woolley, K. Zhu-Salzman

* Graduate Advisor

The Department of Entomology offers Master of Science and Doctor of Philosophy degrees in entomology, as well as the Master of Agriculture degree in Plant Protection. Within these programs, subject matter areas include arthropod ecology, biological control, integrated pest management, molecular biology, physiology, genetics and toxicology, plant resistance, systematics, and urban, medical/veterinary, and forensic entomology. Students come into the field of entomology with diverse interests, science backgrounds and career goals. Students are able to tailor their education and research interests for the respective degree program with the help of their major advisor and advisory committees. Graduates from these programs have become prominent leaders in entomological research, application, education, and regulatory affairs of private sector and government arenas, as well as international agencies and foreign countries.

The Master of Agriculture in Plant Protection degree is designed for students who desire graduate training emphasizing program development and delivery of integrated pest management within agriculture and related businesses involving IPM.

The department occupies five floors of the Minnie Belle Heep Building and nearby buildings that house the Entomology Research Laboratory, the Biological Control Laboratory and Urban, Veterinary and Medical Entomology. Texas A&M is only one of a select group of U.S. locations for a federally approved quarantine laboratory. In addition, the department houses the Center for Urban and Structural Entomology. The department also maintains three multi-room greenhouses. The Texas A&M University Insect Collection is housed

in the Minnie Belle Heep Building. It is the largest and most actively growing arthropod collection in the Southwest, containing more than two million specimens representing more than 43,000 identified species. Graduate students often work with faculty located at 8 research and extension centers across Texas, each addressing entomological issues unique to their particular geographic region.

Comprehensive courses in the biological sciences, general chemistry and organic chemistry are required of all students. Specific course requirements in entomology are dependent upon previous training and professional experience. Prospective students are directed to insects.tamu.edu for additional information.

Entomology (ENTO)

- 601. Principles of Systematic Entomology. (3-0). Credit 3.** An introduction to the principles and theory of systematic zoology and comparative biology including species concepts and speciation; methods for higher classification including phylogenetic systematics, phenetics and evolutionary taxonomy; introduction to zoological nomenclature. Prerequisite: Graduate classification in entomology or other biological sciences.
- 602. Insect Biodiversity and Biology. (3-3). Credit 4.** Biodiversity and biology of the orders and selected families of insects; order-level morphology, family-level natural history and identification; field trips and an insect collection provide experience with insect collecting methods, specimen preparation techniques and field biology. Prerequisite: 6 hours of biological sciences.
- 606. Quantitative Phylogenetics. (2-3). Credit 3.** Designed to provide students with the theory and tools required for inference of phylogenetic (evolutionary) relationships among biological taxa using various types of comparative data including morphological characters, biochemical and molecular characters, and DNA sequences; hands-on analysis of data using contemporary tools. Prerequisite: ENTO 601 or approval of instructor. Cross-listed with GENE 606 and WFSC 646.
- 608. Principles of Biological Control. (3-0). Credit 3.** Theory and practices relating to the role and use of natural enemies in arthropod and plant population regulation; review and analysis of projects in biological control; biology and behavior of entomophagous arthropods. Prerequisite: ENTO 201 or equivalent or approval of instructor.
- 610. Host Plant Resistance. (3-0). Credit 3.** Host plant resistance programs from the standpoint of the plant breeder, plant pathologist and entomologist; team taught with each discipline represented; round-table discussion of assigned readings and lectures. Prerequisite: Approval of instructor. Cross-listed with SCSC 610 and PLPA 610.
- 612. Insect Evolution. (3-0). Credit 3.** Review current and historical ideas about the phylogeny and evolution of the major groups of hexapods; includes evidential basis for hypotheses of monophyly, competing phylogenetic hypotheses, major innovations and trends affecting the adaptive radiations of specific taxa, morphological character systems, and history of insect classification and the major character systems. Prerequisite: One semester of insect or invertebrate zoology.
- 614. Insect Community Ecology. (3-0). Credit 3.** Provide a strong and contemporary foundation in insect population, community and evolutionary ecology; review historical and theoretical perspectives, current philosophies, approaches and a description of classic experiments used to test and modify theories on topics including: insect herbivore-plant interactions; major biological forces affecting population dynamics and community structure (resource availability, competition, predation, mutualisms, etc.). Prerequisite: Graduate classification.
- 615. Insect Physiology. (3-0). Credit 3.** Physiological processes of insects; metabolism, nutrition, neuroendocrinology, nerve action, cell structure, respiration, circulation, excretion and flight; functional integration and regulatory processes of total organism. Prerequisite: ENTO 306 or equivalent.
- 617. Acarology. (3-3). Credit 4.** Systematics, morphology, physiology, and ecology of ticks and mites; management of acarine pests of humans, animals and plants; role of parasitic species in causation and transmission of diseases. Prerequisite: ENTO 208 or equivalent. (Offered in 2012-2013 and alternate years thereafter.)”
- 618. Medical and Veterinary Entomology. (3-3). Credit 4.** Taxonomy, biology and epidemiological role of insects that directly and/or indirectly affect the health and well-being of humans and animals. Prerequisite: ENTO 208 or equivalent. (Offered in 2012-2013 and alternate years thereafter.)”

- 619. Insect Toxicology. (3-3). Credit 4.** Classification and properties of major types of insecticides; chemistry, metabolism and mode of action; selectivity, use hazards, residues and resistance; environmental problems: biological magnification, persistence and effects on non-target organisms. Prerequisites: One course in organic chemistry and ENTO 615 or approval of instructor.
- 621. Biology and Systematics of Entomophagous Insects. (2-3). Credit 3.** Systematics of entomophagous insects at the family level; collecting and rearing parasitoids from their hosts; emphasis on groups used in biological control. Prerequisites: ENTO 301 or approval of instructor. (Offered in 2012-2013 and alternate years thereafter.)
- 623. Advanced Principles of Agroecosystem Management with Emphasis on Insects and Mites. (3-0). Credit 3.** Addresses agriculture from an ecological perspective; provides students with an understanding of how biological and physical components of a system are interconnected and affect the outcome of management decisions; an improved understanding of quantitative techniques used to estimate biological interactions. Prerequisite: ENTO 401 or ENTO 402 or ENTO 424 or approval of instructor.
- 624. Dynamics of Populations. (3-2). Credit 4.** Principles, models and methods for analysis of population dynamics; analysis of contemporary research emphasizing theory and its uses in evaluation and management of animal populations; laboratory emphasizes mathematical, statistical and computer modeling of population phenomena.
- 625. Landscape Ecology. (2-2). Credit 3.** Study of structure, function and change in a heterogeneous land area composed of interacting ecosystems; examine basic ecological principles dealing with landscape structure. Prerequisite: Approval of instructor. Cross-listed with GEOG 625.
- 628. Arthropod Genomes and Gene Expression. (3-0). Credit 3.** Introduction to the vocabulary and experimental procedures routinely used for molecular genetic studies using arthropod systems as model examples; discussion of germ-line transformation, transient gene expression, and the analysis of tissue-specific and genome-wide gene expression. Prerequisite: GENE 301 or equivalent.
- 681. Seminar. (1-0). Credit 1.** Oral reports and discussions of current research and developments in entomology and related fields; designed to broaden understanding of problems in field and to stimulate research. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 to 4 each semester.** On-the-job training in the fields of pest identification, home and garden pest control, medical and veterinary pest control, and pest management of food and fiber crop pests. Prerequisite: Graduate classification in the Master of Agriculture program in economic entomology or plant protection.
- 685. Directed Studies. Credit 1 to 4 each semester.** Entomological problems not pertaining to thesis or dissertation. Prerequisites: Graduate classification with major or minor in entomology; approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of entomology. May be repeated for credit. Prerequisite: Graduate classification.
- 690. Theory of Research. Credit 1.** Examination of concepts and theories in entomological research including applications of novel technologies and experimental approach. May be repeated for credit. Prerequisite: Graduate classification.
- 691. Research. Credit 1 or more each semester.** Research problems on taxonomy, life histories, biological control, ecology and physiology of insects, and toxicology of insecticides. Prerequisite: Graduate classification.

Department of International Studies

N. J. Bracher, F. Ciccolella, L. B. Cooke, O. M. Cooke, R. J. Golsan, S. Harris, M. C. Hawthorne, H. Illbruck, C. W. Kallendorf, C. F. Konrad, J. C. Lake, R. Larson, M. Marchesini, S. M. Oberhelman, E. T. Rich, R. Schoolcraft, R. R. Shandley (Head)

The Department of International Studies offers graduate courses preparing graduate students for the PhD foreign language examinations. These courses (FREN 601 and GERM 603) may not count for hours in a supporting field.

European Studies (EURO)

- 601. The Formation of the Republic of Letters. (3-0). Credit 3.** The beginnings of European culture in ancient Greece, its development into a Europe-wide civilization under the Roman Empire, and its survival as a common, Latin-based culture in the Middle Ages and Renaissance; deals with literature, the arts, and politics. Prerequisite: Graduate classification.
- 602. The Rise of Modern Nation States. (3-0). Credit 3.** Process by which the traditional, Latin-based common culture of Europe is supplemented and supplanted by vernacular cultures tied to the rise of nation states, from the Baroque through the Enlightenment and Romanticism to the nineteenth century; deals with literature, the arts, and politics. Prerequisite: Graduate classification.
- 603. Nationalism and European Integration. (3-0). Credit 3.** From the breakdown of civilization in the twentieth century to the determination, difficulties, and potential of reconstituting a common European culture in the post-national era; deals with literature, the arts, politics, film, press, and new media. Prerequisite: Graduate classification.
- 604. European Avantgardes. (3-0). Credit 3.** An interdisciplinary examination of modernist currents in art, culture, and politics. Prerequisite: Graduate classification.
- 605. European Cinema. (3-0). Credit 3.** An examination of the development of cinematic culture in Europe from the Lumiere brothers' invention of the cinematograph, to the development of national film cultures, to current trends in transnational filmic coproduction. Prerequisite: Graduate classification.
- 606. History and Memory in Modern Europe. (3-0). Credit 3.** Explores artistic, cultural, and political representations of fundamental experiences in the shaping of modern Europe, such as the Holocaust, the Nazi occupation of Europe, and Soviet prison camps of the Gulag. Prerequisite: Graduate classification.
- 607. Europe and Its Margins. (3-0). Credit 3.** Explores the interaction between European and neighboring cultures, such as those of North and Central Asia, the Middle East, North Africa, and the Atlantic in history. Prerequisite: Graduate classification.
- 608. European Drama. (3-0). Credit 3.** Examines literary, social, and historical aspects of dramatic literature and performance in the context of different European cultures. Prerequisite: Graduate classification.
- 610. Seminar in Classical Culture. (3-0). Credit 3.** Topics in Greek and Roman culture and civilization; readings in English. May be repeated for credit. Prerequisite: Graduate classification.
- 620. Seminar in French Culture. (3-0). Credit 3.** Topics in French culture and civilization; readings in English. May be repeated for credit. Prerequisite: Graduate classification.
- 630. Seminar in German Culture. (3-0). Credit 3.** Topics in German outline and civilization; readings in English. May be repeated for credit. Prerequisite: Graduate classification.
- 640. Seminar in Russian Culture. (3-0). Credit 3.** Topics in Russian culture and civilization; readings in English. May be repeated for credit. Prerequisite: Graduate classification.
- 650. Seminar in Italian Culture. (3-0). Credit 3.** Topics in Italian culture and civilization; readings in English. May be repeated for credit. Prerequisite: Graduate classification.
- 681. Proseminar. (1-0). Credit 1.** Student and faculty presentation of research fields, current issues, and research methods. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 4.** Individual problems or research or scholarly activity not pertaining to thesis or dissertation, or selected instruction not covered by other courses. Final documentation of directed study is required. Prerequisites: Graduate classification; approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of European Studies. May be repeated for credit.
- 691. Research. Credit 1 to 12.** Thesis or dissertation research. Credit given only upon acceptance of completed thesis or dissertation. Prerequisite: Graduate classification.

Department of Finance

J. A. Adkisson, D. W. Blackwell, E. Boehmer, A L. Boone, S. Chava, Y. Chen, S. K. Cooper, C. C. Donnell, R. T. Dye, O. E. Elmore, L. P. Fields, D. R. Fraser, M. F. Gallmeyer, N. E. Galpin, W. L. Galpin, J. E. Gaspar, D. Hallermann, R. L. Haney, Jr., T. O. Jackson, S. A. Johnson, H. Kim, J. W. Kolari, D. S. Lee*, A. Mahajan, L. R. Martindale, D. Mauer, R. Petkova, S. M. Sorescu (Head), L. C. Wolken

* Doctoral Student Advisor

The Department of Finance offers graduate studies leading to MS, Master of Real Estate (MRE), and PhD degrees and coursework supporting the Mays Business School's MBA degree. Areas of coursework include corporate finance, trading, investment management, international finance, money and capital markets and real estate analysis. The department offers a five-year integrated Professional Program in Financial Management (PPFM) in cooperation with the Department of Accounting. Students enter the PPFM program in the junior year of their BBA program. Graduates receive a Bachelor of Business Administration degree in accounting and an MS degree in finance. The MBA degree program includes two required course offered by the department and elective credit hours to be taken in finance. The PhD program emphasizes financial theory and research tools and is structured to prepare students for academic careers in finance.

Additional information, including specific departmental requirements, may be obtained by contacting the department or the Office of the Dean, Mays Business School.

Finance (FINC)

- 612. Finance for the Professional. Credit 1 to 4.** Focuses on investment and financing decisions in corporate firms. Emphasizes principles, techniques and applications in corporate finance, including: risk and return, capital budgeting, discounted cash flow valuation, capital structure, and payout policy. Classification 6 students may not enroll in this course. Please note this is changing to a variable credit course. Prerequisite: ACCT 610 or equivalent. Enrollment is limited to BUAD classification 7.
- 613. Finance for the Professional II. Credit 1 to 3.** Focus on advanced topics in domestic and international finance; analysis of dividend, capital structure and refinancing decisions; exposure to financial derivatives; foreign exchange rate determination and risk management. Prerequisite: FINC 612. Enrollment is limited to BUAD classification 7.
- 629. Financial Management I. (3-0). Credit 3.** Analysis of finance function, credit and equity markets, financing and dividend decisions; mechanics of financial analysis. Classification 6 students may not enroll in this course. Prerequisites: FINC 612 or FINC 635; ACCT 610 or ACCT 640.
- 630. Financial Management II. (3-0). Credit 3.** Basic concepts of finance applied to solution of business problems using case studies; financial analysis skills further developed and refined; investment and financing decisions analyzed. Classification 6 students may not enroll in this course. Prerequisite: FINC 629.
- 632. Investment Management. (3-0). Credit 3.** Introductory course in investments; nature and functioning of securities markets; various investment media and tools for analysis of these media; analysis of debt and equity securities. Alternative trading strategies evaluated. Classification 6 students may not enroll in this course. Prerequisite: FINC 612 or FINC 635.
- 635. Financial Management for Non-Business. (3-0). Credit 3.** External and internal factors affecting financial decision-making in the firm; fundamental concepts of accounting and managerial economics. Prerequisite: ACCT 640 or equivalent or approval of instructor.
- 642. Analysis of Money and Capital Markets. (3-0). Credit 3.** U.S. money and capital markets; changes in supply of and demand for money and capital as they influence the policies of financial intermediaries, fiscal and monetary authorities and nonfinancial firms. Interest rates; factors affecting their level and structure; flow of funds in the U.S. economy. Classification 6 students may not enroll in this course. Prerequisite: FINC 612 or FINC 635.
- 643. Commercial Bank Management. (3-0). Credit 3.** Financial management problems of commercial bank management including raising funds, investing funds and making loans; nontraditional bank activities; emphasis on actual case situations. Classification 6 students may not enroll in this course. Prerequisite: FINC 642.

- 644. Funding New Ventures. (3-0). Credit 3.** This course provides an introduction to the general phenomena of small business and entrepreneurship. The central focus of this course will be to provide students an understanding of entrepreneurship and the financing of entrepreneurial ventures. The course will address the types of financing available at different stages of the new venture. Classification 6 students may not enroll in this course.
- 645. International Finance. (3-0). Credit 3.** Problems confronted by financial managers of firms with international business operations; international money and capital markets; exchange rate risks and political risks. May be repeated for up to 3 hours credit. Classification 6 students may not enroll in this course. Prerequisite: FINC 612 or FINC 635. Cross-listed with IBUS 645.
- 647. Financial Statement Analysis. (3-0). Credit 3.** Analytical approach to financial statements; application of finance and accounting principles relevant to the analysis of financial statements. Classification 6 students may not enroll in this course. Prerequisites: FINC 612 or FINC 635; ACCT 610 or ACCT 640. Cross-listed with ACCT 647.
- 649. Financial Modeling. (3-0). Credit 3.** Computer-based modeling of contemporary problems in investments and corporate finance including asset pricing, portfolio optimization, valuation, capital budgeting, cost of capital, risk assessment, and option pricing; using models to evaluate financial decision variables and alternative investment strategies. Prerequisites: Graduate classification; classification 6 students may not enroll in this course; FINC 421 or FINC 632; FINC 434 or FINC 629.
- 660. Fixed Income Analysis. (3-0). Credit 3.** Characteristics of fixed income securities including Treasury issues, federal agency issues, corporate and municipal bonds, mortgage-backed and asset-backed securities; institutional features fixed income markets; risks of bond investing; fixed income valuation; term structure; trade strategies; modeling and assessing credit risks; hedging with fixed income derivatives. Prerequisites: Graduate classification; classification 6 students may not enroll in this course; FINC 421 or FINC 632; FINC 434 or FINC 629.
- 661. Trading Risk Management. (3-0). Credit 3.** Focuses on Mid-office risk management strategies using the energy markets as a focus; develops understanding of commodity market behavior, use of forwards and options for risk management, risk management reporting, Greeks and simulation-based VaR analysis. Classification 6 students may not enroll in this course. Prerequisite: FINC 632.
- 663. Trading and Markets. (3-0). Credit 3.** Issues relating to securities trading and securities markets; discusses why and how people trade, and the operation, structure, and regulation of securities markets; focus on equity markets; comparisons to the markets for derivatives and other securities. Classification 6 students may not enroll in this course. Prerequisite: FINC 632.
- 664. Active Portfolio Management. (3-0). Credit 3.** Analysis of investment tactics designed to earn abnormal returns; identification and evaluation of active strategies that exploit capital market anomalies and market inefficiencies; portfolio structuring, stock and sector selection, performance measurement, attribution analysis and benchmarks in inefficient markets. Prerequisites: Graduate classification; classification 6 students may not enroll in this course; FINC 421 or FINC 632; FINC 434 or FINC 629.
- 665. Derivative Securities. (3-0). Credit 3.** Valuation of financial forward contracts, futures contracts and basic options; course covers valuation and behavior of interest rate and exchange rate forward curves, fixed-for-float transactions, stock options, and index based-options. Classification 6 students may not enroll in this course. Prerequisite: FINC 632.
- 666. Wall Street, Investment Banking and the Financial Markets. (3-0). Credit 3.** Provides students an opportunity to visit Wall Street and the heart of U.S. financial and security markets; focuses on visitations to Wall Street firms and interaction with financial market professionals. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 667. Commodity Trade Strategy. (3-0). Credit 3.** Focuses on Front office trading strategies using the energy markets as a focus; comprehending and evaluating price behavior in energy markets; derivation of price and risk strategies. Classification 6 students may not enroll in this course. Prerequisite: FINC 632.
- 668. Applied Investment Analysis. (3-0). Credit 3.** Theoretical and analytical developments in security selection and portfolio management; includes macroeconomic analysis, portfolio theory, and portfolio performance evaluation; concepts applied to the allocation of investments in a student-managed equity portfolio. Classification 6 students may not enroll in this course. Prerequisites: FINC 632 and approval of instructor.

- 669. Titans of Investing. (3-0). Credit 3.** Readings from the most influential theorists and practitioners of 20th and 21st century investing. Case studies and portfolio sector exercises in an institutional context, based on detailed assessment of global investment risks. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 670. Real Property Analysis. (3-0). Credit 3.** Provides the economic and financial tools used to analyze real estate investments, new property developments and the redevelopment of existing properties. Classification 6 students may not enroll in this course. Prerequisite: Graduate classification.
- 672. Real Property Finance. (3-0). Credit 3.** Primary and secondary mortgage markets; mortgage markets' institutional organization, alternative mortgage instruments, creative financing techniques, loan underwriting factors and risk hedging strategies. Classification 6 students may not enroll in this course. Prerequisites: FINC 612 or FINC 635; FINC 670.
- 673. Real Property Valuation I. (3-0). Credit 3.** Procedures used to estimate market value of real property; market analysis and valuation techniques most appropriate for appraising income-producing properties; demonstration appraisal report. Classification 6 students may not enroll in this course. Prerequisites: FINC 612 or FINC 635; FINC 670; enrollment in MRE program.
- 674. Real Property Valuation II. (3-0). Credit 3.** Provides opportunity to develop advanced competencies in analysis and valuation of more complex assignments and properties; draws upon previous coursework in land economics and real estate program including real property valuations, market analysis, real estate investment analysis and real property finance. Classification 6 students may not enroll in this course. Prerequisites: Enrollment in MRE program; FINC 670.
- 675. Analysis of Real Estate Investment Decisions. (3-0). Credit 3.** Analytical techniques for real estate investment decision-making which emphasize the importance of income tax considerations, the magnitude of relevant cash flows and the timing of both; case histories used to analyze investment problems. Classification 6 students may not enroll in this course. Prerequisite: FINC 612 or FINC 635.
- 676. Commercial Real Estate Law. (3-0). Credit 3.** Commercial real estate law including legal ownership interests in oil and gas law, real estate sales contracts, financing, instruments and closings, commercial leases and real estate regulations and taxation. Classification 6 students may not enroll in this course. Prerequisite: Graduate classification.
- 677. Real Estate Development Analysis. (3-0). Credit 3.** Financial aspects of real estate development; project investment characteristics and merits. Classification 6 students may not enroll in this course. Prerequisites: FINC 612 or FINC 635; enrollment in MRE program.
- 684. Professional Internship. Credit 1 to 6.** A directed internship in an organization to provide students with on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. Classification 6 students may not enroll in this course. Prerequisites: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed study of selected problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisites: Graduate classification and approval of instructor.
- 688. Doctoral Seminar. (3-0). Credit 3.** Historical development of the conceptual framework of finance theory and practices; analysis of current research and controversial issues in the field. For doctoral students only. Classification 6 students may not enroll in this course. May be repeated for credit. Prerequisite: Enrollment in PhD program.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of finance. May be repeated for credit. Classification 6 students may not enroll in this course.
- 690. Theory of Research in Finance. (3-0). Credit 3.** Design of research in various subfields of finance and the evaluation of research results using examples from the current research literature. May be repeated for credit. Classification 6 students may not enroll in this course. Prerequisite: Enrollment in PhD program.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Classification 6 students may not enroll in this course. Prerequisite: Enrollment in PhD program.

Intercollegiate Faculty in Food Science and Technology

G. R. Acuff, C. Alvarado, J. M. Awika, J. B. Carey, M. E. Castell-Perez, A. Castillo (Intercollegiate Faculty Chair), L. A. Cisneros-Zevallos, T. Duong, C. R. Engler, K. B. Harris, J. T. Keeton, K. S. Kubena, R. E. Lacey, J. R. Lupton, R. K. Miller, R. G. Moreira, P. S. Murano, R. M. Nayga, J. P. Nichols, W. N. Osburn, T. D. Phillips, S. D. Pillai, M. A. Riaz, R. L. Richter, L. W. Rooney, L. H. Russell, Jr., A. R. Sams, J. W. Savell, S. B. Smith, J. M. Sturino, S. M. Talcott, S. T. Talcott, T. A. Vestal, A. B. Wagner

The intercollegiate faculty in food science and technology is composed of faculty members from the College of Agriculture and Life Sciences, the Dwight Look College of Engineering, and the College of Veterinary Medicine. Faculty members have academic appointments in the Departments of Agricultural Economics, Biological and Agricultural Engineering, Animal Science, Chemical Engineering, Horticultural Sciences, Nutrition and Food Science, Poultry Science, Soil and Crop Sciences, and Veterinary Integrative Biosciences. Graduate training in food science is designed to provide advanced training in the basic sciences, processing technology, and engineering processes related to the production, processing, distribution, or utilization of food. Courses of study lead to the Master of Agriculture, the Master of Science and the Doctor of Philosophy degrees.

Degree programs for students are prepared by the students' graduate committee in consultation with the student. Courses for the degree program are selected from the various departments and colleges which serve the needs of the food scientist. Degree programs generally consist of a selection of basic science courses and elected courses to strengthen the specific interests of individual students. Basic science and support courses are usually selected from chemistry, biochemistry, statistics or microbiology. Food science courses to strengthen the primary interest of the student are selected from those listed by the departments participating in the program. Areas of specialization include meat science, cereal chemistry, horticultural sciences, engineering, food chemistry, food microbiology, food safety, toxicology and poultry science.

Graduate study provides the student the opportunity to conduct research in laboratories equipped with modern analytical instruments and food processing equipment. These facilities are located in the various departments represented by members of the faculty of food science.

Applicants for advanced degrees who do not have previous academic training in food science are expected to acquire background skills as part of, or in excess of the advanced degree requirement. Graduate assistantships and fellowships are available on a competitive basis from faculty members in individual departments.

Food Science and Technology (FSTC)

- 605. Chemistry of Foods. (3-0). Credit 3.** Chemical covalent and noncovalent interactions in food systems; the glass transition and moisture in foods; carbohydrate chemistry; reactions of food lipids; food protein functionality; chemistry of flavor; processing chemistry; food additives; and nutraceutical phytochemicals. Prerequisite: BICH 410 or BICH 603.
- 606. Microbiology of Foods. (3-0). Credit 3.** Nature and function of beneficial and defect-producing bacteria in foods; food-borne illness, effects of processing, storage and distribution; techniques for isolation and identification from foods. Cross-listed with DASC 606.
- 607. Physiology and Biochemistry of Muscle as a Food. (2-2). Credit 3.** Biochemical, histological, anatomical and physical characteristics of muscle cells and factors associated with transformation of muscle cells into meat. Prerequisite: BICH 410 or approval of department head. Cross-listed with ANSC 607.
- 610. Nutritional Pharmacometrics of Food Compounds. (3-0). Credit 3.** Introduction into nutritional pharmacokinetics and pharmacodynamics of food compounds; specific examples of toxicological and pharmacological effects of food compounds. Prerequisite: NUTR 202 or NUTR 203 or FSTC 201 or CHEM 227 or CHEM 222 or instructor approval. Cross-listed with NUTR 610.
- 611. Poultry Processing and Distribution Technology. (3-2). Credit 4.** Poultry and egg composition, mechanisms of poultry and egg quality preservation, effects of storage environments, time and product treatment; evaluation of commercial methods of product assembly, processing, distribution and quality control; evaluation of physical, microbiological, functional and chemical methods of quality determination. Cross-listed with POSC 611.
- 619. Molecular Methods for Microbial Characterization. (2-2). Credit 3.** Underlying principles of molecular methods for microbial detection and characterization in natural and man-made ecosystems; emphasis on method application and data interpretation; emphasis on microbial pathogens and indicator organisms in foods and environment; laboratory covers select protocols. Prerequisites: FSTC 326; SCSC 405; POSC 429; approval of instructor. Cross-listed with SCSC 619, POSC 619, and VTMI 619.

- 629. Microbiology of Food Irradiation. (2-2). Credit 3.** The course provides a lecture plus laboratory overview of electron beam and x-ray based food irradiation principles. The objective is to provide students with a working knowledge of using electronic pasteurization as a means of destroying microbial pathogens or retarding microbial spoilage in foods. Cross-listed with POSC 629.
- 630. Cereal Grains for Human Food. (3-3). Credit 4.** Fundamental concepts of dry milling, wet milling, oil extraction, baking, malting, brewing, storage, sanitation and quality evaluation and control inter-related with physical and biochemical properties of cereals and their products; use of instruments and techniques to evaluate cereal quality. Prerequisite: Approval of instructor. Cross-listed with SCSC 630.
- 631. Food Carbohydrates. (3-0). Credit 3.** Chemistry, structure, functionality and nutritional properties of food carbohydrates; fiber chemistry, functionality and nutritional properties, artificial sweeteners, starch structure and functionality and hydrocolloid functionality. Prerequisite: BICH 410. (Offered in alternate years.)
- 634. Oilseed Proteins for Foods. (3-0). Credit 3.** World production, composition, processing technologies, uses of products (oil, meal, protein concentrates and isolates, and texturized products) in feeds and foods; present and potential food applications of oilseed proteins. Prerequisites: CHEM 228 and CHEM 317. (Offered in alternate years.)
- 635. Oil and Fat Food Products. (3-0). Credit 3.** Composition, properties and reactions; sources, handling and storage of raw materials; extraction refining and bleaching; hydrogenation, deodorization, esterification and interesterification; fractionation; uses in salad oils, shortenings, margarine, bakery products and other foods. Prerequisites: CHEM 228 and CHEM 317. (Offered in alternate years.)
- 640. Therapeutic Microbiology I. (3-0). Credit 3.** Alimentary (gastrointestinal) microbiology including: (i) the "normal" intestinal microbiota; (ii) probiotic and prebiotic nutritional supplements; (iii) recombinant pharmabiotics; (iv) gut-associated lymphoid tissue and mucosal immunity; (v) foodborne gastrointestinal pathogens; and (vi) fermented products as functional foods. Prerequisite: Undergraduate survey course in microbiology (or instructor's consent). Cross-listed with NUTR 640.
- 647. Technology of Meat Processing and Distribution. (3-0). Credit 3.** Quantitative and qualitative characteristics of meat and meat products as related to food technology processing operations; manufacturing, preservation, packaging and merchandising. Cross-listed with ANSC 647.
- 657. Hazard Analysis and Critical Control Point System. (3-0). Credit 3.** Examination of the Hazard Analysis and Critical Control Point (HACCP) principles specifically related to meat and poultry; microbiological and process overviews; good manufacturing practices (GMP) and standard operating procedures (SOP) development; team-building and implementation into industry operations. This class is designed for the production of food and fulfills the training requirements of USDA's HACCP regulation for meat and poultry (9 CFR Part 417), and FDA's HACCP regulations for fish and fishery products (21 CFR Part 123 and 1240) and for juice (21 CFR Part 120). Cross-listed with ANSC 657.
- 667. Industrial Processed Meat Operations. (2-2). Credit 3.** Application of scientific principles and business practices to manufactured meat products; interrelationships among marketing, manufacturing, product development, regulatory compliance and quality assurance in commercial processed meat operations. Prerequisite: Approval of instructor. Cross-listed with ANSC 667.
- 669. Experimental Nutrition & Food Science Laboratory. (1-6). Credit 4.** Nutritional intervention in animal models of metabolic or emotional disorders; genetic modifications or pathogens in food products; analyses of gene expression and behavior. Prerequisite: BICH 432/GENE 432 recommended; graduate in nutrition or related major. Cross-listed with NUTR 669.
- 671. Critical Evaluation of Nutrition and Food Science Literature: Evidence Based Reviews. (3-0). Credit 3.** Evaluation of scientific literature, research methods within the literature, and the quality of scientific studies to produce an evidence-based review in areas specific to nutrition and food science. Prerequisites: NUTR 202 or NUTR 203 and STAT 302; knowledge of nutrition, statistics, and technical writing helpful. Cross-listed with NUTR 671.

- 677. Instrumental Methods in Food Analysis. (2-6). Credit 4.** Technique of chemistry, biochemistry and molecular biology used to analyze food products, operational principles of current instrumentation; hands-on experience with a variety of sample preparation techniques and modern laboratory instruments. Prerequisite: CHEM 316/CHEM 318 or equivalent. Cross-listed with ANSC 677.
- 681. Seminar. (1-0). Credit 1.** Oral reports and discussions of current research and developments in food technology designed to broaden understanding of problems and to stimulate research.
- 684. Professional Internship. Credit 1 or more each semester.** Experience in application of formal training to a commercial operation under supervision of operations manager and designated faculty member. Student will investigate matter of mutual interest and report results in a professional paper approved by the graduate committee.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed study of selected problems emphasizing recent developments in research techniques.
- 687. Sensory Evaluation of Foods. (2-2). Credit 3.** Application of sensory science principles and practices to food systems including an understanding of discriminative, descriptive and consumer sensory techniques. Prerequisite: CHEM 222 or CHEM 228. Cross-listed with ANSC 687.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of food science and technology. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Investigations leading to thesis or dissertation in various areas of food science and technology.
- 697. Applied Microbiology for Foods of Animal Origin: Processing, Sanitation and Sanitary Design. (3-0). Credit 3.** Application of basic food microbiology knowledge and principles to food production processes and products; sources of microbiological contamination and their impact on food safety and spoilage; application of sanitary design and validation; testing and auditing to monitor and troubleshoot the process. Prerequisites: DASC 326/FSTC 326 or FSTC 606 or equivalent. Cross-listed with ANSC 697.

French

(faculty, see [page 413](#))

(FREN)

- 601. Introduction to Scientific French. (3-0). Credit 3.** Intensive course to prepare graduate students to read scientific material; technical vocabulary and translation. May not count for hours in a supporting field. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems in the field of French. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of French. May be repeated for credit. Prerequisite: Approval of instructor.
- 692. Readings. (3-0). Credit 3.** Readings in French literary texts in the original language. Prerequisite: Graduate classification.

Intercollegiate Faculty in Genetics

C. D. Allred, H. Amrein, H. Andrews-Polymenis, R. Aramayo, K. Bayless, D. Bell-Pedersen, M. J. Benedik, L. R. Bernstein, S. E. Bondos, M. Bryk, R. S. Chapkin, B. P. Chowdhary, J. D. Cirillo, C. J. Coates (Faculty Chair), N. D. Cohen, E. W. Collisson, P. J. de Figueiredo, J. N. Derr, M. B. Dickman, S. V. Dindot, D. J. Ebbole, J. W. Erickson, R. Fan, A. C. R. Ficht, R. H. Finnell, L. R. Garcia, C. A. Gill, J. R. Gold, R. H. Gomer, C. F. Gonzalez, J. H. Gould, T. L. Gumienny, T. C. Hall, P. E. Hardin, A. D. Herring, J. C. Hu, L. A. Hurtado, N. H. Ing, J. Ji, J. S. Johnston, G. M. Kapler, C. M. Kenerley, S. R. King, R. J. Kohel, K. V. Krutovsky, G. R. Kunkel, J. L. Leibowitz, J. T. Lightfoot, R. Lints, C. R. Long, C. A. Loopstra, K. A. Maggert, C. W. Magill, M. Mateos, S. A. Maxwell, T. D. McKnight, R. C. G. Miranda, L. E. Mitchell, J. E. Mullet, W. J. Murphy, S. C. Murray, V. M. Panin, S. L. Payne, A. E. Pepper, B. D. Perkins, D. O. Peterson, M. Polymenis, W. W. Porter, H. Qin, T. Raudsepp, P. K. Riggs, B. B. Riley, G. Rosenthal, K. J. Ryan, M. S. Sachs, S. H. Safe, P. B. Samollow, J. E. Samuel, H. B. Scholthof, C. M. Seabury, B. D. Shaw, D. E. Shippen, D. A. Siegle, R. Sitcheran, J. T. Skare, L. C. Skow, C. W. Smith, T. E. Spencer, D. M. Stelly, P. Straight, J. M. Sturino, V. L. Tesh, N. D. Turner, C. J. Welsh, M. E. Westhusin, J. R. Wild, H. H. Wilkinson, V. G. Wilson, J. E. Womack, H. Zhang, W. E. Zimmer

Genetics, the science of heredity and variation, occupies a central position in biology. Many of the recent significant research developments in the life sciences have occurred in this dynamic discipline. Multiple opportunities exist for the further development of genetic theory and for the application of genetic principles to improve animal and plant species.

The graduate program in genetics is supervised by the faculty of genetics, which is composed of faculty from several departments and colleges whose training, teaching and research is in genetics. Supporting coursework is available in such fields as biochemistry, computer science, cytology, molecular biology, pathology, physiology and statistics.

Research areas that may be pursued include biochemical genetics, cytogenetics, developmental genetics, immunogenetics, molecular genetics, population genetics, quantitative genetics, somatic cell genetics, forest genetics, animal breeding and plant breeding. Commonly used experimental organisms include bacteria, viruses and fungi, and many species of higher plants and animals.

Admission to the genetics graduate program requires approval by both the faculty of genetics and a participating academic department. Graduate assistantships and fellowships are available from the faculty of genetics and from individual departments.

The language requirement for students in the genetics program is determined by their administrative department.

Genetics (GENE)

- 603. Genetics. (4-0). Credit 4.** Development of fundamental concepts related to the structure, function, organization, transmission and distribution of genetic material. Prerequisite: GENE 301.
- 606. Quantitative Phylogenetics. (2-3). Credit 3.** Designed to provide students with the theory and tools required for inference of phylogenetic (evolutionary) relationships among biological taxa using various types of comparative data including morphological characters, biochemical and molecular characters, and DNA sequences; hands-on analysis of data using contemporary tools. Prerequisite: Entomology 601 or approval of instructor. Cross-listed with ENTO 606 and WFSC 646.
- 608. Critical Analysis of Genetic Literature. (1-0). Credit 1.** An introduction to primary literature in the field of genetics which will give students experience in critically evaluating scientific papers and develop an appreciation of how genetics can be used to address important biological questions.
- 612. Population Genetics. (3-0). Credit 3.** Biological approach to genetic characteristics of populations dealing with genetic equilibrium, allelic variation, determination of genetic variation in populations, effects of mating systems, selection, mutation and drift on population parameters. Prerequisites: GENE 603; STAT 651.
- 613. Quantitative Genetics I. (3-0). Credit 3.** Quantitative genetics concepts particularly dealing with partitioning of phenotypic variance into genetic and environmental components, selection response, effects of systems of mating, genetic covariance and threshold effects. Prerequisites: GENE 612; STAT 652.

- 614. Maximum Likelihood Estimation of Genetics. (3-0). Credit 3.** Theoretical and analytical approaches to the application of maximum likelihood for the estimation of parameters under linear and nonlinear models; single and polygene genetic models including Hardy-Weinberg equilibrium, linkage analysis and quantitative trait loci detection. Prerequisites: GENE 603; STAT 651; STAT 652 or STAT 601. Cross-listed with ANSC 614.
- 620. Cytogenetics. (3-0). Credit 3.** Examination and analysis of variation in chromosome structure, behavior and number; developmental and evolutionary effects of this variation. Prerequisite: GENE 603.
- 626. Analyses of Gene Expression. (1-3). Credit 2.** Proficiency in handling DNA and RNA gained during exercises used routinely in analyses of gene expression; RNA preparation and analysis on Northern blots; in vitro transcription and polyacrylamide gel analysis of nucleic acids; sub-cloning and mRNA quantitation using polymerase chain reaction. Prerequisites: GENE 450 or approval of instructor; radiation safety training. Cross-listed with ANSC 626.
- 629. Applied Animal Genomics. (3-0). Credit 3.** Theory and application of genomics by livestock industries; consideration of genetic markers, gene mapping methods, genome analysis and emerging technologies such as microarrays, transgenesis, cloning and marker assisted selection; exposure to bio-informatic tools for genomics. Prerequisite: GENE 603 or by approval of instructor. Cross-listed with ANSC 629 and POSC 630.
- 631. Biochemical Genetics. (3-0). Credit 3.** Genetic control of cellular metabolism. Mechanism of gene action; gene-enzyme relationships; regulation of gene expression; structure and organization of genomes; biochemical manipulation and characterization of genetic molecules. Prerequisite: GENE 431 or BICH 431; BICH 603. Cross-listed with BICH 631.
- 633. Conservation Genetics. (3-0). Credit 3.** Genetic concepts and techniques relevant to management and conservation of biological diversity; research and conservation within a conservation genetics framework. Prerequisites: Introductory courses in genetics and ecology or biological conservation. Cross-listed with WFSC 633.
- 643. Molecular Quantitative Genetics and Plant Breeding. (3-0). Credit 3.** Classical, applied and molecular aspects of quantitative genetics in plant breeding; genetic relationships; genetic diversity; genetic phenomena (linkage, heterosis and epistasis); genotype by environment interaction; mapping quantitative trait loci (QTL); genomic and marker-assisted selection; application of statistical software. Prerequisites: STAT 651, SCSC 642 or GENE 613 or approval of instructor. Cross-listed with SCSC 643.
- 648. Molecular Evolution. (2-2). Credit 3.** Theory and tools used in the analysis of molecular evolutionary patterns of DNA and protein sequences; format combines lecture presentations by instructor, discussion of relevant scientific literature, computer exercises, preparation of research proposal or independent research project, and practice in peer review process. Prerequisites: Basic courses in general Genetics and in Evolution. Cross-listed with WFSC 648.
- 654. Analysis of Complex Genomes. (3-0). Credit 3.** History and current status of genetic and molecular analysis of higher eukaryotic genomes; coverage of techniques for dissection of genomes into manageable parts; investigations in genetics, breeding and evolution; emphasis on quantitative inheritance, genetic mapping, physical mapping, map-based cloning, with examples drawn from a wide range of organisms. Prerequisite: GENE 603. Cross-listed with SCSC 654 and MEPS 654.
- 655. Analysis of Complex Genomes—Lab. (0-7). Credit 3.** Laboratory methods in molecular genetic techniques for genetic mapping, physical mapping, and map-based cloning of both qualitative and quantitative phenotypes. Prerequisite: GENE 603 or equivalent or approval of instructor. Cross-listed with SCSC 655 and MEPS 655.
- 662. Eukaryotic Transcription. (1-0). Credit 1.** Intensive short course in molecular mechanisms of eukaryotic transcription and its regulation. Prerequisite: GENE 631 or BICH 631 or approval of instructor. Cross-listed with BICH 662.
- 673. Gene Expression. (1-0). Credit 1.** Oral presentations and discussions related to the biochemistry and molecular biology of gene expression in animal, plant, and microbial systems. Course may be repeated for credit up to 12 times. Prerequisite: Graduate classification in biochemistry or genetics or approval of instructor. Cross-listed with BICH 673.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of topics of current importance in genetics; reports to be prepared and presented by graduate students enrolled in course.
- 685. Directed Studies. Credit 1 to 4 each semester.** Individual problems or research not pertaining to thesis or dissertation. Prerequisite: Approval of instructor.

- 689. Special Topics in...** **Credit 1 to 4.** Selected topics in an identified area of genetics. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research.** **Credit 1 or more each semester.** Prerequisite: GENE 603.
- 697. Teaching Genetics Labs. (1-0). Credit 1.** Theory and practical aspects of teaching genetics labs, with emphasis on content, grading, instructional methods and practical aspects of genetics labs. May be repeated for credit. Prerequisites: Graduate classification in genetics; appointment as a TA for genetics labs.

Department of Geography

R. S. Bednarz, S. W. Bednarz, C. Brannstrom*, D. M. Cairns, M. C. Ewers, A. Filippi, O. W. Frauenfeld, J. R. Giardino, I. Guneralp, W. D. Heyman, C. Houser, P. J. Hugill, W. Jepson, A. G. Klein, J. B. Kracht, C. W. Lafon, H. Liu, A. C. Millington, K. M. O'Reilly, S. M. Quiring, E. B. Roark, J. M. Smith, V. P. Tchakerian (Head), M. R. Waters

* Graduate Advisor

Graduate work in geography is offered at the master's and doctoral levels. The department has a wide scope. Faculty interests include physical geography (geomorphology, biogeography, climatology, hydrology), human geography (cultural, economic, historical, political, social, urban), mapping sciences (geographic information systems, remote sensing), human-environment relations and geographic education. The Department of Geography can also serve as the "home" department for the Master of Geoscience degree. The MGSc is a non-thesis degree that provides a multidisciplinary background in the geosciences, appropriate for educators or individuals interested in environmental issues.

Graduate students are required to be involved with research work and teaching. Primary data collection is encouraged. Many graduate courses are taught as seminars requiring research papers. A non-thesis option is available for master's-level students, especially those with professional/vocational goals.

Graduate Certificate Program in Geographic Informations Science (GIS) or Remote Sensing (RS)

The department, in cooperation with the Department of Ecosystem Science and Management, offers graduate certificate programs in GIS or RS. The programs require a minimum of 12 credit hours comprising two foundation courses and two elective courses. The Remote Sensing curriculum comprises the following courses: Introductory Level—GEOG 651 or ESSM 655 (1 of 2 is required); Intermediate Level—GEOG 661 and ESSM 656 (both required), and Specialized Courses (choose 1 from the following courses)—GEOG 696, ATMO 655, ECEN 634, ECEN 642, or ECEN 649. The GIS curriculum comprises the following courses: Introductory Level—GEOG 660 or BAEN 651/ESSM 651; Intermediate Level—GEOG 665 and BAEN 652/ESSM 652, and Specialized Courses (choose 1 from the following courses)—ENTO 625 (Cross-listed with GEOG 625), PLAN 625, BAEN 610, ESSM 665, or ESSM 635. For more information, please contact the graduate advisor.

Geography (GEOG)

- 603. Processes in Economic Geography. (3-0). Credit 3.** Spatial organization and distribution of economic activity; patterns of land rent and land use; theories of economic development; models of spatial decision making. Prerequisite: GEOG 304 or equivalent or approval of instructor.
- 604. Processes in Physical Geography. (3-0). Credit 3.** Methodologies and problems of physical geography with emphasis on the interrelationships of the physical environment; a foundation course for graduate work in geography. Prerequisite: Approval of instructor.
- 605. Processes in Cultural Geography. (3-0). Credit 3.** Evolution of cultural landscapes; processes of innovation, diffusion and adaptation in context of developing human-environment relationships. Prerequisite: Approval of instructor.

- 610. Geographical Methods and Theory. (3-0). Credit 3.** Development of geography as a discipline; methods and theories used in geography for understanding place and for spatial analysis of human and biophysical phenomena. Prerequisite: Graduate classification in geography or approval of instructor.
- 611. Geographical Research Design. (3-0). Credit 3.** Methods, techniques and conceptual models for the conception, design, planning and conduct of geographical research. Prerequisite: Graduate classification in geography or approval of instructor.
- 612. Applied Climatology. (3-0). Credit 3.** Climate data and methods to solve a wide range of environmental problems; collection, processing, analysis and interpretation of surface observations, radar, satellite, reanalysis and climate model data; statistical methods and physical modeling; practical problems and development of tools for decision makers. Prerequisite: Graduate classification.
- 616. Urban Geography. (3-0). Credit 3.** Spatial patterns and processes of urban systems; growth and sprawl; environmental impacts; residential choice models; political fragmentation; economic development; power and privilege; place-based identity. Prerequisite: GEOG 306 or equivalent.
- 619. Human Impact on the Environment. (3-0). Credit 3.** Human alterations of landscapes, the atmosphere and the waters of the earth; interference with natural chemical cycles; disturbance of ecological equilibria; depletion of natural resources; roles of technology and population growth. Prerequisite: Approval of instructor.
- 621. Land-Use and Land-Cover Change. (3-0). Credit 3.** Human dimensions of land-use and land-cover change; theories of global and regional land-use and land-cover changes that emphasize processes, institutions, and patterns at multiple scales; methodologies and research agendas including geo-spatial analysis, modeling, and social science approaches. Prerequisites: GEOG 619 or approval of instructor; Graduate classification.
- 622. Environment and Society on the US-Mexico Border. (3-0). Credit 3.** Students will examine issues of environment and society on the US-Mexico border; processes of environmental change, environmental outcomes and societal responses will be discussed; theoretical foundations of human dimensions of environmental change, resource use, and management will be examined in detailed case studies. Prerequisite: Permission from instructor.
- 623. Ecohydrology. (3-0). Credit 3.** This course will provide a framework for understanding how plants and animals affect the water cycle; the water cycle in all of its aspects will be examined and explored with the idea of understanding how changes in land cover may influence the water cycle; implications for both upland and riparian systems will be examined. Prerequisite: Graduate Classification. Cross-listed with ESSM 635.
- 624. Biogeography: Theory and Methods. (3-0). Credit 3.** Theory and methods utilized in contemporary biogeography. Emphasis on the analysis of vegetation communities and their environmental controls. Various methods of ordination and predictive methods for analyzing vegetation ranges. Spatial analysis of vegetation. Prerequisite: Approval of instructor.
- 625. Landscape Ecology. (2-2). Credit 3.** Study of structure, function, and change in a heterogeneous land area composed of interacting ecosystems; examine basic ecological principles dealing with landscape structure. Prerequisite: Approval of instructor. Cross-listed with ENTO 625.
- 626. Fluvial Geomorphology. (3-0). Credit 3.** Concepts and methods applicable to the fluvial systems; components affecting rivers and drainage basin and analysis geomorphology; analytical treatment of problems arising from fluvial changes. Prerequisite: GEOG 203 or approval of instructor.
- 627. Arid Lands. (3-0). Credit 3.** Processes and landforms in dryland environments; nature and dynamics of gravity, water and wind in deserts; Quaternary climates and arid lands; human impact in drylands. Prerequisite: GEOG 604 or approval of instructor.
- 629. Cultural and Political Ecology. (3-0). Credit 3.** History of ideas about humans and environment; political and social meanings of nature and culture; access and control of resources; theories of environmental change; geographic approaches to political ecology research; current debates and future directions.
- 635. Advanced Biogeography. (3-0). Credit 3.** Theory and contemporary research in biogeography; methods used in conducting biogeographical research; spatial and temporal changes in the distribution of organisms; influences of humans and the physical environment on biogeographic patterns. Prerequisite: GEOG 624 or approval of instructor.

- 640. Historical Geography. (3-0). Credit 3.** Themes of historical geography: demography, economic structure and social structure; patterns of selective migration from specified source regions to specific destinations and resulting processes and forms of settlement.
- 641. Historical Geography of the World-System. (3-0). Credit 3.** Theoretical and actual global development since 1431 A.D.; world-system theory, Kondratieff Long-Wave theory, geographic and geostrategic reality; organic and mineral-based systems of production; changing technologies of agricultural and industrial production and of transportation and communication; rise and fall of nation states as hegemon powers. Prerequisite: Approval of instructor.
- 642. Past Climates. (3-0). Credit 3.** Terrestrial and marine proxy records of past climate variability, including tree rings, coral, and sediments; past climate change events such as the Little Ice Age and Medieval Warm Period; greenhouse gases and global temperature; insight into the nature of climate change and challenges humankind faces in the next few centuries. Prerequisite: Graduate classification. Cross-listed with GEOS 642.
- 643. Geopolitics and Geostrategies of Energy. (3-0). Credit 3.** This graduate seminar course will examine the geopolitics and geostrategies of energy with a primary focus on the development of “hydrocarbon frontiers”. It will also deal more briefly with alternative energy sources.
- 644. Geographic Education: Theory and Practice. (3-0). Credit 3.** Geography as an element of the educational system: K-12, undergraduate, graduate; geography’s role in curricula and its practice in classrooms; course design and integration of geographic concepts into classroom instruction. Prerequisite: Graduate classification.
- 645. Research in Geographic Education. (3-0). Credit 3.** Research in geographic education and the interface between research in geography and geographic education; identification of research questions; choice of methodology; review of literature; data collection and analysis; communication of results. Prerequisite: Graduate classification.
- 646. Periglacial Geomorphology. (3-0). Credit 3.** Essential concepts and methods applicable to the study of periglacial geomorphology; review history and processes of periglacial geomorphology; periglacial environments and significance of process on predicting environmental changes. Prerequisite: GEOG 203 or approval of instructor.
- 648. Political Geography of the World-System. (3-0). Credit 3.** Political and geopolitical evolution of the modern world-system; major geopolitical theories, settler colonization, extractive colonization, imperialism, decolonization, development of European state-system hegemonic change and theory of world leadership cycles. Prerequisite: Graduate classification.
- 651. Remote Sensing for Geographical Analysis. (3-0). Credit 3.** Provides an introduction to remote sensing fundamentals. Discussion of past, present and planned earth observing sensors as well as technical issues involved in the collection, processing and interpretation of remote sensing images with emphasis on application to geographic problems, including geomorphology, hydrology and coastal oceanography. Prerequisite: Graduate classification.
- 652. Quantitative Methods in Geography. (3-0). Credit 3.** This course is designed to acquaint students with quantitative methods commonly used in geographical research to describe, characterize, model and analyze geo-spatial data. Prerequisite: Permission from Instructor.
- 660. Applications in GIS. (3-0). Credit 3.** Integrates spatial analysis and modeling with GIS for environmental and socio-economic applications. Prerequisites: GEOG 390; STAT 651 and STAT 652.
- 661. Digital Image Processing and Analysis. (3-0). Credit 3.** Principles of georectifying, processing, manipulating and interpreting data collected by nonphotographic sensors concentrating on solid earth resources using Thematic Mapper with supplemental data from the SPOT satellite. Prerequisite: GEOG 332 or approval of the instructor.
- 662. GIS in Land and Property Management. (2-2). Credit 3.** Introduction to concepts of design, planning and implementation of GISs related to commercial real estate development; case studies for land and property management; laboratory exercises in practical applications for real estate. Prerequisites: Enrollment in Master of Land Economics and Real Estate; approval of instructor.

- 665. GIS-Based Spatial Analysis and Modeling. (3-0). Credit 3.** Investigates methodology of integrating various spatial analysis and modeling techniques with GIS for environmental/socio-economic applications; practical applications; theoretical/technical aspects of related issues in detail. Prerequisites: GEOG 390; STAT 651 or equivalent; approval of instructor.
- 666. Coastal Geomorphology. (3-0). Credit 3.** Essential concepts and methods to coastal geomorphology; review history and processes of coastal geomorphology; analytical treatment of problems associated with coastal environmental changes. Prerequisite: GEOG 203 or equivalent.
- 667. Dynamic Modeling of Earth and Environmental Systems. (3-2). Credit 4.** Dynamical systems modeling; dynamic complexity; key concepts, processes and human impact on earth and environmental systems; model building and testing; system behavior over time; model validation and sensitivity; examples from the applications in earth and environmental sciences. Prerequisite: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of current research and selected topics. Prerequisite: Approval of department head.
- 685. Directed Studies. Credit 1 to 6 each semester.** For students with major or minor in geography to undertake investigations in special aspects of geography. Prerequisite: Approval of instructor.
- 686. Quaternary Geomorphology. (3-0). Credit 3.** Essential concepts and methods applicable to the study of Quaternary landscapes; review of the history of Quaternary studies, stratigraphy and geochronology; Quaternary history of glaciated and non-glaciated areas of the world, Pleistocene extinctions, and human evolution. Prerequisite: GEOG 203 or approval of instructor.
- 687. Geoarchaeology. (3-0). Credit 3.** Application of geological concepts and methods to archaeological research; history of geoarchaeology; site formation processes; modification of archaeological sites and sediments; landscape reconstruction and change and their effects on human behavior. Prerequisite: ANTH 602 or equivalent. Cross-listed with ANTH 624.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of geography. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Original research in various areas of geography. Research for thesis or dissertation.
- 695. Frontiers in Geographic Information Science. (3-0). Credit 3.** Theoretical foundations and the latest development of geographic information science (GIScience); topics related to representations of space and time, geocomputation, spatially integrated social sciences, and social informatics. Prerequisite: Introductory GIS.
- 696. Geomorphology and Remote Sensing. (3-0). Credit 3.** Application of remote sensing to study landforms, imagery, includes, aerial photography; LANDSAT; SPOT, TM and shuttle photography. Prerequisite: GEOG 203 or approval of instructor.

Department of Geology and Geophysics

T. A. Blasingame, R. L. Carlson, F. M. Chester, J. S. Chester, B. M. Clement, B. Duan, M. E. Everett, P. J. Fox, J. R. Giardino (Head), R. L. Gibson, Jr., E. L. Grossman, R. N. Guillemette, A. Hajash, B. E. Herbert, T. W. C. Hilde, L. T. Ikelle, B. Johnson, A. K. Kronenberg, W. M. Lamb, E. A. Mancini, F. Marcantonio, C. C. Mathewson, B. V. Miller, J. Newman, T. D. Olszewski, M. Pope, R. K. Popp, P. D. Rabinowitz, A. L. Raymond, M. J. Richardson, E. M. Riggs, W. W. Sager, J. H. Spang, D. W. Sparks, Y. Sun, V. P. Tchakerian, D. J. Thomas, M. M. Tice, J. D. Vitek, B. Wade, J. Watkins, R. Weiss, T. E. Yancey, H. Zhan

Geology

Graduate work in geology is offered at both the master's and doctoral levels. Programs are designed to provide the student with an understanding of the fundamentals of geology and of related disciplines. Research investigations comprise a significant part of each program. The Department of Geology and Geophysics can also serve as the "home" department for the Master of Geoscience degree. The MGSc is a non-thesis degree that provides a multidisciplinary background in the geosciences, appropriate for science teachers in public schools, or for individuals interested in environmental issues, for example.

Opportunities for research at both the MS and PhD levels are available in ground-water investigations, sedimentation, mineralogy, paleontology and paleoecology, stratigraphy, structural geology, tectonophysics, petrology, field geology, engineering and environmental geology and geochemistry.

Current research areas of members of the department include studies in the origin and spatial distribution of reservoir porosity in depositional, diagenetic and fracture systems; field, theoretical and experimental study of the formation of faults and fault networks; fluid flow and deformation within thrust sheets; the hydrostatic and hydrodynamic trapping of oil and gas; carbonate platform-to-basin transitions; sandstone provenance and diagenesis; integrated quantitative basin analysis; archaeological palynology; isotope stratigraphy and global change; paleobiogeography of plants; how fossil assemblages form from and reflect living communities; water/rock interactions in flow-through experimental systems; fate and transport of organic pollutants in the unsaturated and saturated zones; composition of movement of crustal fluids; crystal chemistry, phase relations and thermodynamics of mantle-derived amphiboles and micas; diagenesis of clastic sediments in relation to reservoir rock potential and quality; metal contaminants in alpine systems; groundwater impacts of surface mining; groundwater interference in civil construction and mining; landslide mechanics; fluid-flow properties of faults and dynamics of faulted reservoirs; and groundwater flow in strongly heterogeneous media.

The department has state-of-the-art laboratory facilities for radiogenic and stable isotope geochemistry, environmental geochemistry, evolutionary biology, paleobiology, rock mechanics, sedimentary geology, petrology and electron microprobe analysis. In addition, sample preparation labs, petrographic microscopes and an extensive network of computers and peripherals are available for student research. More detail can be found at geoweb.tamu.edu under Research Facilities.

The Texas A&M Microscopy and Imaging Center houses additional transmission and scanning electron microscopes. An inductively coupled Ar-plasma emission spectrometer (ICP) and other analytical equipment are available in the Department of Chemistry and the Center for Trace Characterization.

The department benefits from the close association with the Integrated Ocean Drilling Program (IODP). Located in the Texas A&M Research Park adjacent to campus, this \$42 million-per-year basic research program is operated by the College of Geosciences, Texas A&M. The IODP facilities include a large core-storage station and physical-properties, petrography and sedimentary laboratories. Many scientific staff members of the IODP hold adjunct faculty positions in the Department of Geology and Geophysics. The facilities both in the department and elsewhere in the University provide students with an excellent opportunity to use state-of-the-art equipment in their research.

Although degree level is not a requirement for professional practice in geology, the BS should usually be considered as preparatory, the MS should be considered the professional degree and the PhD should be considered the teaching and research degree. The MS degree is granted thesis option only.

In addition to graduate studies requirements for the PhD, the student's committee chair, with advice from the other committee members, will determine, on an individual basis, the student's needs in either foreign language or other broadening areas of study.

(GEOL)

- 609. Field Geology. Credit 1 to 6.** Individual instruction in advanced and specialized field methods, geologic interpretation and field evaluation procedures. Choice of topics and locations of field studies will vary depending upon individual and specific needs. Prerequisite: GEOL 300 or approval of instructor.*
- 610. Field Methods in Hydrogeology. (1-6). Credit 3.** Field methods in hydrogeology; including ground water drilling technology and law; investigation and planning of well sites; installation of ground water wells; field testing of aquifer properties and analysis of field data. Field trips may be required for which departmental fees may be assessed to cover costs. Prerequisite: GEOL 410 or approval of instructor.
- 612. Structural Geology. (3-0). Credit 3.** Mechanical principles important to structural geology and experimental results relating to rock deformation followed by applications to natural deformation; mechanisms, rather than geometries. Primarily for students not concentrating in structural geology but who desire an advanced general course. Prerequisite: Approval of instructor.
- 619. Petroleum Geology. (3-0). Credit 3.** Properties of reservoir rocks; origin, migration and accumulation of petroleum; geologic interpretation of borehole logs and fluid-pressure measurements and the role of hydrostatic and hydrodynamic pressures in oil accumulation. Prerequisite: Approval of instructor.

- 621. Contaminant Hydrogeology. (3-0). Credit 3.** Physical concepts of mass transport; dispersion; diffusion; advection; geochemical processes including surface reaction; hydrolysis; biodegradation; aspects of modeling; process and parameter; and remediation. Prerequisite: GEOL 410 or approval of instructor.
- 622. Stratigraphy. (3-0). Credit 3.** Principles for correlating and naming stratigraphic units; controls on stratigraphic development (sediment supply, base-level change, subsidence, climate, and compaction); principles and application of sequence stratigraphy; subsurface stratigraphy; facies analysis and stratigraphic architecture. Prerequisite: Graduate classification or approval of instructor.
- 623. Carbonate Rocks. (3-0). Credit 3.** Principles of carbonate sedimentology; carbonate depositional sequences defined in modern environments and utilized to interpret the rock record; introduction to depositional and diagenetic microfacies; shelves, ramps and isolated platforms and their tectonosedimentary significance; suggested for geoscience majors. Prerequisites: A basic understanding of sedimentology and the associated terminology; graduate classification.
- 624. Carbonate Reservoirs. (3-0). Credit 3.** Recognition and description of hydrocarbon reservoirs in carbonate rocks; classification of carbonate porosity; capillary pressure curves and pore types; pore characteristics as proxies for permeability in reservoir modeling; techniques for mapping flow units. Prerequisites: Graduate classification and approval of instructor.
- 625. Applied Ground Water Modeling. (3-0). Credit 3.** Concept of groundwater flow and contaminant transport; numerical simulations of solving flow and transport equations; finite difference and finite element methods; software structures of groundwater flow, contaminant transport, density-dependent fluid flow and hydrocarbon remediations; real case applications of software including geological, physical, chemical, biological and hydrological information. Prerequisite: GEOL 410 or approval of instructor.
- 629. Regional Geology of North America. (3-0). Credit 3.** Regional geology of North America, examining the accumulation and deformation of the rock units involved; structural form and style emphasized; entire geologic history investigated. Prerequisite: Graduate classification or approval of instructor.
- 631. Engineering Geomorphology. (3-0). Credit 3.** Active surface processes as they influence engineering construction; erosion, rivers and floods, slope processes, subsidence, coastal processes, ice, weathering and ground water. Prerequisites: Graduate classification in engineering or geosciences; GEOG 331 or approval of instructor.
- 633. River Restoration. (3-0). Credit 3.** Geologic, geomorphic and geomechanical principles applied to the investigation, design, construction, and maintenance of river restoration projects. Prerequisite: GEOL 631 or GEOG 626 or approval of instructor.
- 635. Engineering Geology. (3-0). Credit 3.** Geological principles applied to the investigation design, construction and maintenance of engineering projects; history, development and role of engineering geologic practice as applied to dams, waste disposal, surface and ground water, tunneling, quarrying and construction materials.
- 641. Environmental Geochemistry. (3-0). Credit 3.** Geochemical processes affecting the fate and transport of inorganic and organic pollutants in terrestrial systems; equilibrium and kinetic modeling. Prerequisite: GEOL 451 or approval of instructor.
- 643. Introduction to Electron Microprobe Analysis. (1-3). Credit 2.** Digital imaging and qualitative and quantitative chemical analysis of geological and material science samples using the electron microprobe; emphasis on quantitative chemical analysis using WDS (wavelength-dispersive spectrometry) methods; use the electron microprobe and correctly interpret analytical results. Prerequisite: Approval of instructor.
- 645. Geochronology. (3-0). Credit 3.** Earth's 4.5 billion-year history is divided into units of geologic time based on the observed changes in the rock record: the timing of those changes is quantified by numerical dating methods: this course examines both dating methods and physical and biological changes observed in the rock record. Prerequisite: Graduate classification or approval of instructor.
- 646. Biogeochemical Cycling in Subsurface Systems. (3-0). Credit 3.** Fundamental concepts and research techniques in the study of coupled biogeochemical cycles; focus on connections between major elemental cycles of carbon oxygen, hydrogen, nitrogen, sulfur, phosphorus, and metals including biotic and abiotic transformations in subsurface systems. Prerequisite: Graduate classification.

- 648. Stable Isotope Geology. (2-3). Credit 3.** Stable isotopes of oxygen, carbon, sulfur and hydrogen applied to problems in paleontology and paleoecology, carbonate diagenesis, petroleum exploration, and igneous and metamorphic petrology; isotopic paleotemperatures; analytical methods; theory of isotopic fractionation. Prerequisite: GEOL 451 or approval of instructor.
- 650. Paleoecology. (2-3). Credit 3.** Interrelationships of organisms and environment in the fossil record; methods and criteria available for interpreting ancient environments; critical review of classical studies and current research in paleoecology. Prerequisite: Approval of instructor.
- 651. Paleoecological Community Analysis. (3-0). Credit 3.** Quantitative analysis of multivariate paleoecological community data; measurement of diversity; cluster analysis; gradient analysis by standard and canonical ordination techniques. Prerequisite: A basic course in statistics or approval of instructor.
- 652. Biogeology. (2-3). Credit 3.** Major trends and processes in the evolution of life through geologic time. Interrelationships of biological and physical processes in earth history; application of paleontology to current problems in geology; critical review of modern developments in biogeology. Prerequisite: GEOL 305 or approval of instructor.
- 653. Geobiological Research. (1-6). Credit 3.** Team-based research in modern or historical geobiology; definition of questions and hypothesis testing; analytical techniques; project lifecycle; reporting of results. May be taken two times for credit. Prerequisite: Approval of instructor.
- 654. Evolutionary Patterns and Theory. (3-0). Credit 3.** Evolutionary patterns in the fossil record and application of evolutionary theory to understanding these patterns; comparisons of neo-Darwinian and punctuational hypotheses; events and processes pertaining to microevolutionary and macroevolutionary change; and methods of determine phylogenies of organisms. Prerequisite: Graduate classification in geological or biological sciences.
- 658. Earth Systems Through Deep Time: Global Change, Paleoclimate and Life. (3-0). Credit 3.** History and cause of global change in the earth system, Archean to Holocene; Impact of biotic change on the earth system; influence of tectonics on paleochemistry and climate change; influence of climate on tectonics; methods and models for evaluating global change. Prerequisite: Graduate classification.
- 663. Fracture and Faulting of Rocks. (3-0). Credit 3.** The structure of fractures and faults in the Earth's crust at the macroscopic and microscopic scale; formation and evolution of faults, faults networks and fault zones; fault-related rocks and faulting mechanisms; influence of faults on fluid flow properties; seismic faulting and creep; current problems and research opportunities. Prerequisite: Graduate classification.
- 664. Mechanical Analysis in Geology. (3-0). Credit 3.** Mechanical analysis of geological problems based on concepts of stress, strain, strength, elasticity, viscosity and plasticity; folding, faulting, dike formation, hydraulic fracturing, magma and glacial flow, and cooling of magmatic bodies. Prerequisites: MATH 253; approval of instructor.
- 665. Structural Petrology. (3-3). Credit 4.** Mechanisms of rock deformation from single crystal to mountain range; techniques for mapping stresses and strains and for inferring physical conditions and mechanical behavior at time of deformation; laboratory assignments on descriptive techniques include petrographic microscope-universal stage methods, field procedures and data analysis. Prerequisite: Approval of instructor.
- 667. Structural Geology II. (3-0). Credit 3.** Application of theoretical and experimental results to problems in natural rock deformation; structural mechanisms on the phenomenological, laboratory and natural scales with emphasis on the genesis of structural features in layered rocks. Prerequisites: GEOL 665, GEOP 611, GEOP 615.
- 668. Clastic Sedimentology and Sedimentary Petrology. (3-3). Credit 4.** Detailed analyses of clastic sedimentary rocks: relationships of facies and depositional environments with emphasis on continental, coastal and shallow shelf clastic sediments; petrography and diagenesis of modern and ancient clastic sediments. Prerequisites: Optical mineralogy course and sedimentology (undergraduate); graduate classification.
- 678. Earth Science Modeling. (3-3). Credit 4.** Techniques for building, solving and analyzing numerical models applied to a wide variety of problems in geology, geochemistry, geobiology and geophysics; derivation and scaling of conservation laws; finite difference and finite element techniques and error analysis; programming in MATLAB or a high-level language.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of current research and selected topics from geologic literature. Prerequisite: Graduate classification.

- 685. Directed Studies. Credit 1 or more each semester.** Enables graduate students to undertake limited investigations not within their thesis or dissertation research and not covered in established curricula. Prerequisites: Graduate classification and approval of instructor.
- 689. Special Topics in...** Credit 1 to 4. Selected topics in an identified area of geology. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Original research on problems in various phases of geology. Research for thesis or dissertation.

* Field trips required for which departmental fee may be assessed to cover costs.

Geophysics

The degrees of Master of Science and Doctor of Philosophy are offered in geophysics. Geophysics includes all areas of scientific inquiry that deal with the physical state of the planets and with the dynamic physical processes that act on and within the planets. The deep interior, crust, atmosphere, oceans and space all lie within the province of the geophysicist. To work effectively in so broad an area requires considerable depth and breadth of understanding of physical principles and considerable proficiency in mathematics. Thorough undergraduate training in an earth or physical science is ordinarily regarded as a necessary prerequisite for advanced study.

An intensive two-year program of study at the master's level is available for students who wish to enter the petroleum industry. This MS curriculum pools the resources of the Departments of Geology and Geophysics and Petroleum Engineering in a manner designed to better prepare students for the petroleum industry than conventional offerings in the separate disciplines. The curriculum is intended for students with an undergraduate degree in geology or extensive exposure to geologic concepts through academic training and/or experience. The course sequencing and the subject sequence in each course is carefully designed to use previously acquired knowledge optimally, and to provide experience in applying fundamental concepts in different contexts and in integrating geological, physical, mathematical, computer and statistical skills in the solution of practical problems.

Current research areas of members of the department include studies in theoretical and model seismology focusing on the internal structure of the earth, earthquake mechanisms and seismic exploration; studies of the anisotropy and anelastic properties of sedimentary rocks and application to exploration; regional and global seismology; studies in experimental rock deformation focusing on the failure strength of rocks, friction in rocks; mechanics of fault development; fluid-flow properties of faults and dynamics of faulted reservoirs; marine studies of the structure of the oceanic crust and continental margins in the Gulf of Mexico, the Caribbean Sea and the Western Pacific; studies of the magnetic anomalies near mid-ocean-ridge systems and the magnetization of oceanic crust; the analysis of magnetic and gravity anomalies and application to exploration and global geophysics; gravity anomalies near trenches, convection in the mantle and global tectonics; vertical seismic profiling; and attenuation of seismic waves.

Members of the department also are involved in geophysical investigations of the sea floor through the Integrated Ocean Drilling Program, which Texas A&M University manages on behalf of JOI, Inc. These investigations include rock magnetism, heat flow, borehole logging and other aspects of marine geophysics.

The department has an extensive computer network of workstations, computer servers and storage for data processing, imaging and modeling. The Immersive Visualization Center provides state-of-the-art 3D visualization of large data sets and models. The Texas A&M Supercomputing Facility is available to students and faculty for computer-intensive applications. The department has field exploration equipment for gravity, ground-penetrating radar, seismic reflection/refraction and electromagnetic surveys. More detail can be found geoweb.tamu.edu under Research Facilities.

Geophysics

(faculty, see [page 426](#))

(GEOP)

- 611. Geomechanics. (3-0). Credit 3.** Development of continuum mechanics and its application to rock deformation; stress, strain, stress equilibrium, constitutive relations; governing equations for elastic solids and viscous fluids formulated and used to solve elementary boundary-value problems which have application to structural geology and solid-state geophysics. Prerequisite: MATH 221 or equivalent.

- 615. Experimental Rock Deformation. (3-3). Credit 4.** Results of laboratory testing of mechanical properties of rocks at high pressure and temperature; interaction of theoretical, experimental, petrofabric and field studies of rock deformations as applied to problems in structural geology, seismology and engineering; philosophy of experimentation, apparatus design, data interpretation and extrapolation. Prerequisite: GEOP 611 or GEOL 665 or approval of instructor.
- 620. Geophysical Inverse Theory. (3-0). Credit 3.** Inferences about Earth structure from geophysical data; explicit treatment of sparse and noisy observations; construction of smooth Earth models; linear inversion of marine magnetic anomalies from seafloor magnetization; smooth inversion of DC sounding data from electrical structure; seismic tomography and geodetic fault-plane reconstructions; advanced methods for nonlinear deterministic inversion. Prerequisite: Graduate classification.
- 622. Petroleum Seismology II. (3-2). Credit 4.** Sampling (wavefield sampling); F-K analysis (applications to dip filtering and migration); deconvolution (deterministic and predictive); velocity estimation and tomography (travel time inversion); imaging in time and depth (migration); Zoeppritz equations and AVO analysis. Prerequisite: GEOP 421 or approval of instructor.
- 623. Petroleum Seismology III. (3-3). Credit 4.** Seismic wave propagation in acoustic, isotropic and anisotropic media; description of point and distributed sources; the effect of depth, age; lithology, porosity, pore content and temperature on seismic velocity; use of amplitude versus offset measurements to determine lithology and pore content; spatial resolution. Prerequisite: Approval of instructor.
- 628. Basin Architecture. (3-0). Credit 3.** Tectonic classification of basins; tectonic mechanisms responsible for basin formation: mechanical behavior of the lithosphere; subsidence; geophysical signatures of sedimentary basins; tectonic controls on sedimentation and basin filling; petroleum systems and basin-scale hydrologic systems. Prerequisite: Approval of instructor.
- 629. Seismic Interpretation. (3-3). Credit 4.** Introduces students to the problem of converting seismic properties of reflection time, velocity, impedance, amplitude and phase to geologic parameters of lithology, structures and stratigraphy using both models and real data. Prerequisite: Approval of instructor.
- 630. Interactive Seismic Interpretation. (0-3). Credit 1.** Introduces students to computerized interpretation used in modern exploration and reservoir studies. Prerequisite: GEOP 629 or concurrent enrollment or approval of instructor.
- 651. Theoretical Seismology. (3-0). Credit 3.** Wave propagation in unbounded and bounded elastic media; seismic reciprocity and the elastodynamic representation theorem; radiation patterns from earthquake sources; body waves, Rayleigh waves, Stoneley waves, Love waves and Lamb waves; characteristic equation for surface waves in a layered half-space; dispersion and phase and group velocities; methods of stationary phase and steepest descents; Cagniard-deHoop technique; ray theory in an inhomogeneous earth; inversion of travel times; viscoelastic wave propagation; normal modes of vibration of the earth. Prerequisite: GEOP 652 or approval of the instructor. (Offered in alternate years.)
- 652. Earthquake Seismology. (3-0). Credit 3.** Seismometry and earthquake precursors; mathematical theory of elasticity and its application to earthquake studies; dissipation of elastic energy; seismic sources; earthquake risk; free modes of the earth; discrimination between underground nuclear explosions and earthquakes. Prerequisite: GEOP 421 or approval of instructor.
- 655. Borehole Acoustic. (3-0). Credit 3.** Introduces propagation of acoustic waves in boreholes, with applications to petroleum exploration and comparisons to other waveguide phenomena in the earth sciences; survey of full waveform acoustic logging and influence of borehole modes for crosswell and vertical seismic profile experiments; exercised in data analysis with industry software. Prerequisite: GEOP 421 or GEOP 652 or approval of instructor.
- 660. Physics of the Earth's Interior. (2-3). Credit 3.** Structure, composition and physical state of the Earth's interior; constraints on models of the Earth imposed by seismic, gravity, heat flow, and electrical conductivity; thermodynamics and high pressure mineral physics; Earth's motion and deformation; rheology. Prerequisite: Graduate classification.
- 661. Reservoir Rock Physics. (3-2). Credit 4.** Poroelasticity and electrostatics of porous media; Biot Theory, Gassman fluid substitution and advanced rock physics models; relationships between seismic/electromagnetic properties and multiphase reservoir properties such as porosity, saturation, permeability, wettability, connectivity and other pore-structure parameters; computer-based rock physics modeling; application to reservoir characterization; time-lapse reservoir monitoring. Prerequisite: Approval of instructor. (Spring, alternate years.)

- 666. Principles of Geodynamics. (4-0). Credit 4.** Geological and geophysical methods and phenomena pertinent to geodynamics; plate tectonics; seismicity and seismology; magnetics; gravity; heat flow; igneous, metamorphic and sedimentary petrology; paleontology; and rock mechanics. Prerequisite: Approval of instructor. Cross-listed with OCNG 666.
- 681. Seminar. (1-0). Credit 1.** Discussion of subjects of current importance. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 6 each semester.** For graduate students to undertake limited investigations not within their thesis or dissertation research and not covered in established curricula. Prerequisites: Graduate classification and approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of geophysics. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research toward thesis or dissertation.

College of Geosciences (GEOS)

- 601. Polar Regions of the Earth: Science, Society, and Discovery. (3-0). Credit 3.** Disciplines and topics that define modern polar science in the north and south; includes history of the Polar Regions, polar geosciences, major polar scientific projects, and special topics; participate as individuals and teams in education, outreach and science projects. Prerequisite: Graduate classification.
- 642. Past Climates. (3-0). Credit 3.** Terrestrial and marine proxy records of past climate variability, including tree rings, coral, and sediments; past climate change events such as the Little Ice Age and Medieval Warm Period; greenhouse gases and global temperature; insight into the nature of climate change and challenges humankind faces in the next few centuries. Prerequisite: Graduate Classification. Cross-listed with GEOG 642.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of geosciences. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.

German

(faculty, see [page 413](#))

(GERM)

- 603. Introduction to Scientific German. (3-0). Credit 3.** Intensive course to prepare graduate students to read scientific material; technical vocabulary and translation. May not count for hours in a supporting field. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems in the field of German. Prerequisite: Approval of department head.
- 692. Readings. (3-0). Credit 3.** Readings in German literary texts in the original language. Prerequisite: Graduate classification.

Department of Health and Kinesiology

R. B. Armstrong, W. S. Barnes, P. J. Batista, G. R. Bennett, S. A. Bloomfield, J. D. Brender, J. J. Buchanan, C. J. Bunting, A. R. Carter, L. Chen, D. D. Christou, E. Christou, S. F. Crouse, G. B. Cunningham, M. E. Dennis, J. D. Fluckey, C. P. Gabbard, P. Goodson, J. S. Green, C. M. Greenwood, J. J. Guidry, R. B. Kreider (Head), J. M. Lawler, J. T. Lightfoot, R. E. McBride, E. L. McKyer, M. P. Massett, R. Misra, J. W. Peachey, B. E. Pruitt, S. E. Riechman, M. D. Shaw, C. H. Shea*, J. Singer, C. Woodman, D. L. Wright, P. Xiang

* Graduate Advisor

The following graduate degrees are offered in the department.

Master of Science (MS) in Athletic Training: is an entry-level athletic training program for students who do not hold a bachelor's degree in athletic training but who wish to pursue athletic training credentials by the Board of Certification (BOC) and pursue a career as a Certified Athletic Trainer (ATC).

Joint Bachelor of Science/Master of Science (BS/MS) in Health Education: Allows for a seamless transition from the B.S. degree to the M.S. degree for exceptional undergraduate students. The program is designed to prepare advanced level health educators.

Master of Science (MS) in Health Education: is a theory-based degree that provides advanced training with emphases in health education. There are non-thesis and thesis options.

Master of Science (MS) in Kinesiology: provides advanced training in the general area of kinesiology with an emphasis on research. Within this broad option, students may elect more specialized study in clinical exercise physiology, exercise physiology, motor behavior, sport pedagogy and sport physiology. Both thesis and non-thesis options are offered.

Master of Science (MS) in Sport Management: provides advanced training in the general area of sport management. Both thesis and non-thesis options are offered.

Doctor of Philosophy (PhD) in Health Education: prepares students for research in health education. Graduates may aspire to research-oriented positions in public or higher education and schools of allied health as well as voluntary or governmental health and/or safety agencies. Graduates of this program are prepared for careers in teaching and research in each of these areas.

Doctor of Philosophy (PhD) in Kinesiology: prepares students for post-doctoral appointments and positions in universities, industry, the military and research institutes. Graduates are trained for teaching and research careers in the following specialization.

Exercise Physiology: The program prepares students to conduct research in basic and applied exercise physiology. Emphases in the applied programs are in neuromuscular efficiency and control, cardiorespiratory response to exercise, exercise and lipid metabolism, and changes in bone structure and metabolism in response to exercise as well as disuse, bed rest and micro gravity. Emphases in basic research include mechanisms of exercise-induced injury, neuromuscular efficiency, muscle blood flow, muscle metabolism and free radical stress, and the molecular biology of bone adaptation to stress.

Motor Behavior: The program is experimentally oriented and is specifically designed to provide students with a thorough foundation in the theoretical processes that assist the performance and learning of perceptual-motor skills. Emphases in motor learning, motor control and motor development are offered.

Sport Management: The program prepares students to conduct research in applied and basic areas of sport management. Emphases in the applied areas are in organizational and group diversity; the underrepresentation of women and ethnic minorities in sport organizations; organizational effectiveness; organizational structure and strategy; organizational change; sport marketing; and consumer behavior. Emphases in the basic areas focus on relational demography; intergroup processes; and sport consumer behavior. Special areas of research correspond to those of the sport management faculty.

Sport Pedagogy: This specialization prepares students to design and conduct research on teaching/teacher education and curriculum and instruction, with an emphasis on linking theory to physical education practice. Interdisciplinary collaboration and research across the College of Education and Human Development are viewed as integral components of the sport pedagogy program.

Health (HLTH)

- 605. Health Research Methods. (3-0). Credit 3.** Designing and conducting health education and health promotion research including survey design, sampling, data collection, management and analysis. Prerequisite: Graduate classification.
- 607. International Health. (3-0). Credit 3.** Health and health care delivery around the world; how various organizations are addressing global health concerns; includes emerging diseases, eradication of disease, global nutrition, family planning; emphasis on providing health information on a cross cultural environment. Prerequisite: Graduate classification.
- 609. Applied Epidemiology. (3-0). Credit 3.** Principles and methods of epidemiology; epidemiologic investigation and research are discussed with emphasis on application of epidemiological methods to health promotion and disease prevention. Prerequisite: Graduate classification.

- 610. Health Assessment. (3-0). Credit 3.** Concepts and procedures of health assessment, interpretation of health appraisal instruments; function of health assessment in health education, health promotion and wellness programs. Prerequisite: HLTH 425 or course in statistics.
- 611. Organization and Administration of Health. (3-0). Credit 3.** Organizing and management of public health education and health promotion programs; public health administration issues and management skills emphasized. Prerequisite: Graduate classification.
- 622. Issues and Trends in Health Education. (3-0). Credit 3.** Background and development of health education as an applied science; current issues and trends in health education and their implications for health education.
- 629. Environmental Health. (3-0). Credit 3.** Examination of environments that threaten health and implications for human health and community health planning; emphasis on planning and implementing health education and promotion strategies to promote a healthy environment. Prerequisite: Graduate classification.
- 630. Health Program Planning. (3-0). Credit 3.** Public health education and promotion program planning including educational diagnosis, selection of educational strategies, program implementation and evaluation; using planning models. Prerequisite: Graduate classification.
- 631. Community and Public Health. (3-0). Credit 3.** Community health problems; public health laws; national, state and local health agencies.
- 632. Health Program Evaluation. (3-0). Credit 3.** Evaluation of public health education and promotion programs; overview of theory of program evaluation, methodology and application. Prerequisite: Graduate classification.
- 634. Women's Health. (3-0). Credit 3.** Health and health care concerns of women; emphasis on importance of women's health issues to public health; identification of special concerns for planning and implementation of women's health programs. Prerequisite: Graduate classification.
- 635. Race, Ethnicity and Health. (3-0). Credit 3.** Explore racial, ethnic, and cultural dimensions that underlie health and health disparities; special attention to culture, social economic status, and governmental policies as they influence the adaptations of health practices. Prerequisite: Graduate classification.
- 639. Behavioral Foundations of Health Education. (3-0). Credit 3.** Theoretical and historical foundations of health behavior research: emphasis placed on understanding and predicting behavior, as well as facilitating behavior change programs through health education.
- 640. Health Intervention and Wellness. (3-0). Credit 3.** Wellness as a concept and a process; systematic planning, implementation and evaluation of wellness programs and review of research relating to the efficacy of wellness programs and methods. Prerequisite: HLTH 415 or equivalent.
- 641. Foundations in Health Education. (3-0). Credit 3.** Introduction to the profession of Health Education; basic history, philosophy, theory, and standards; responsibilities and competencies of the health educator; methods of practice. Prerequisites: Graduate classification; admission to E-Master's program in Health Education.
- 642. Health Education Ethics. (1-0). Credit 1.** Basic concepts in health education ethics; ethical dilemmas faced by health educators; articulated ethics framework; includes fairness, justice, and the reduction of unjust disparities in the health education practice. Prerequisites: Graduate classification; admission to E-Master's program in Health Education.
- 643. Introduction to Epidemiology. (2-0). Credit 2.** Principles and methods of epidemiology; epidemiologic investigations and research; emphasis on application of epidemiological methods for health promotion and disease prevention. Prerequisites: Graduate classification; admission to E-Master's program in Health Education.
- 644. Health Education Theory. (3-0). Credit 3.** Theory in the practice of Health Education; selected theories and their structure, function, and value to health professionals. Prerequisites: Graduate classification; admission to E-Master's program in Health Education.
- 645. Health Education Research and Program Evaluation. (3-0). Credit 3.** Design and conduct health education and health promotion research and evaluation; provide an overview of program evaluation and research theory, methodology, and application. Prerequisite: Graduate classification; admission to E-Master's program in Health Education.

- 646. Health Education Training. (3-0). Credit 3.** Designing, implementing, and evaluating workforce training for professional health educators; emphasis on evidence-based workforce training. Prerequisites: Graduate classification; admission to E-Master's program in Health Education.
- 649. Advanced Health Behavior Theory. (3-0). Credit 3.** Examine the nature of theoretical thinking and its application to health research design, analysis, and program development; explore new theoretical trends in health education sciences research and education; exposed to an informed critique of current health behavior theories and their uses. Prerequisite: HLTH 639 or approval of instructor.
- 659. Writing for Health Educators. (3-0). Credit 3.** Provides students with practical application activities to enhance writing appropriate for entry level Ph.D. trained professionals in their field; course will be taught in a seminar format. Prerequisite: Graduate student.
- 660. Health Issues in Aging, Dying and Death. (3-0). Credit 3.** Health issues related to aging, dying and death including: health problems of aging individuals; community response to health problems of aging individuals; issues regarding definitions of death; bereavement, grief and mourning and educational implications of aging, dying and death. Prerequisite: Approval of instructor.
- 669. Professional Skills Development for Health Educators. (3-0). Credit 3.** Provide students with the tools necessary to become an effective health education professional; issues will be discussed that will be critical to the success of a future university faculty member. Prerequisite: Graduate student.
- 671. Interdisciplinary Seminar in Prevention Science. (1-0). Credit 1.** Contemporary research programs that represent interdisciplinary field of prevention science; strengths and limitations of diverse theoretical and conceptual bases of research in prevention science, application of research findings to issues related to the prevention of mental, emotional, and physical health problems and the promotion of well-being. May be taken 3 times for credit. Prerequisite: Graduate classification and enrollment in the interdisciplinary graduate certificate in prevention science or approval of instructor. Cross-listed with COMM 671, RPTS 620 and SPSY 620.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of topics of current interest in the discipline.
- 684. Professional Internship. Credit 1 to 6 each semester.** Designed to permit students the opportunity for on-the-job training with professionals in schools and public and institutional health agencies. Prerequisites: 12 semester hours of selected graduate work; approval of department head.
- 685. Directed Studies. Credit 1 to 12 each semester.** Directed study of selected problems within the discipline. May be repeated for credit. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of the discipline. May be repeated for credit. Prerequisite: Approval of department head.
- 690. Theory of Research in the Discipline. (3-0). Credit 3.** Theory and design of research problems and experiments in various subfields of the discipline; communication of research proposals and results; evaluation of current research of faculty and students and review of current literature. May be repeated for credit. Cross-listed with KINE 690.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of committee chair.

Department of Hispanic Studies

V. Arizpe, A. Cieslicka, R. K. Curry, N. J. Dyer, E. Espina, J. C. Galdo, R. Heredia, B. Imhoff, H. Kallendorf*, A. Lawo-Sukam, V. Loureiro-Rodriguez, A. Luiselli, S. J. Miller, S. M. Misemer, J. L. Mitchell, T. J. Mitchell, A. Moreiras (Head), M. I. Moyna, M. E. Quintana, E. Urbina, R. J. Vela, T. M. Vilaros, J. P. Villalobos

* Graduate Advisor

Graduate work in Hispanic Studies will directly prepare the student for professional careers concerned with Spanish and bilingualism, for teaching positions and for further graduate studies. A high competence in the Spanish language is required. This competence also assists the student in pursuit of professional employment outside of traditional areas.

The Ph.D. in Hispanic Studies is an interdisciplinary program with a set of required core courses and four overlapping concentrations. The four concentrations are as follows: Hispanic Literatures, Linguistics and Pedagogy, Hispanic Cultural Studies, and Bilingual/Bicultural Studies. Coursework for the program includes

12 hours of core courses, 15 hours of courses prescribed by concentration, 12 hours of elective courses in Hispanic Studies, and 6 hours of free elective courses. The program also requires an original dissertation, as well as reading proficiency in a language other than English and Spanish.

The Master of Arts program offers courses in Peninsular Spanish literature, Spanish American literature, language and linguistics, Hispanic literature of the United States, and Hispanic folklore and culture. A minimum of 6 credit hours must be taken in a selected minor field. A non-thesis option and thesis option are available.

Prerequisites: Admission to graduate studies and an undergraduate degree in Spanish or an equivalent competence in Spanish language and literature.

Hispanic Studies (HISP)

- 600. Introduction to Hispanic Studies. (3-0). Credit 3.** Examination from an interdisciplinary perspective of the cultural history of the Hispanic world, with particular emphasis on what the different disciplinary approaches reveal about literature, language, historical development and socioeconomic issues. Prerequisite: Graduate classification.
- 601. Research, Theory and Writing. (3-0). Credit 3.** Orientation to traditional and new issues in advanced study of Spanish-language literature, linguistics, cultural studies; mechanics and ethics of scholarly procedure and bibliographical guidance on original research project; and individually-tailored Spanish-language writing practicum. Prerequisite: Graduate classification.
- 602. Spanish Applied Linguistics. (3-0). Credit 3.** Current linguistic research that investigates real-world issues related to Spanish language use and the acquisition of Spanish as a second language. Prerequisite: HISP 600.
- 603. Development of the Spanish Language. (3-0). Credit 3.** The origin and development of the Spanish language from pre-Roman to modern period with emphasis on the socio-historical contexts; analysis of literary and documentary evidence of linguistic evolution. Prerequisite: HISP 602 or approval of instructor.
- 606. Spanish in the United States. (3-0). Credit 3.** In-depth description and analysis of Spanish varieties spoken in the United States, by both traditional and new immigrant populations, including New Mexico and Louisiana Spanish, Mexican, Cuban, Puerto Rican, Dominican, Central and South American dialects; topics include accommodation, koinéization, borrowing, code-switching, attitudes and policies related to language maintenance and shift. Prerequisite: Graduate classification and proficiency in Spanish.
- 607. Seminar in Spanish Linguistics. (3-0). Credit 3.** Intensive investigation of an issue important to understanding historical linguistics, dialectology, sociolinguistics, developments in theoretical and applied linguistics. May be repeated for credit as content varies. Prerequisite: HISP 602 or approval of instructor.
- 614. Spanish Dialectology. (3-0). Credit 3.** Analysis of regional linguistic variation from a synchronic and diachronic perspective; topics include varieties spoken in Spain, the Americas, and worldwide; dialect diversification, contact varieties, Spanish-based pidgins and creoles. Prerequisite: Graduate classification and proficiency in Spanish.
- 618. Hispanic Folklore and Popular Culture. (3-0). Credit 3.** An examination of popular literature and other cultural forms in the Hispanic world. Students will learn to appreciate, evaluate, and compare written and oral traditional formats, and acquire methods of analyzing language and cultural artifacts that reflect recent research trends. Prerequisite: Graduate classification.
- 620. Studies in Critical Theory. (3-0). Credit 3.** Examination of the development of theories of literary criticism and their application to the study of literary texts. Prerequisite: Graduate classification.
- 625. U.S. Hispanic Literature and Culture. (3-0). Credit 3.** Study of the origins and evolution of U.S. Hispanic literature, culture and folklore, and U.S. Hispanic regional dialects. Prerequisite: Graduate classification.
- 630. Studies in Latin American Literature. (3-0). Credit 3.** Possible topics include colonial literature, the chronicles, Romanticism, Modernism, contemporary trends in the Latin American novel, the novel of the Mexican Revolution, Rubén Darío, contemporary Argentine fiction, the literature of revolution in Latin America, Afro-Hispanic literature, Hispanic Caribbean literature. May be taken 3 times for credit. Prerequisite: Graduate classification.

- 640. History of Ideas in the Hispanic World. (3-0). Credit 3.** Intensive study of cultural and ideological currents, especially as they are reflected in the works of essayists and other writers. Possible topics include Spain and European culture, European thought in Latin America, the Renaissance in Spanish literature and social life, Spain and the Western tradition, the search for national identity in Mexico, U.S. Hispanic nationalism. Prerequisite: Graduate classification.
- 645. Hispanic Women Writers. (3-0). Credit 3.** A study of the development of writing by women in the Hispanic world, including Spain, Latin America, and the United States. Topics include identity and nation, building of a feminine aesthetics, the reception of women writers, literary canons and exclusion, women and/in the Latin American boom, Latina writers in the United States. Prerequisite: Graduate classification.
- 646. Cultural Encounters and Borders, from Baroque to the Present. (3-0). Credit 3.** Topics include literature of marginalization in medieval Spain, colonial literature and the chronicles, Modernism, Vanguardism, contemporary trends in the Latin American novel, the novel of the Mexican Revolution, Afro-Hispanic literature, Hispanic Caribbean literature. Prerequisite: Graduate classification.
- 650. Methods of Study in Spanish Linguistics. (3-0). Credit 3.** Examination of various methods of linguistic analysis in Spanish, such as transformational grammar, socio- or psycholinguistics in Spanish. Prerequisite: Graduate classification.
- 653. Don Quixote and the Hispanic Novel. (3-0). Credit 3.** Don Quixote and the development of modern fiction, its influence in the Hispanic narrative tradition, from Fernández de Avellaneda to Pérez Galdós, G. García Márquez, and Carlos Fuentes, and presence in the U.S. Hispanic novel. Prerequisite: Graduate classification.
- 660. Reading and Research in Hispanic Cultural Studies. (3-0). Credit 3.** Independent research in specialized subjects not normally or not often included in the regular course offerings. May be taken 3 times for credit as content varies. Prerequisite: Graduate classification.
- 664. Hispanic Theatre. (3-0). Credit 3.** Topics include Golden Age drama and its antecedents, Neo-Classical movement in Spain, regionalized and criollo drama in Latin America, avant-garde and collective creation theatre, Teatro Campesino and Chicano movement drama, Hispanic performance artists. Prerequisite: Graduate classification.
- 665. Studies in Spanish Literature. (3-0). Credit 3.** Topics include El Cid, El Arcipreste de Hita, El Romancero, Spanish Renaissance poetry, Golden Age theater, Cervantes, Lope de Vega, Góngora and Gongorismo, eighteenth-century essayists, Galdós, the Generation of 98, Romanticism, Miguel de Unamuno, the theater of García Lorca, contemporary Spanish poetry, Spanish literature after Franco. Prerequisite: Graduate classification.
- 667. Hispanic Genre Studies. (3-0). Credit 3.** Selected topics in the works, authors, characteristics and classifications of a given genre cultivated by Hispanic writers. May be taken 3 times for credit as content varies. Prerequisite: Graduate classification.
- 670. Studies in U.S. Hispanic Literature. (3-0). Credit 3.** Topics include bilingual literature, Nuyorican literature, Cuban American literature, Chicano literature, the immigrant novel, ethnic autobiography, U.S. Hispanic theater, Chicano theater. Prerequisite: Graduate classification.
- 671. Bilingualism in the Spanish-speaking World. (3-0). Credit 3.** Linguistic, psycholinguistic, and social aspects of bilingualism and multilingualism with special reference to Spanish and the United States; bilingual speakers and bilingual acquisition; bilingual communities: language identity, language maintenance and shift; implications for education and society; written and oral manifestations of bilingualism in the media and arts. Prerequisite: Graduate classification.
- 672. Hispanic Film and Performance Arts. (3-0). Credit 3.** A theoretical and historical exploration of cinema and performance arts in the Hispanic world. The description and interpretation of films and performance arts such as flamenco and folkloric ballet with particular attention to history, ethnology, artistic trends, and tendencies and relationships to other arts. Prerequisite: Graduate classification.
- 675. Spanish Language Teaching Methods. (3-0). Credit 3.** Overview of the current language methodology as it applies to the teaching of Spanish to native and non-native speakers, pedagogical and professional issues related to teaching Spanish at the college level. Prerequisite: Graduate classification and approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems in the field of Spanish language or literature. Prerequisite: 12 hours of advanced courses in Spanish.

- 689. Special Topics in...** **Credit 1 to 4.** Selected topics in an identified area of Spanish. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research.** **Credit 1 or more each semester.** Thesis research credit given only upon acceptance of completed thesis. Prerequisite: Twelve hours of advanced courses in Spanish.

Department of History

R. J. Q. Adams, A. C. Alonzo, S. Alpern, T. H. Anderson, D. Baum, T. O. Bickham, J. K. Blackwelder, C. K. Blanton, C. A. Bouton, J. C. Bradford, H. W. Brands, C. E. Brooks, A. S. Broussard, W. L. Buenger, G. A. Chambers, J. C. Coopersmith, J. G. Dawson, L. DeVun, O. Dror, T. R. Dunlap, C. S. L. Dunning, S. Emre, K. C. Engel, A. L. Hatfield, F. Hinojosa, S. Hoffert, A. P. Hudson, W. D. Kamphoefner, H. Kim, A. J. Kirkendall, A. P. Krammer, J. H. Lenihan, B. M. Linn, H. C. Livesay, P. A. Mishra, E. M. B. Obadele-Starks, A. Palmer, J. C. Parker, L. Ramos, R. R. Reese, R. P. Resch, J. M. Rosenheim, B. J. Rouleau, R. H. Schloss, H. C. Schmidt, D. Schwartz, A. R. Seipp*, A. N. Stranges, K. R. Unterman, D. J. Vaught (Head), D. Wang, M. Warsh, J. E. Wood, L. W. Yarak

* Graduate Advisor

Graduate study in history leads to the degrees of Master of Arts and Doctor of Philosophy. The graduate program is designed to prepare students for careers in teaching, business, government and social service. Studies toward the PhD are also designed to produce research scholars.

Prerequisites: For a major in history at the master's level, the student must present a minimum of 24 semester hours (including 12 advanced hours) of acceptable undergraduate courses in history. A doctoral student will normally be expected to hold the MA degree. For further information concerning the requirements for the MA or PhD, contact the departmental graduate advisor.

Thesis option: The standard MA degree requires a minimum of 30 semester hours, including 24 hours of coursework and 6 hours of HIST 691-Research for the thesis. Of the 24 hours of coursework, 15 shall be taken in the major area of concentration and 9 in the minor field. The non-thesis MA degree option includes 36 semester hours of coursework. The PhD requires a minimum of 64 semester hours, including at least 18 semester hours of formal coursework divided into 2 areas of concentration: 1) a major area, 12 hours; and 2) a minor area, 6 hours. Additional required courses are set in consultation with the student's advisor.

MA students must demonstrate a reading knowledge of one foreign language. PhD candidates will normally demonstrate a reading knowledge of two foreign languages or, in the case of those with U.S. history as the major field, one foreign language.

History (HIST)

- 601. Colonial North America. (3-0). Credit 3.** The 17th- and 18th-century settlement of European North American colonies; slavery; comparisons of colonial administrations; interactions of Native Americans, Europeans, and African Americans across racial, ethnic, and cultural borders. May be taken two times for credit as content varies. Prerequisite: Graduate classification.
- 604. The Early Republic. (3-0). Credit 3.** War for Independence; organizing the new government; the Constitutions; Federalists and Jeffersonians; Wars of 1812 and 1846; race, class, and gender in Jacksonian society; political, social, cultural, economic and territorial changes. May be taken two times for credit as content varies. Prerequisite: Graduate classification.
- 613. Twentieth Century United States Diplomacy. (3-0). Credit 3.** U.S. foreign policies from end of Spanish-American War to present; scope, principles, practices, objectives, dangers and lessons learned. Prerequisite: Approval of department head.
- 615. Colonial Latin America. (3-0). Credit 3.** Social, ethnic, political, economic, religious, military, and cultural institutions in colonial Latin America, including attention to ethnohistory, women, and comparative colonial systems. Prerequisite: Graduate classification.
- 617. Latin America: The National Period. (3-0). Credit 3.** Social, ethnic, cultural, religious, political, and economic history of Latin America. Prerequisite: Graduate classification.
- 620. Sectionalism, Civil War and Reconstruction. (3-0). Credit 3.** Antebellum sectional divisions; causes of the Civil War; military campaigns and political and military leadership; the changing status of African Americans; social, political, economic, cultural and diplomatic developments; Reconstruction. Prerequisite: Graduate classification.

621. **The Emergence of Modern America. (3-0). Credit 3.** Social, political, economic and cultural developments in the late 19th and early 20th centuries; industrialization; labor and farmer unrest; immigration; frontier transitions, imperialism. Prerequisite: Graduate classification.
622. **War, Prosperity, and Depression. (3-0). Credit 3.** The United States from the early 20th century to 1945; World War I; changes in the 1920s; depression and the New Deal; military campaigns and political and military leadership in World War II; social, political, economic, cultural and diplomatic transitions. Prerequisite: Graduate classification.
623. **America since World War II. (3-0). Credit 3.** The Cold War; wars in Korea, Vietnam, and the Persian Gulf; the Civil Rights and Women's Rights Movements; immigration; social, cultural, and gender controversies. Prerequisite: Graduate classification.
626. **American Cultural and Intellectual History. (3-0). Credit 3.** Major themes, issues, and interpretations in the history of thought and culture in the United States. May be taken for credit two times as content varies. Prerequisite: Graduate classification.
628. **Historiography. (3-0). Credit 3.** Analysis of historical writing and philosophy of history; works of important historians from Herodotus to present; schools, theories and function of history. Prerequisite: Approval of department head.
629. **Research Methods and Professional Development. (3-0). Credit 3.** Prepares students for a career in history by exploring the practical side of the profession; includes life as a graduate student, teaching, research methods, ethics, grant-writing, conference papers, publishing, non-academic alternatives, and the job market. Prerequisite: Approval of Instructor.
630. **Quantitative Methods in Historical Research. (3-0). Credit 3.** Introduction to formal methods of analysis in historical research using computers; and applying quantitative methods to research problems. Prerequisite: Approval of instructor.
631. **Reading Seminar in United States History to 1877. (3-0). Credit 3.** Prerequisite: Approval of department head.
632. **Reading Seminar in United States History after 1876. (3-0). Credit 3.** Prerequisite: Approval of department head.
633. **The American West. (3-0). Credit 3.** Immigrants and settlement patterns; international conflicts; social, racial, ethnic and cultural interactions across frontiers and borders; economic developments; politics and admission of new states into the United States; women's and gender issues; environmental concerns. May be taken two times as content varies. Prerequisite: Graduate classification.
634. **Maritime History and Sea Power. (3-0). Credit 3.** Examines the maritime and naval history of the world with emphasis on the Western World since 1600; trade and communication, exploration, technology, maritime communities and naval warfare. Prerequisite: Graduate classification.
635. **Writing History. (3-0). Credit 3.** Development of writing skills for graduate students in history; preparation of publishable-quality article-length essays based on primary sources; peer review and criticism. Prerequisites: Graduate classification; approval of instructor.
636. **History of the American South. (3-0). Credit 3.** Economic developments, including cotton, other crops and industrialization; influence of slavery; social, racial, ethnic and cultural developments; women's and gender issues; environmental concerns. May be taken two times for credit as content varies. Prerequisite: Graduate classification.
637. **Early Middle Ages. (3-0). Credit 3.** Beginnings of Medieval Europe; barbarian migrations; early Christianity; social, political, religious, and cultural interaction across frontiers and borders. Prerequisite: Graduate classification.
638. **Medieval Europe. (3-0). Credit 3.** Institutional, social, cultural, and political developments; conflicts between Christianity and Islam across frontiers and borders; leadership of Charlemagne. Prerequisite: Graduate classification.
643. **Reading Seminar in European History from Renaissance to French Revolution. (3-0). Credit 3.** Reading seminar in European history from the Renaissance to the French Revolution, classic and current themes, debates and methodologies in European history from the Renaissance to the French Revolution. Prerequisite: Approval of Department Head.

- 644. Reading Seminar in European History from French Revolution to Present. (3-0). Credit 3.** Reading seminar in European history from the French Revolution to the present; classic and current themes, debates and methodologies in European history from the French Revolution to the present. Prerequisite: Approval of Department Head.
- 645. Modern Military History. (3-0). Credit 3.** Topics and issues in modern military history. May be taken two times for credit as content varies. Prerequisite: Graduate classification.
- 646. Readings in Military History. (3-0). Credit 3.** Selected topics and themes in military history; preparation for and conduct of war in different nations and among different peoples; social and cultural changes caused by military conflicts; developments in leadership, technology, military institutions, and civil-military relations. May be taken three times for credit as content varies. Prerequisite: Approval of instructor and director of graduate studies; graduate classification.
- 666. History of Technology. (3-0). Credit 3.** Origins of the subfield; historiography; industrial development and labor relations; impact on the military; gender, class, and other social aspects. Prerequisite: Graduate classification.
- 677. Modern Britain. (3-0). Credit 3.** Political, social, cultural, economic and diplomatic development of the United Kingdom in the 20th Century. May be taken for credit two times as content varies. Prerequisite: Graduate classification.
- 678. Comparative Border Studies. (3-0). Credit 3.** Questions how groups create, articulate, enforce, and challenge difference; brings together disparate historiographies to consider a variety of theoretical and methodological approaches used in understanding borders; examines contact, conflict, and change across various kinds of historical and cultural boundaries. Prerequisite: Graduate classification.
- 679. Topics in Comparative Border Studies. (3-0). Credit 3.** Selected topics and themes in an identified area of Comparative Border Studies. May be taken two times for credit as content varies. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 6 each semester.** Individual problems of research or scholarly activity not pertaining to thesis or dissertation, or selected instruction not covered by other courses. Prerequisite: Approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of American or European history. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Thesis research. Credit given only upon acceptance of completed thesis. Prerequisite: Approval of department head.

Department of Horticultural Sciences

M. A. Arnold, D. H. Byrne*, R. I. Cabrera, L. A. Cisneros-Zevallos, B. G. Cobb, K. M. Crosby, F. J. Dainello, F. T. Davies, Jr., T. D. Davis, M. Gu, C. R. Hall, E. W. Hellman, K. D. Hirschi, J. L. Jifon, J. L. Johnson, S. R. King, P. E. Klein, H. Koiwa, D. J. Leskovar, R. D. Lineberger (Head), L. Lombardini, J. G. Masabni, G. R. McEachern, J. C. Miller, Jr., S. D. Nelson, G. Niu, B. S. Patil, H. B. Pemberton, E. Pierson, L. M. Pike, D. W. Reed, T. W. Starman, A. Volder, A. B. Wagner, X. Wang, D. F. Welsh, D. C. Wilkerson, J. M. Zajicek

* Graduate Coordinator

Horticulture

Advanced work in horticulture may be conducted with areas of specialization in fruit production, nut production, vegetable production, ornamental horticulture and nursery crops, and fruit, nut and vegetable processing. Supporting work may be required in several of the related fields such as chemistry, botany, plant pathology, plant physiology, entomology, soils, genetics, nutrition and agricultural engineering. The specific objective of the individual student will guide his or her committee in the choice of courses from the departments mentioned above and others in special cases.

Programs of study leading to the Master of Agriculture, Master of Science and Doctor of Philosophy degrees are available.

(HORT)

- 601. Nutrition of Horticultural Plants. (3-3). Credit 4.** Principles of nutrition related to horticultural plants; micro- and macronutrients; root uptake; short- and long-distance transport; management practices of fruit, nut, ornamental and vegetable plants; development of skills in nutrition research. Prerequisite: MEPS 313 or approval of instructor.*
- 604. Applied Physiology of Horticultural Crops. (3-0). Credit 3.** Chemical, biological and environmental factors in growth and differentiation and their application to ornamental, fruit and vegetable crops; growth kinetics; source-sink relations; fruit development; seed development and germination; juvenility; apical dominance; growth retardants; pruning; photoperiodism; flowering; sex expression; and senescence. Prerequisites: MEPS 313 or approval of instructor.
- 605. Internet Applications for Horticulture. (2-2). Credit 3.** Internet applications for horticulture presents the theory and practice of computer networks and networking so that the information and educational content (not the hardware) is the key; the focus is on the World Wide Web and creating Web materials for teaching, research and extension applications. Prerequisite: Graduate classification.
- 608. Plants for Landscape Design. (3-2). Credit 4.** Identification and use of indigenous and introduced plants in landscape designs; plants for special uses in commercial and residential developments; emphasis on ornamental attributes, identification, cultural requirements, limitations and adaptability in urban and suburban environments for important taxa; discussion of current issues, research, and trends in selection, marketing, and utilization of plants for landscape design. Prerequisite: HORT 201 or HORT 308 or BIOL 101, or approval of instructor, not open to students with previous credit for HORT 306.*
- 609. Plants for Landscape Design II. (3-2). Credit 4.** Identification and use of indigenous and introduced landscape plants; plants for special uses in urban environments; emphasis on plants' ornamental attributes, cultural requirements, and adaptability in urban and suburban environments. Not open to students who have completed HORT 308. Prerequisites: BOTN 101, HORT 201, HORT 306, HORT 608, or approval of instructor.
- 610. Physiological and Molecular Basis for Plant Stress Response. (3-0). Credit 3.** Provide the student with tools to understand the molecular and physiological consequences caused by environmental factors (abiotic and biotic) on plant growth and development and the mechanisms of stress adaptation to stress. Prerequisite: MEPS 313 or equivalent. Cross-listed with MEPS 610.
- 611. Ecology of Urban Landscape. (3-0). Credit 3.** Basic concepts and current topics in ecology or urban landscapes. Role of plants in urban and fragmented ecosystems ranging from individual plant responses to changes in ecosystem function. Students will discuss recent literature in the field of urban plant ecology. Prerequisite: An undergraduate or graduate class in plant biology or plant ecology is recommended.
- 618. Root Biology. (3-0). Credit 3.** Basic concepts and current topics in root-soil ecology; managed and natural ecosystems including grasslands, cropping systems and forests; role of roots in the rhizosphere, the effects of soil, nutrient and water stress and climate change in C and N cycling and carbon sequestration; participate in discussions and critique recent literature. Prerequisite: Approval of instructor. Cross-listed with MEPS 618.
- 622. Citrus and Subtropical Fruits. (3-0). Credit 3.** Various types of citrus; identification, culture, processing, marketing, and the economic future; prepares students to function in a continuously changing production environment in production areas. Prerequisite: Approval of instructor.
- 626. International Floriculture Marketing. (2-2). Credit 3.** Importance, cost and opportunities in marketing floral products, fresh cut flowers, flowering potted plants, foliage plants, and bedding/garden plants; topics include world production areas, economic value, species grown, marketing channels, retail environments, current/future consumers, postharvest handling, promotion/advertising, perceived/added value, marketing trends and employment opportunities. Prerequisite: Graduate classification.
- 630. Post-Harvest Biology, Physiology and Genetics of Plants. (3-0). Credit 3.** Overview of biological, physiological and genetic mechanisms which impart phenotypes associated with quality and value of plant products; current emphasis in areas of ripening, senescence, fruit and flower development, and relevant applications of biotechnology will be focus of course. Prerequisite: Approval of instructor. Cross-listed with MEPS 630.

- 640. Phytochemicals in Fruits and Vegetables to Improve Human Health. (3-0). Credit 3.** Current scientific knowledge about the role of phytochemicals in their diet; increase the knowledge and awareness of successful, cost effective, public and private integrated approaches to reduce the health and economic burden of chronic diseases; provide instructional curricular resources media for dissemination through conventional and distance education technology. Prerequisite: Approval of Instructor.
- 644. Food Quality. (3-0). Credit 3.** Physical, chemical and biological properties of foods; fundamental attributes of flavor, color, odor and texture; esthetic, ethnic and nutritional requirements; role of additives; regulatory standards and quality control regimes; current techniques in food investigations.*
- 645. World Agriculture and International Plant Breeding. (1-0). Credit 1.** Evolution of world agriculture; plant breeding and improved varieties; international agricultural research centers and green revolution; population growth; environmental challenges; IPR; role of plant breeding and biotechnology in meeting world food needs. Prerequisite: SCSC 304, HORT 404 or approval of instructor. Cross-listed with SCSC 645.
- 681. Seminar. (1-0). Credit 1.** Student and staff participation in review of literature and reporting on current developments in research on production and processing of horticultural crops. Required of all graduate students in horticulture and floriculture.
- 684. Professional Internship. Credit 1 to 4.** Program planned to provide professional training in student's particular field of interest. Faculty and employer will supervise the activity. Work-study planned as a part of the Master of Agriculture degree program in fruit, ornamentals or vegetable production, processing and handling or landscape or garden design and maintenance. Prerequisite: Approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Individual problems of research or scholarly activity not pertaining to thesis or dissertation, or selected instruction not covered by other courses. Final documentation of directed study is required. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of horticulture. May be repeated for credit. Prerequisite: Approval of department head.
- 690. Theory of Research. (1-0). Credit 1.** Design of research experiments in various fields of horticulture and floriculture and evaluation of results with the aid of examples taken from the current scientific literature. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research in horticultural problems for thesis or dissertation.
- 693. Professional Study. Credit 1 to 9.** Approved professional paper undertaken as the requirement for the Master of Agriculture. May be taken more than once, but not to exceed 3 hours of credit towards a degree. Prerequisite: Graduate classification.

* Field trips required for which departmental fee may be assessed to cover costs.

Humanities

(faculty, see [page 513](#))

(HUMA)

- 685. Directed Studies. Credit 1 to 6.** Directed studies in specific problem areas in the humanities. May be repeated for credit. Prerequisite: Approval of instructor.

Industrial Distribution

(faculty, see [page 407](#))

(IDIS)

The Dwight Look College of Engineering offers a web-based, graduate program leading to the degree of Master of Industrial Distribution (MID). Enrollment in MID classes is restricted to students who have been admitted to the MID program. The program of study has been designed for individuals with interest and/or background in industrial and high technology channels. See [page 120](#) of this catalog for details on MID.

- 611. Current Issues in Industrial Distribution. (3-0). Credit 3.** Contemporary issues and trends affecting participants in the industrial distribution industry; opportunities and challenges for leaders identified and explored from the perspective of industrial distributors, manufacturers and end users. Prerequisite: Enrollment in the MID program.

- 614. Industrial Distributor Networks. (3-0). Credit 3.** Industrial distributor's network channel in distribution centers, warehouse management systems, hot-shot and standard truck fleets, forecasting and purchasing strategies for technical products; an examination of the integration of the field and inside sales force into distributor network strategy. Prerequisite: Enrollment in the MID program.
- 621. Industrial Distributor Processes I. (3-0). Credit 3.** Industrial distributor processes with an emphasis on assessing the value added effectiveness of specific industrial distributor initiatives. Prerequisite: IDIS 644.
- 622. Industrial Distributor Processes II. (3-0). Credit 3.** Continuation of IDIS 621. Prerequisite: IDIS 621.
- 624. Strategic Relationships for Industrial Distributors. (3-0). Credit 3.** Issues related to establishing and maintaining a beneficial relationship between distributors and manufacturers; developing effective buyer-seller relationships in the industrial distribution sector. Prerequisite: Enrollment in the MID program.
- 634. Quality Concepts in Industrial Distribution. (3-0). Credit 3.** Concepts, issues and techniques used to plan, analyze, control, and improve the quality of industrial distribution products and processes for increased consumer satisfaction. Prerequisite: IDIS 655.
- 644. Industrial Distributor Information and Technology Management. (3-0). Credit 3.** Industrial distributor's use of information systems to manage operations; combination of information systems and automation to achieve increased cross docking drop ships and automated tracking of industrial distributor operations metrics. Prerequisite: IDIS 614.
- 655. Global Distribution. (3-0). Credit 3.** Issues in global distribution on a small to large scale; emphasis on competitive global business strategies, cultural and exchange issues, distribution practices of other countries, global distribution networks, and transportation issues across the globe; an optional one week international trip to solidify students' foundation in international distribution concepts and strategies. Prerequisite: IDIS 611.
- 664. Distribution Profitability Analysis. (3-0). Credit 3.** Integrating advanced financial and accounting analysis useful to distribution executives in assessing the financial performance of distribution operations. Concepts and techniques in using financial statements and industrial distribution industry studies to manage cash flow, debt, working capital risk, capital budgeting, credit, receivables, inventory, personnel and profitability. Prerequisite: IDIS 624.
- 674. Industrial Distribution Enterprise. (3-0). Credit 3.** Explore changing environment of industrial distribution from globalization effects, environmental conditions, industrial distribution culture and organizational factors; focus on building, achieving and sustaining a competitive advantage. Prerequisite: IDIS 664.
- 685. Directed Studies. Credit 1 to 6.** Individual and group problems dealing with application of industrial distribution theory and practice; foreign and domestic projects of special interest. May be repeated for credit. Prerequisites: Enrollment in the MID program and approval of program director.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of industrial distribution. May be repeated for credit. Prerequisite: Approval of MID program director.
- 693. Professional Study. Credit 1 to 6.** Approved professional study project in industrial distribution; preparation of a record of study summarizing the rationale, procedure and results of the completed study. Prerequisite: Approval of MID program director.

Department of Industrial and Systems Engineering

A. P. Banerjee, G. K. Bennett, J. E. Bickel, S. Butenko, S. Cetinkaya, G. L. Curry*, A. V. Deshmukh, Y. Ding, N. C. Ellis, R. M. Feldman, T. K. Ferris, G. M. Gaukler, N. Gautam, I. V. Hicks, A. L. Johnson, K. Kianfar, G.-A. Klutke, R. J. Koppa, V. J. Leon, S. A. McComb, C. O. Malave (Interim Head), E. Moreno-Centeno, L. Ntamo, B. A. Peters, D. T. Phillips, K. F. Reinschmidt, D. R. Smith, E. Tekin, H. Uster, W. E. Wilhelm, M. A. Wortman, J. T. Yates

* Graduate Advisor

The department offers Master of Science (MS), Master of Engineering (MEng) and Doctor of Philosophy (PhD) degrees in industrial engineering. Facilities for study and research are excellent, and participation in research is an integral part of the PhD program.

Departmental faculty working in diverse areas of industrial engineering provide students with a wide range of opportunities to gain valuable research experience. Faculty members are presently involved in research in applied statistical analysis, mathematical optimization, stochastic processes, production and inventory control, manufacturing processes and system organization, networks, systems simulation, manufacturing system analysis, quality and reliability engineering, transportation systems and logistics.

There is no foreign language requirement for the PhD in industrial engineering. Students in the industrial engineering PhD program are required to pass a departmental qualifying exam within three semesters of starting the program, and PhD students are required to maintain a GPR of 3.50 for courses on their degree plans, in order to take the Preliminary Exam and the Final Exam.

Industrial and Systems Engineering (ISEN)

601. **Location Logistics of Industrial Facilities. (3-0). Credit 3.** Selection of the optimal locations of industrial plants and distribution centers through analytical modeling of the costs of inventory storage, transportation, utilities, labor supply and other cost components. Prerequisites: ISEN 620.
602. **Applications of Random Processes. (3-0). Credit 3.** Introduction to probability and random processes as a basis for studying topics in industrial engineering and operations research. Prerequisites: ISEN 609; STAT 212 or STAT 601.
603. **Advanced Logistics. (3-0). Credit 3.** Topics in logistics including measures of logistical systems performance, facilities location—allocation, production/distribution system design, transportation network design, vehicle routing; emphasis on mathematical modeling based on large scale integer programs and solution approaches for general network design problems. Prerequisites: ISEN 601, ISEN 622, ISEN 623, ISEN 668 or approval of instructor.
604. **Competing on Information Flows in Supply Chains. (3-0). Credit 3.** Review, evaluate, and contribute to the existing knowledge base regarding the management of information flows from automatic identification systems such as RFID. Prerequisites: ISEN 615 and PhD students or Masters students with a thesis degree plan or approval of instructor.
605. **Material Handling Systems. (3-0). Credit 3.** Analysis and design of integrated material handling systems; automatic storage and retrieval of unit loads, and identifying and establishing boundary conditions on key parameters required to specify the desired system required for equipment vendors to design appropriate hardware. Prerequisites: ISEN 420; ISEN 416.
608. **Industrial Case Analysis. (3-0). Credit 3.** Practice in applications of principles to the solution of actual case problems involving broad management decisions. Prerequisite: Approval of instructor.
609. **Probability for Engineering Decisions. (3-0). Credit 3.** Introduction to probability and stochastic processes for characterization of uncertainty in engineering decisions. Prerequisite: Approval of instructor.
611. **Foundations of Technology Evaluation and Assessment. (3-0). Credit 3.** Quantifying gambles arising in engineering activities associated with the design, deployment, and operations of technology; analytical foundations of technology evaluation and assessment from an engineering perspective; focus on examination of probability models supporting quantification of value and risk. Prerequisites: ISEN 609 or approval of instructor.
612. **Design by Reliability. (3-0). Credit 3.** Quantitative reliability analysis in engineering design. Reliability methods applicable to risk based design, component reliability and degradation, static and dynamic system reliability modeling and analysis, life testing, stress/strength analysis, and fault tree analysis. Prerequisites: ISEN 609; STAT 414.
613. **Engineering Data Analysis. (3-0). Credit 3.** Selected topics in probability and data analysis for quality in engineering problems; measurement principles, data collection and data analysis to solve quality engineering problems. Introduction to courses in the assurance sciences—reliability, maintainability, quality control and robust design.
614. **Advanced Quality Control. (3-0). Credit 3.** Advanced methods applied to quality control and anomaly detection; classical treatments and recent developments in statistical process control; evaluation, design and maintenance of quality control programs; focus on monitoring and root cause identification. Prerequisite: STAT 212 or STAT 601.

- 615. Production and Inventory Control. (3-0). Credit 3.** Model development for inventory management and for production planning; production control models for line balancing, lot sizing, dispatching, scheduling, releasing, kitting, MRP and just-in-time with treatment of flexible manufacturing and assembly. Prerequisites: ISEN 620; ISEN 609.
- 616. Design and Analysis of Industrial Experiments. (3-0). Credit 3.** Fundamental theory, concepts and procedures required for industrial experimental design, statistical data analysis, and model building, with emphasis on engineering formulations and applications. One-factor experiments with and without restrictions on randomization, treatment comparison procedures, Latin and other squares, factorial experiments, full and fractional two-level factorial experiments, blocking in factorial designs, response surface methodologies and introduction to Taguchi methods. Prerequisite: STAT 212 or STAT 601.
- 617. Quantitative Models for Supply Chain Coordination. (3-0). Credit 3.** Concepts, complexities, and models pertaining to supply chain management and relate these to recent practical initiatives; includes channel coordination models, supply chain contracting, and vendor-managed, inventory models. Prerequisites: ISEN 615, ISEN 623, and ISEN 609 or STAT 615 or approval of instructor.
- 618. Stochastic Processes in the Assurance Sciences. (3-0). Credit 3.** Stochastic processes necessary to deal with advanced problems in reliability, maintainability and other related areas. Prerequisite: ISEN 602.
- 619. Analysis and Prediction. (3-0). Credit 3.** Data-mining methods and data-driven models; statistical model building and parameter estimation for Markov processes; sampling of dynamic systems with random disturbances; on-line identification algorithms; design of time-series control charts for process monitoring; multivariate analysis; applications using real data. Prerequisite: ISEN 609.
- 620. Survey of Optimization. (3-0). Credit 3.** Theory and numerical methods for deterministic linear and nonlinear optimization; topics include linear programming, unconstrained-nonlinear optimization, constrained-nonlinear optimization, Lagrange and K-K-T conditions, and numerical algorithms. Prerequisite: MATH 304 or MATH 311.
- 621. Heuristic Optimization. (3-0). Credit 3.** Focus on heuristic optimization methods that search beyond local optima; includes neighborhood search methods and advanced search strategies such as genetic algorithms, simulated annealing, neural networks, tabu search, and greedy randomized adaptive search procedures. Prerequisites: ISEN 620 or ISEN 622 or approval of instructor.
- 622. Linear Programming. (3-0). Credit 3.** Development of the mathematics and algorithms associated with linear programming; convex sets and cones, polyhedral sets, duality theory, sensitivity analysis, simplex, revised simplex and dual simplex methods; also covered are bounded variables, column generation, decomposition, integer programming; computer assignment. Prerequisite: MATH 304.
- 623. Nonlinear and Dynamic Programming. (3-0). Credit 3.** Understanding of algorithms for nonlinear optimization; development of optimality conditions and different types of algorithms for unconstrained and constrained problems; formulation and solution of many types of discrete dynamic programming problems. Prerequisite: MATH 304.
- 624. Applied Distribution and Queueing Theory. (3-0). Credit 3.** Queueing theory and its applications; single and multiple channels, priorities, balking, batch arrivals and service, and selected non-Markovian topics. Prerequisite: ISEN 609 or ECEN 646.
- 625. Simulation Methods and Applications. (2-3). Credit 3.** Fundamental methodologies of simulation modeling; random number and variate generation, statistical analysis of model output, and discrete event modeling using a commercial simulation language. Prerequisite: STAT 212 or STAT 601.
- 626. Model Building and Applications of Operations Research. (3-0). Credit 3.** Problem-solving environment exposing students to a variety of unstructured problems in operations research requiring organization, formulation and solving an appropriate model. Selection and use of an efficient technique. Computer solution procedures. Selected readings in current literature. Prerequisite: Approval of instructor.
- 627. Engineering Analysis for Decision Making. (3-0). Credit 3.** Principles and application of techniques in analysis of decision processes involving engineering systems under uncertainty. Areas of utility and information theory as related to quantification of information for decision-making. Prerequisites: ISEN 609; STAT 601 or approval of instructor.

- 628. Combinatorial Optimization. (3-0). Credit 3.** Formulation techniques are studied along with general approaches for solving integer and combinatorial optimization problems: basic polyhedral theory, cutting planes, branch and bound, matroids and theoretical background behind network optimization problems including the traveling salesman problem. Prerequisite: ISEN 620 or ISEN 622.
- 629. Engineering Optimization. (3-0). Credit 3.** Develops a modern framework for studying nonlinear programming problems using convex analysis; convex sets and cones, separating hyperplanes, sub-differentiability, conjugate transforms, duality theory and parametric analysis; applications of the principles and methods will be studied. Prerequisite: ISEN 623; corequisite: MATH 409.
- 630. Human Operator in Complex Systems. (3-0). Credit 3.** Basic understanding of the theory and practice of human factors engineering. Topics are presented within the framework of humans as functioning systems and their requirements when incorporated in hardware and software systems.
- 635. Human Information Processing. (3-0). Credit 3.** Perceptual and cognitive issues as related to the design of man-machine systems; perception, central processes, decision making and other performance aspects of the human component as an information processor. Prerequisite: ISEN 430 or approval of instructor.
- 636. Large-Scale Stochastic Optimization. (3-0). Credit 3.** Introduction to models, theory and computational methods for large-scale stochastic optimization including decomposition-coordination algorithms for stochastic programming such as generalized Benders decomposition and resource-price directive methods; emphasis on practical algorithm implementation and computational experimentation. Prerequisites: ISEN 620 or ISEN 622, STAT 610 and CSCE 602 or approval of instructor.
- 637. Stochastic Dynamic Programming. (3-0). Credit 3.** Methodologies for stage-wise stochastic-decision processes; includes finite-horizon models, infinite-horizon discounted total cost models, and average cost models; applications of methods to various situations. Prerequisites: ISEN 609 and ISEN 622, or approval of the instructor.
- 638. Polyhedral Theory and Valid Inequalities. (3-0). Credit 3.** Advanced knowledge of polyhedral theory and valid inequalities for (mixed) integer programming; introduction to fundamental concepts in polyhedral theory and several approaches to generation of valid inequalities; includes state-of-the-art advancements and current avenues of research. Prerequisite: ISEN 668.
- 639. Methods Improvement for Construction Engineers. (3-0). Credit 3.** Application of work methods and measurements to civil engineering construction; examination of factors that affect productivity in construction; study of motivational factors; review of the principles of accident prevention. Prerequisites: CVEN 405 and CVEN 473 or approval of instructor. Cross-listed with CVEN 639.
- 640. Systems Thinking and Analysis. (3-0). Credit 3.** Introduction to the systems thinking process and the fundamental considerations associated with the engineering of large-scale systems, or systems engineering. Prerequisite: MATH 304 or approval of instructor.
- 641. Systems Engineering Methods and Frameworks. (3-0). Credit 3.** Concepts, methodology, methods and tools for discovery, definition, analysis, design, creation, and sustainment of systems involving information, physical, and human elements; architecture modeling methods include IDEF/UPDM; systems engineering frameworks include DoDAF/MoDAF, and Zachman; analysis tools include executable architectures to assess consistency, interoperability and performance. Prerequisites: MATH 304 or approval of instructor.
- 642. Engineering Project Control. (3-0). Credit 3.** Project controls bridge from information-based to physical-based development processes; includes detailed design, testing of designs, design realization, and preparation of facilities for steady state operations; application of basic project control theories, tools, and methods to development projects. Prerequisite: Graduate classification in civil engineering or industrial and systems engineering or approval of instructor. Cross-listed with CVEN 717.

- 643. Strategic Construction and Engineering Management. (3-0). Credit 3.** Strategic and systems perspectives applied to construction and engineering management projects, organizations, and industries; system dynamics methodology to model construction and engineering systems; understanding drivers of performance; feedback and high leverage points for performance improvement. Prerequisite: Graduate classification or approval of instructor. Cross-listed with CVEN 654.
- 644. Project Risk Management. (3-0). Credit 3.** Identifies causes of risks in projects; discusses probabilistic description of risks and formulation of risk models; Bayesian methods for revising probabilities; qualitative and quantitative risk assessment; setting contingencies on budgets and schedules; risk mitigation and risk management; handling technological risk; Utility theory and game theory in management of risks. Prerequisite(s): STAT 601 or equivalent; graduate status in Engineering, approval of instructor. Cross-listed with: CVEN 644.
- 645. Lean Thinking and Lean Manufacturing. (3-0). Credit 3.** Introduces the principles of lean thinking in modern manufacturing systems; philosophical, managerial and organizational requirements studied; lean manufacturing quantitative modeling methodologies, lean manufacturing cell design and case study analysis. Prerequisites: ISEN 609 or approval of instructor.
- 654. Manufacturing Systems Planning and Analysis. (3-0). Credit 3.** The systems perspective of a computer integrated manufacturing system; manufacturing and its various levels and the planning and control of product movement through the production system in the context of using realtime control, multiprocessor systems, network architectures and databases. Prerequisite: ISEN 420. Cross-listed with MEEN 648.
- 655. Control Issues in Computer Integrated Manufacturing. (3-0). Credit 3.** Examines the nature of computer aided manufacturing systems with emphasis on control; an architecture for control of CAM systems is presented; control issues, problems and procedures to control CAM systems are studied and developed. Prerequisite: Approval of instructor. Cross-listed with MEEN 650.
- 656. Virtual Manufacturing. (3-0). Credit 3.** Focus on principles of virtual reality and 3-D graphics and their application in manufacturing, automation and simulation; virtual reality modeling, motion, collision detection and networking issues studied and developed. Prerequisite: Approval of instructor.
- 659. Modeling and Analysis of Manufacturing Systems. (3-0). Credit 3.** Analytical models applied to the description, design operation and control of manufacturing processes and systems; includes serial assembly, jobshops, FMS and cellular manufacturing configurations. Prerequisites: ISEN 609.
- 660. Quantitative Risk Analysis. (3-0). Credit 3.** Fundamental concepts, techniques, and applications of quantitative risk analysis and risk-informed decision making for students in all engineering fields. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas. Prerequisites: Graduate or Senior status. Cross-listed with CHEN 660 and SENG 660.
- 661. Network-Based Planning and Scheduling Systems. (3-0). Credit 3.** Fundamental theory, mathematical modeling, and algorithms of network flow models including shortest path models maximum flow and cost minimization models; out-of-kilter algorithm; pure and generalized network specializations of the primal simplex method; introduction to multi-commodity networks. Prerequisite: ISEN 620 or ISEN 622.
- 662. Production Economics. (3-0). Credit 3.** Develop an understanding of the analytical and empirical techniques required to conduct an analysis of the magnitude and the sources of productivity change; programming and regression approaches to analyze industries include manufacturing, energy, and service systems. Prerequisites: ISEN 303 and ISEN 620 or approval of instructor.
- 663. Engineering Management Control Systems. (3-0). Credit 3.** Integration of human relations, planning and control concepts, systems analysis and design, and principles of management oriented toward engineering functions within an organization; organizational design and administration as they impact along the product life cycle, i.e., research, design, development, production and use.
- 664. Principles of Scheduling. (3-0). Credit 3.** Scheduling and sequencing for production, assembly, supply chain, logistics and service operations; relevant solution methods including algebraic, branch and bound, Lagrangian relaxation, facet generation, branch and price, heuristics and simulation; computational complexity issues. Prerequisite: ISEN 620 or ISEN 622 or approval of instructor.
- 667. Engineering Economy. (3-0). Credit 3.** Fundamental concepts and advanced techniques of engineering economic analysis; evaluation of alternative capital investments considering income taxes, depreciation and inflation; discounted cash flow analysis of competing projects, break-even analysis and determination of rate of return on investment. Risk and uncertainty in engineering analysis. Prerequisite: ISEN 303 or approval of instructor.

- 668. Integer Programming. (3-0). Credit 3.** Formulation principles and general approaches for solving integer (and mixed, integer linear) programs including preprocessing, cutting plane methods, branch and bound, branch and cut, branch and price, and Lagrange relaxation; classical problem structures with special-purpose solution algorithms; fundamental theory of polyhedra, methods to generate valid inequalities and computational complexity. Prerequisite: ISEN 620 or ISEN 622.
- 669. Software Tools for Stochastic Decision Support Analysis. (3-0). Credit 3.** Overview of stochastic decision analysis; focus on Palisade Corporation's Decision Tools Suite of Excel add-in macros; topics include sensitivity analysis of Excel models, decision tree construction and analysis, and simulation within Excel. Prerequisite: STAT 630 or equivalent and ISEN 667.
- 681. Seminar. (1-0). Credit 1.** Opportunity to present research in a professional atmosphere. Presentations are not restricted to thesis or problem research. Acquaints the student with departmental research activities and procedures in documenting research.
- 684. Professional Internship. Credit 1 or more each semester.** On-the-job training under supervision of practicing engineers in settings appropriate to professional objectives. Prerequisite: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 12 each semester.** Special topics not within scope of thesis research and not covered by other formal courses. Prerequisite: Graduate classification in industrial engineering.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of industrial engineering. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research in industrial engineering field; content and credit dependent upon needs of individual student.
- 692. Professional Study. Credit 1 to 9.** Approved professional study or project. May be taken more than once, but not to exceed 4 hours of credit toward a degree. Must be taken on a satisfactory/unsatisfactory basis. Prerequisite: Approval of instructor.

Department of Information and Operations Management

E. E. Anderson, A. Arreola-Risa, E. Boone, F. P. Buffa, J. Choobineh, B. E. Flores, G. C. Fowler, H. N. Geismar, G. R. Heim, J. Jasperson, M. E. Ketzenberg*, X. Koufteros, S. Kumar, Y. Li, R. Metters (Head), R. Oliva, X. Peng, O. Perdikaki, A. Sen, R. Sen, B. Shetty, W. E. Stein, M. J. Tretter, D. Whitten**, D. W. Wichern

* Doctoral Student Advisor

** MS Student Advisor

The Department of Information and Operations Management offers a Master of Science in Management Information Systems (MS-MIS) and a PhD in Supply Chain Management. In addition, the department offers coursework supporting the Mays Business School's MBA degree and the Professional Program.

Students enrolled in the Mays MBA program may opt to pursue a certificate in Supply Chain Management or a combined MBA/MS-MIS degree. Students admitted to the Professional Program offered by the Department of Accounting may elect to participate in the five-year integrated MS-MIS program. Graduates of this program receive a Bachelor of Business Administration degree in Accounting and a Master of Science degree in Management Information Systems.

Masters Program

The MS-MIS degree program prepares students to enter this exciting and dynamic career field. It provides students with a solid technical information systems foundation and appropriate business skills that enables graduates to immediately contribute to solving business problems. Graduates are highly valued and respected in the workforce and are sought by first class employers.

The program is equally beneficial for students with an information systems background as well as those wishing to leverage and enhance their undergraduate degree from another field. The MS-MIS degree is an ideal complement for any undergraduate student with a degree in business, engineering, science, math or other analytically-oriented majors. The MS-MIS degree can jump start your career and provide fast-track opportunities not available to those with only an undergraduate degree.

The 18-month MS-MIS degree program requires 36 credit hours and produces graduates who are both business analysts (i.e., professionals who understand business) and information system specialists (i.e., professionals who can implement information systems strategies). Graduates of the program possess the skills to meet challenges and opportunities created by rapidly evolving information technology. Our graduates make business better.

Prerequisites for the MS-MIS degree include a course in each of the following:

1. Statistics
2. Computer Programming (any language)
3. Databases
4. Systems Analysis and Design
5. Business Data Communications

Doctoral Program

The doctoral program in operations and supply chain management is strongly research oriented and has a systems point of view. It stresses the relationships among the functional business areas and the importance of effective decision making with the goal of developing professionals who are well grounded in underlying theory in their disciplines and who have refined problem-solving capabilities.

The program has three primary objectives: 1) Provide comprehensive knowledge of business concepts and practices in functional business areas to support teaching and research interests; 2) Develop advanced competencies for conducting quality research, directing research of others, and communicating research findings through teaching and writing; and 3) Prepare candidates for the varied responsibilities of academic careers or for positions requiring similar research and analytical skills. Additional information, including specific departmental requirements, may be obtained by contacting the department graduate advisors or the Office of the Dean, Graduate School of Business.

Information and Operations Management (INFO)

- 601. Fundamentals of Business Programming. (3-0). Credit 3.** Business Application Development using both procedural and object-oriented programming techniques; use of component based software design and development for distributed business software systems. Prerequisite: Graduate business classification or instructor approval.
- 610. Quantitative Analysis for Business Decisions. Credit 1 to 3.** Formulation and structuring of business problems using selected quantitative techniques; modeling and statistical analysis stress computer applications. May be repeated for up to 3 hours credit. Classification 6 students may not enroll in this course. Prerequisite: Enrollment is limited to MBA students.
- 612. Management Information Systems. Credit 1 to 3.** Concepts, theories, and the strategic role of information systems as applied to business organizations will be covered; course is to be highly integrative/cross functional in nature. Classification 6 students may not enroll in this course. Prerequisite: Enrollment is limited to MBA students.
- 614. Operations Management. Credit 1 to 3.** Theory and applications of designing, analyzing and controlling productive systems in the allocation and use of resources to produce goods and services. May be repeated for up to 3 hours credit. Classification 6 students may not enroll in this course. Prerequisites: INFO 610 or equivalent; enrollment is limited to MBA students.
- 616. Supply Chain Management. (3-0). Credit 3.** Focus on the integrated management of the total product delivery system; purchasing, inventory management and distribution functions with emphasis on physical and information flows. Prerequisites: INFO 614 and MBA student.
- 618. E-Commerce: Auctions, Contracts and Exchanges. (3-0). Credit 3.** Design and implementation of contract mechanisms, auctions, and internet exchanges for business-to-business transactions; tools for dealing with these issues developed as well as an understanding of what issues are critical to the successful implementation of virtual vertical integrations. Prerequisite: G7 classification or approval of instructor. Cross-listed with AGEC 618.
- 621. MIS Project Management and Implementation. (3-0). Credit 3.** Advanced coverage of systems development topics with emphasis on the management and implementation of business computing systems; group project orientation to include feasibility analysis, alternative evaluation and selection, and management approval; use of software engineering tools where appropriate. Classification 6 students may not enroll in this class. Prerequisite: INFO 629.
- 622. Management of Information Systems Quality. (3-0). Credit 3.** Management of post-implementation systems in a multi-project environment; discussion of software evolution and metrics, tactical management decisions concerning legacy systems, outsourcing, use of open source, and the consequences of real-time dynamic decisions made by project managers. Prerequisite: INFO 629 or equivalent.

- 623. Groupware and Collaborative Technology. (3-0). Credit 3.** Theory, application, and human and organizational issues of groupware and collaborative technologies as they apply to collocated and dispersed team members working together. Introduction to groupware, virtual teams, and collaboration technology. Prerequisite: Graduate business classification or instructor approval.
- 628. Business Database Systems. (3-0). Credit 3.** Information processing and management involving applications and user orientation in a business environment using commercially available database management systems. Prerequisite: Knowledge of one programming language.
- 629. Systems Analysis and Design. (3-0). Credit 3.** Methodologies, techniques, and tools for information systems analysis and design; the analysis and logical design of business processes and management information systems focusing on the systems development life cycle; techniques for logical system design. Prerequisite: INFO 628 or concurrent enrollment.
- 631. Business Component Design and Development. (3-0). Credit 3.** Analysis and design of large application systems using component technologies; code and design reuse emphasized; issues of metadata, software repositories, DCOM and CORBA discussed. Prerequisites: INFO 628; graduate classification in business or approval of instructor.
- 632. Business Operating Systems. (3-0). Credit 3.** Theory and practice of Operating Systems used in a business information system environment. Prerequisite: Knowledge of a procedural programming language or approval of instructor.
- 633. Business Objects Analysis and Design. (3-0). Credit 3.** Analysis and design of business information systems using object-oriented development tools; fundamentals of object-oriented analysis and design; Unified Modeling Language, principles of N-tier architectures, and object-oriented development methodologies. Prerequisite: INFO 628 or equivalent or approval of instructor.
- 634. Business Data Communications. (3-0). Credit 3.** Concepts and technology of on-line and network-based systems in business; analysis of data communication requirements, design, selection and application of network technologies including wide and local area networks, distributed processing, network architecture, and systems management and control; software simulation projects emphasized. Classification 6 students may not enroll in this course. Prerequisites: Graduate classification.
- 635. Global Information Systems. (3-0). Credit 3.** Impact and the central role of Information Systems (IS) on globalization of business; issues of deployment of information systems and technology in international commerce, global IS environmental variables such as technology, legal, political, economic, social and cultural. Classification 6 students may not enroll in this course. Prerequisite: INFO 634 or equivalent, or approval of instructor. Cross-listed with IBUS 635.
- 636. Decision Support Systems. (3-0). Credit 3.** Use of decision support systems in business-related decision making, business environment, use of models, user interface with decision support systems and decision support systems examples. Classification 6 students may not enroll in this course. Prerequisite: INFO 303 or equivalent.
- 637. Data Warehousing. (3-0). Credit 3.** Provides an understanding of the process by which a data warehouse system is designed and developed along with the underlying concepts and software systems; includes OLAP models and their differences with standard OLTP models. Prerequisite: INFO 628 or approval of instructor.
- 638. Information Technology in Supply Chain Management. (3-0). Credit 3.** Review, evaluate, and contribute to the existing knowledge base regarding the management of information flows from automatic identification systems such as RFID. Prerequisites: ISEN 615 and PhD students or Masters students with a thesis degree plan or approval of instructor.
- 639. Corporate Information Planning. (3-0). Credit 3.** Concepts regarding the design and use of computer-based management information and decision support systems; combinations of computing hardware and software and design concepts evaluated to meet managers' information needs. Classification 6 students may not enroll in this course. Prerequisites: INFO 628 or equivalent or approval of instructor.
- 640. Strategy and Business Modeling in E-Commerce. (3-0). Credit 3.** Theories and practices of conducting web-based and web-enabled commerce; includes Internet technology for business advantage, managing electronic commerce funds transfer, reinventing the future of business through E-Commerce, business opportunities in E-Commerce, and business plans for technology ventures. Prerequisite: INFO 634 or equivalent or approval of instructor.

- 641. Theory and Research in Management Information Systems. (3-0). Credit 3.** Theory, applications, and human and organizational issues of Management Information Systems (MIS); current academic research into the analysis, design, and implementation of computer information systems. Classification 6 students may not enroll in this course. Prerequisites: PhD classification and approval of instructor.
- 642. Customer Relationship Management and Technologies. (3-0). Credit 3.** Theory and application of information technology in customer relationship management, construction of CRM infrastructures in organizations. Prerequisite: INFO 628.
- 643. Knowledge Management. (3-0). Credit 3.** Theory of what is knowledge, how is it generated and transferred in organizations; topics include knowledge skills and roles, technologies used for knowledge management and practical applications. Prerequisite: Graduate classification.
- 644. Business Process Design. (3-0). Credit 3.** Introduction to business process design and analysis; tools and techniques to document, analyze and improve business processes; Six Sigma process design and improvement; process metrics; computer simulation of processes; aligning business process with organizational goals and objectives; and case study of real world business problems. Prerequisites: Graduate classification or approval of instructor; INFO 614, INFO 660 or approval of instructor.
- 645. E-Commerce Technologies. (3-0). Credit 3.** Theory and application of constructing E-Commerce sites, including n-tier architecture and technologies, web servers, server interactions with databases, and transaction managers. Prerequisite: INFO 628 or equivalent.
- 646. E-Services. (3-0). Credit 3.** Examines the deployment and utilization of information technologies by businesses, governments and not-for-profit organizations to deliver services, with applications in banking and financial advisory services, healthcare, and federal, state and local governments. Prerequisite: INFO 629.
- 650. Business Data Mining. (3-0). Credit 3.** Rationale for business Data Mining through case studies of business applications; process of data mining by using commercial Data Mining software on very large data sets; half of the course devoted to lab training in the use of Data Mining software including SAS Enterprise Miner and SPSS Clementine. Prerequisite: STAT 652 or approval of instructor.
- 655. Forecasting Methods and Applications. (3-0). Credit 3.** Development of statistical models for describing business trends and economic fluctuations, generation of forecasts and error limits, evaluation of forecasts; applications to economic data arising in business. Classification 6 students may not enroll in this course. Prerequisite: STAT 652 or equivalent or approval of instructor. Cross-listed with STAT 655.
- 657. Methods in Multivariate Analysis. (3-0). Credit 3.** Multivariate extensions of the chi-square and t-tests, discrimination and classification procedures; applications to diagnostic problems in biological, medical, anthropological and social research; multivariate analysis of variance, principal component and factor analysis, canonical correlations. Classification 6 students may not enroll in this course. Prerequisites: MATH 423 and STAT 602 or STAT 608 or approval of instructor. Cross-listed with STAT 636.
- 658. Business Computer Models and Simulation. (3-0). Credit 3.** Design and implementation of computerized decision models in the business organizational setting. Classification 6 students may not enroll in this course. Prerequisite: INFO 303 or equivalent.
- 660. Introduction to Contemporary Manufacturing Management. (3-0). Credit 3.** Introduction to manufacturing management; emphasis on the hierarchical nature of manufacturing decisions, links among these decisions and contemporary views of manufacturing processes. Classification 6 students may not enroll in this course.
- 665. International Telecommunications. (3-0). Credit 3.** International telecommunications management, policy, and technology issues in planning and operating corporate voice, data and image networks worldwide. Prerequisites: INFO 615 or INFO 634 or ENTC 615; INFO 625 or ENTC 625. Cross-listed with ENTC 665.
- 667. Logistics and Distribution Management. (3-0). Credit 3.** Contemporary logistics activities including inbound and outbound materials and service flows, with special emphasis on their relationships to the firm's manufacturing function. Classification 6 students may not enroll in this course. Prerequisite: INFO 614 or INFO 660 or equivalent.

- 669. Enterprise Resource Planning. (3-0). Credit 3.** Concepts and applications in ERP from an Operations Management perspective. This includes the activities of an organization from acquisition of raw materials to delivery of finished products. Prerequisite: INFO 614 or INFO 660 or approval of instructor.
- 674. Business Information Security. (3-0). Credit 3.** Explores the business, managerial, and technological aspects of information security; analysis, design, and implementation issues surrounding effective information security; authentication, authorization, availability, business continuity planning, confidentiality, disaster recovery, encryption, firewalls, fraud protection, security policy development, integrity, risk management, virus protection, VPNs and wireless security. Classification 6 students may not enroll in this course. Prerequisite: INFO 634.
- 675. IT Consulting. (3-0). Credit 3.** Concerns with the practice of IT consulting; and develops an understanding of consulting practices, business development and revenue management, client relationships, team-based knowledge, knowledge services, technology evaluation, selection and integration, collaboration tools, business process and organizational change, and large application implementations; involves a full semester client-based project. Prerequisites: INFO 628, INFO 629, and INFO 660, and permission of the instructor.
- 684. Professional Internship. Credit 1 to 6.** A directed internship in an organization to provide students with on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. May be repeated for credit. Classification 6 students may not enroll in this course. Prerequisite: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed study on selected problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor and graduate advisor.
- 686. Theory and Research in Management Information Systems. (3-0). Credit 3.** Theory, applications and human and organizational issues of Management Information Systems (MIS); current academic research into the analysis, design and implementation of computer information systems. Classification 6 students may not enroll in this course. Prerequisites: Doctoral classification and approval of instructor.
- 688. Doctoral Seminar in... Credit 3.** Evaluation of current research and controversial issues in management information systems, production/operations management or management science. May be repeated for credit five times as content varies. For doctoral students only. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in identified area of information systems, operations management or management science. Classification 6 students may not enroll in this course. May be repeated for credit.
- 690. Theory of Research in Information and Operations Management. (3-0). Credit 3.** Design of research and the evaluation of research results using examples from the current research literature. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Classification 6 students may not enroll in this course.

Interdisciplinary Engineering

The Ph.D. degree in Interdisciplinary Engineering (ITDE) was initiated to accommodate outstanding engineering students whose research interests cross engineering disciplines and/or college lines. A student applying to the Ph.D. program in ITDE must be a current Ph.D. student in one of the departments within the Dwight Look College of Engineering. The ITDE program is administratively housed in the Dwight Look College of Engineering under the leadership of the Associate Dean for Graduate Programs. Interested students must contact the Associate Dean for Graduate Programs for admissions and program requirements.

(ITDE)

- 685. Directed Studies. Credit 1 to 12.** Research problems of limited scope designed primarily to develop research technique.
- 691. Research. Credit 1 or more.** Research for thesis or dissertation.

International Affairs

(INTA)

(faculty and courses are listed under BUSH, see [page 341](#))

These master's level courses are intended for individuals preparing for professional careers in the conduct of international affairs.

602. **Homeland Security and Homeland Defense. (3-0). Credit 3.** Course will thoroughly examine the strategy for homeland defense and civil support, Department of Defense policy and doctrine, along with numerous scholarly articles focusing on homeland security. This master's level course is intended for individuals preparing for professional careers in the conduct of international affairs.
603. **American Diplomacy. (3-0). Credit 3.** Explores the use of diplomacy in American foreign policy during recent decades; description and assessment are undertaken of United States diplomatic efforts to pursue its vital interests and to respond to changing international conditions and challenges; specific regions or substantive issues may be highlighted in a given semester using a variety of learning strategies. Prerequisite: Graduate classification.
604. **Politics of the Contemporary Middle East. (3-0). Credit 3.** Learn factors influencing the political course of the middle east, what makes the region seemingly "impervious" to worldwide trends, topics include regime types, influential political trends, the role of kinship, religion and tribe in opposition and regime politics, regional oil economy, democratic liberalization, growth of civil society. Prerequisite: Graduate classification.
605. **American Foreign Policy Since World War II. (3-0). Credit 3.** An examination of American foreign policy from 1945 to the present. It will focus on decisions made by American elected and appointed officials at critical moments of the Cold War and after. Theory will provide a framework for the course, but the focus will be on practical matters that confronted decision-makers. Prerequisite: Graduate classification.
606. **International Politics in Theory and Practice. (3-0). Credit 3.** The effects of international politics on the competing forces of global integration and disintegration are investigated and policy implications are considered, drawing upon theories of interstate politics. Prerequisite: Admission to MPIA or approval of instructor.
608. **Fundamentals of the Global Economy. (3-0). Credit 3.** Examines three fundamental pillars of the global economy: international trade, international finance and foreign direct investment (FDI). Students gain an appreciation for the complexities of the international environment from both theoretical and policy perspectives. Prerequisite: Graduate classification.
609. **Principles of International Law. (3-0). Credit 3.** Introduction to the nature and sources of international law, including jurisdiction of states; law governing the making, interpretation, application and termination of treaties and agreements; recognition of states and government; nationality of persons and corporations; state immunities from jurisdiction and control; and human rights. Prerequisite: Graduate classification.
611. **Authoritarianism and Political Elites in the Arab World. (3-0). Credit 3.** The purpose of this course is to introduce the students to the concept of political elite and to try and link it to the authoritarian state in the Arab world, in an attempt to explain the lack of democracy in that part of the world.
612. **U.S. Law and Homeland Security. (3-0). Credit 3.** The course will analyze the threat to the homeland as reflected in a number of pre and post 9/11 commission reports. This master's level course is intended for individuals preparing for professional careers in the conduct of international affairs.
613. **Diplomatic Negotiations: A U.S. Embassy Perspective. (3-0). Credit 3.** Explore the role of a formal Presidential National Security Strategy, gain first-hand skills and practice in how an American Embassy functions to achieve national security objectives. This master's level course is intended for individuals preparing for professional careers in the conduct of international affairs.
614. **Protection of the Nation's Critical Infrastructure. (3-0). Credit 3.** Survey an overview of the Nation's strategies for Critical Infrastructure Protection and securing cyberspace and the definition of critical infrastructures as it exists today. This master's level course is intended for individuals preparing for professional careers in the conduct of international affairs.

- 615. Democratization as Foreign Policy. (3-0). Credit 3.** Explores concept of democracy and its “requisites”, focuses on “third wave” and possible “fourth wave” of democratization, attention to cases in Eastern and Southern Europe, Latin America, Middle East; addresses in-depth international dimension of democratization; war, institutional change, aid and the promotion of democracy; assessment of relationship between democracy and peace.
- 616. Economic Development in China. (3-0). Credit 3.** Course in economic development in China introducing descriptive information of development strategies, institutional changes and policy effectiveness with respect to industrialization, economic growth income distribution and welfare at different historical stages.
- 617. Deterrence and Coercion. (3-0). Credit 3.** Introduces students to deterrence and coercion as instruments of defense policy by applying them to historical and contemporary security problems.
- 618. Government and Homeland Security. (3-0). Credit 3.** Focus on how government is structured to combat terrorism, essentially a course in federalism, with a concentration on issues related to homeland security. Topics will include governmental structure and jurisdiction, political, fiscal and administrative. This master’s level course is intended for individuals preparing for professional careers in the conduct of international affairs.
- 619. Weapons of Mass Destruction. (3-0). Credit 3.** Comprehensive study of weapons of mass destruction and their potential use by a terrorist group. The course will consider both political and technological issues associated with WMD terrorism. The focus will be on prevention, protection, response and recovery to WMD terrorism events. This master’s level course is intended for individuals preparing for professional careers in the conduct of international affairs.
- 620. International Security. (3-0). Credit 3.** Evaluates frameworks for understanding international conflict and then uses these perspectives to survey security problems across several regions, including East Asia, the Middle East and South Asia.
- 621. Chinese Foreign Policy. (3-0). Credit 3.** Provide an overview of Chinese Foreign Policy since 1949, understand the major external and domestic determinants of Chinese foreign policy, the results of domestic politics and/or international pressures, the role of ideology in Chinese foreign policy, economic interests affecting Chinese foreign policy, and what drives China’s involvement in international affairs.
- 622. Chinese Strategic Thought. (3-0). Credit 3.** Intensive reading and research course in Chinese strategic thought from the Warring State period (403-221 BC) to 21st century China with two goals: to provide an introductory understanding of the nature of strategic thinking throughout Chinese history and to provide the conceptual tools to put Chinese strategic thought in a comparative perspective.
- 623. Grand Strategy. (3-0). Credit 3.** Addresses origins of great powers, grand strategies, impact of international system on grand strategic options, alliance behavior of states, why and when great powers balance, impact of technology and location on strategies, and causes of great powers’ overexpansion; utilizes theoretical approaches and historical case studies to understand grand strategies.
- 625. International Trade Policy Analysis. (3-0). Credit 3.** Traditional and strategic trade theory and analysis are used to examine such concepts as comparative advantage, Heckscher-Ohlin-Samuelson model, gains from specialization and trade, partial equilibrium analysis of free trade, violations of the free trade model, welfare effects of trade, trade creation and diversion, and other topics. Prerequisites: Graduate classification; approval of instructor.
- 626. Balance of Payments in Theory and Policy. (3-0). Credit 3.** This is a course on the basic macroeconomics of open economy, coordination of policies and exchange rate regimes, the main characteristics of the international payments system, the role of international organizations and proposals for reform. It is intended as a survey course with emphasis on current policy issues. Prerequisites: Graduate classification; approval of instructor; ECON 203 or equivalent.
- 627. The Great Books of World Politics. (3-0). Credit 3.** Fundamental texts dealing with war and diplomacy from ancient Greeks through the present; authors will include Thucydides, Sun-tzu, Ibn Khaldun, Plutarch, Cicero, Augustine, Aquinas, Machiavelli, Hobbes, Bacon, Rousseau, Hume, Bentham, Grotius, Vattel, Montesquieu, Smith, Kant, The Federalists, Tocqueville, Burke, Mill, Hegel, Nietzsche, Clausewitz, Marx, Freud, Schmitt, Heidegger, and Rawls among others. Prerequisites: Graduate classification and approval of instructor.

- 629. Multinational Enterprises. (3-0). Credit 3.** Provides a broad survey of the field of international business; multinational enterprises in a variety of sectors, countries, and organizational forms; focus primarily on the past 20 years, but the historical development of MNEs also examined. Prerequisites: Graduate classification; approval of instructor.
- 630. International Economic Development. (3-0). Credit 3.** Course will cover the economic dimensions of international development issues in the context of the major problems facing development planners such as poverty, inequality, population growth, environmental impact, the urban-rural interface, subsistence, agriculture, gender concerns, low rates of human capital formation, and globalization.
- 631. U.S. Military Power. (3-0). Credit 3.** Introduces students to U.S. general purpose forces; course will examine issues at the intersection of military strategy and operations, including force planning and future operational environment; course relies on relevant historical examples, including recent conventional and unconventional military campaigns.
- 639. Homeland Security and Emergency Management. (3-0). Credit 3.** This course will examine the evolution of emergency management. It will survey the multiple disciplines involved in the disaster process and examine future directions for this field.
- 650. National Security Law. (3-0). Credit 3.** An introduction to the nature and sources of national security law including such topics as the framework of separate branches of law with shared national security powers, maintaining national security abroad, terrorism and other national security threats, and protecting national security information. Prerequisite: Graduate classification.
- 651. National Security Policy. (3-0). Credit 3.** A graduate-level seminar on national security policy that will provide a forum for developing an understanding of key concepts, players, institutions, intergovernmental processes, and contemporary issues in the national security policy domain. Prerequisite: Graduate classification.
- 652. The Role of Intelligence in Security Affairs. (3-0). Credit 3.** A survey of U.S. Intelligence operations, techniques, objectives and resources, with particular emphasis on how intelligence has contributed and continues to contribute to U.S. national security. Prerequisite: Graduate classification.
- 653. Technical Collections Systems for International Security. (3-0). Credit 3.** An introduction to the technical aspects of remote sensing and signals technology applied to international security issues and an introduction to interpretation of the acquired information. Featured outside speakers from U.S. government agencies explain the operation of technical collection systems and their contribution to national and international security. Prerequisites: Graduate classification; approval of instructor.
- 654. Military Strategy in the Conduct of Nations. (3-0). Credit 3.** This course is an overview of strategic thought and national security policy. It focuses on both the works of prominent military theorists, the historical context, and the significance for current international strategic affairs. Prerequisite: Admission to MPJA or approval of instructor.
- 655. Evolution of the European Union. (3-0). Credit 3.** Explore the wider implications of EU enlargement and integration, critically assess current EU developments and policies pertinent to international affairs, generate and apply a variety of individual and team oriented skills on real-world problems. Prerequisite: Graduate classification.
- 656. Fundamentals of Homeland Security. (3-0). Credit 3.** An introduction to the theory, practice, challenge and prospects for securing the "American Homeland" against terrorist attack, with special emphasis on how American policy makers are resolving this dilemma, and their prospects for the future; draws heavily on current events and emerging policy solutions as examples. Prerequisite: Graduate classification.
- 657. Terrorism in Today's World. (3-0). Credit 3.** Comprehensive survey of international terrorism from its origins to the present; emphasis on how the U.S. government has responded and how it has organized to counter the threat; all major terrorist groups studied; understanding of the nature of the terrorist threat and the implications for the U.S. Government. Prerequisite: BUSH or INTA G6 or G7 classification or approval of instructor.
- 658. Congress and International Security. (3-0). Credit 3.** Develop knowledge of Congress, gain a deeper understanding of the key concepts, players institutions, intergovernmental processes, and contemporary issues in the topic area of Congress and international and national security policy.

- 659. Transnational Security Issues. (3-0). Credit 3.** Understand the composition, role, mission of offices, departments that comprise Intelligence Community; obtain appreciation for transnational security issues; address potential impact short/long term to U.S. national security policies and/or programs that may affect those transnational security issues by the year 2020.
- 663. International Transfer Pricing. (3-0). Credit 3.** Valuation of cross-border transactions between units of a multinational enterprise; includes internal and external motivations for transfer pricing, managerial and economic approaches, estimates of transfer manipulation, arm's length standard; U.S. and OECD rules and procedures, tax court cases, and ethical dilemmas. Cross-listed with MGMT 663.
- 667. International Crisis Management: The Policy Process. (3-0). Credit 3.** Examination of the policymaking process used by U.S. government officials in response to rapidly moving international crisis situations; simulations of executive meetings, briefings and press conferences; analysis of political, diplomatic, legal and ethical issues involved. Prerequisite: Graduate classification.
- 670. International Affairs Capstone Seminar. (3-0). Credit 3.** Capstone team exercise in subject related to international affairs. For MPIA majors only. Prerequisites: For MPIA majors only, graduate classification and approval of MPIA director.
- 677. Political Islam and Jihad. (3-0). Credit 3.** Investigate how Political Islam developed in the first half of the century and why it gained so much support. Examine the various strategies state elites have taken toward political Islam and will consider the regional and transnational manifestations and implications of Islamist movements. This master's level course is intended for individuals preparing for professional careers in the conduct of international affairs.
- 678. Interstate War: Theory and History Implications for the 21st Century. (3-0). Credit 3.** Comprehensive look at the central organizing principles for international security and the nature and role of war in contemporary relations among state and the evolving challenges.
- 679. Homeland Security and Business. (3-0). Credit 3.** Study the impact of terrorism and homeland security on business in the U.S. It will examine the 10 principal functional areas in which business/companies/corporations are affected by terrorism and homeland security. This master's level course is intended for individuals preparing for professional careers in the conduct of international affairs.
- 680. Political Violence and Terrorism within the International System. (3-0). Credit 3.** Focuses on terrorism as special case of political violence and on non-state actors as a specific category of players toward which the international system must adapt; develops underlying concepts of terrorism and core response strategies to terrorism; develops both national and international responses to terrorism, emphasizing need for complementary policy approaches.
- 682. Law of War. (3-0). Credit 3.** Provides key concepts for those who desire an expanded understanding of how and why Law of War influences U.S. Military operations and national security and foreign policy decisions today; introduction to the historical, customary development and the significant efforts of Law of War codification such as the Hague and Geneva Conventions.
- 683. U.S. Border Security: Policies, Strategies and Issues. (3-0). Credit 3.** U.S. border security policies, strategies and issues; policies and strategies for homeland defense and security; Mexican and Canadian governments' border policies; southern U.S. border situation and issues; considerations when border land is privately versus federally owned; impact of criminal elements on border security; efforts to secure the U.S. coasts. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 to 6.** Directed internship in a public or private organization to provide on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 685. Directed Studies. Credit 1 to 4.** Directed individual instruction in selected problems in government and public service. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 686. Russia and International Politics. (3-0). Credit 3.** Examines changes within Russia and its role in international politics since 1991, emphasizing the period of Vladimir Putin's presidency, explores Putin's approach to political, economic and social challenges facing Russia, as well as the war in Chechnya and terrorism within Russia, also examines Russia's critical relationship with the United States.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of government and public service. May be repeated for credit. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

International Business

International business courses are not offered as part of a graduate degree program, but as highly recommended elective or required courses supporting the MBA degree program, the MS and PhD programs offered by the departments of the Mays Business School, and as elective courses in other University graduate degree programs. Additional information about these courses can be obtained from the Center for International Business Studies or from the department offering the course (e.g., the Department of Marketing for IBUS 677, Multinational Marketing Management).

(IBUS)

- 635. Global Information Systems. (3-0). Credit 3.** Impact and the central role of Information Systems (IS) on globalization of business; issues of deployment of information systems and technology in international commerce, global IS environmental variables such as technology, legal, political, economic, social and cultural. Prerequisite: INFO 634 or equivalent, or approval of instructor. Cross-listed with INFO 635.
- 645. International Finance. (3-0). Credit 3.** Problems confronted by financial managers of firms with international business operations; international money and capital markets; exchange rate risks and political risks. May be repeated for up to 3 hours credit. Classification 6 students may not enroll in this course. Prerequisite: FINC 612 or FINC 629 or FINC 635. Cross-listed with FINC 645.
- 646. International Accounting. (3-0). Credit 3.** Introduction and examination of accounting issues unique to multinational enterprises and international business activity. Classification 6 students may not enroll in this course. Prerequisites: ACCT 328; FINC 341. Cross-listed with ACCT 646.
- 667. Multinational Enterprises. (3-0). Credit 3.** Graduate seminar in international business; multinational enterprises (MNEs) are studied from various perspectives including economics, management, entry and expansion strategies, contractual agreements, transfer pricing, impacts on home and host countries, MNE-state relations, regional integration, public policies towards MNEs. Prerequisite: Graduate classification. Cross-listed with MGMT 667.
- 677. Multinational Marketing Management. (3-0). Credit 3.** Theoretical and empirical materials on multinational marketing; nature and justification of international trade, analysis of environments faced by multinational firms and formulation of multinational marketing strategy. Classification 6 students may not enroll in this course. Prerequisite: MKTG 613 or MKTG 621 or equivalent. Cross-listed with MKTG 677.
- 678. International Management. (3-0). Credit 3.** Survey of the issues, problems, challenges, and opportunities facing organizations competing in a global economy; includes: the environment of international management, international strategies, forms of organization design used by multinational firms, managing human resources in an international context, and cultural and control issues facing the international manager. Prerequisite: Graduate classification. Cross-listed with MGMT 678.
- 679. International Business Policy. (3-0). Credit 3.** Determinants of U.S. competitiveness in international markets; the international environment of business; introduction to multinational enterprises, global competition, international organizations, protection of intellectual property; international trade regulations; strategic trade theory. Prerequisite: Graduate classification. Cross-listed with MGMT 679.
- 685. Directed Studies. Credit 1 to 4.** Directed study of selected international business problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisite: Graduate classification and approval of instructor.
- 689. Special Topics in... Credit 4.** Selected topics in an identified area of international business. May be repeated for credit. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 692. International Professional Study II. Credit 1 to 12.** Approved professional studies abroad on international business issues and organizations. May be taken to meet requirements for the MBA or MS degrees in business. Course to be taken for a grade. May be taken 3 times for credit. Prerequisite: Admission to approved program.
- 693. International Professional Study. Credit 1 to 12.** Approved professional studies abroad of international business issues and organizations. May be taken to meet requirements for the MBA or MS degrees in business. To be taken on a satisfactory/unsatisfactory basis. Prerequisites: Admission to approved program; approval of program coordinator.

Italian

(faculty, see [page 413](#))

(ITAL)

692. **Readings. (3-0). Credit 3.** Readings in Italian literary texts in the original language. Prerequisite: Graduate classification.

Kinesiology

(faculty, see [page 432](#))

(KINE)

601. **Reading Research Publications in Kinesiology. (3-0). Credit 3.** Instruction in, and development of, research skills through the study of published reports and readings in kinesiology.
606. **Motor Neuroscience I. (3-0). Credit 3.** Neurophysiology of the neuromuscular system with emphasis on motor control; topics include organization of the CNS; reflexes; integration of sensory information; experimental approaches to study neuromuscular control and neurophysiology of contemporary motor control theories. Prerequisite: KINE 406 or equivalent.
622. **Supervision of Health and Kinesiology. (3-0). Credit 3.** Principles and processes of supervision; in-service training of personnel.
623. **Administration of Health and Kinesiology. (3-0). Credit 3.** Administration of comprehensive programs of kinesiology in higher education settings.
624. **Pedagogical Research in Teaching/Physical Education. (3-0). Credit 3.** Examine pedagogical research in education and relate to the specialty area of physical education; study key research paradigms that now influence inquiry in physical education and link to current practices in effective teaching. Prerequisites: Graduate classification and approval of instructor.
625. **Motor Neuroscience in Special Populations. (3-0). Credit 3.** Emphasis placed on identifying the etiology, neurophysiology, and behavioral characteristics of common movement disorders in children and adults. Prerequisite: Graduate classification.
626. **Exercise for Clinical Population. (3-0). Credit 3.** Principles relevant to exercise programming for persons with chronic disease/disability; includes information for each condition: pathophysiology, effect on exercise response, effects of exercise on disease process, and recommendation for exercise testing and programming. Prerequisite: KINE 433 or instructor approval.
627. **Exercise Biomechanics. (3-0). Credit 3.** An integrated, mechanistic study of biomechanics of human motion during physical activity and exercise; biology and mechanical properties of the human movement system including bones, tendons, ligaments, cartilage, skeletal muscles, joints, and whole body systems are investigated. Prerequisite: KINE 426 or equivalent.
628. **Nutrition in Sport and Exercise. (3-0). Credit 3.** Interaction between nutrition, exercise, and athletic performance; including: biochemical and physiological aspects of nutrition and exercise; nutrition for training and competition; exercise and oxidant stress; nutritional supplements and ergogenic acids; and nutritional aspects of body composition and weight control. Prerequisite: Graduate classification; BIOL 320; KINE 433 or approval of instructor.
629. **Physiology of Strength and Conditioning. (3-0). Credit 3.** Physiological, bio-mechanical, and metabolic aspects of muscular strength and conditioning programs for various athletic and non-athletic populations; review of resistance training based on scientific literature; promote the use of a structured scientific approach in the prescription of progressive resistance training. Prerequisite: Graduate classification, BIOL 320; KINE 433 or approval of instructor.
637. **Exercise Physiology I. (3-0). Credit 3.** Functional changes brought about by acute and chronic exercise; topics include muscle structure/function, energy transduction, biochemistry of exercise, muscle mechanics, fatigue and adaptation. Prerequisite: KINE 433 or equivalent.
638. **Exercise Physiology II. (3-0). Credit 3.** Functional changes brought about by acute and chronic exercise; topics include pulmonary and cardiovascular physiology, training and detraining, and special topics. Prerequisite: KINE 433 or equivalent.

- 639. Exercise Electrocardiography. (3-0). Credit 3.** Electrocardiography (ECG) for the exercise scientist; emphasis on recognition and interpretation of normal and aberrant ECG patterns encountered during the graded exercise test; physiologic mechanisms underlying the normal and abnormal ECG. Prerequisites: KINE 638 and KINE 648 or approval of instructor.
- 640. Motor Neuroscience II. (3-0). Credit 3.** Contemporary theories of motor learning that link behavioral analysis to underlying neural correlates of control; topics include memory; physical, mental and observational practice; internal models, motor planning-programming; and self-organization in perception-action systems; emphasis on cognitive and behavioral neuroscience. Prerequisite: KINE 406 or equivalent.
- 641. Motor Neuroscience: Development Issues. (3-0). Credit 3.** Explores the contemporary developmental issues associated with motor behavior (perception to action) across the lifespan; topics include physical and neurological growth, perception, motor control, and environmental influence. Prerequisite: KINE 307 or equivalent.
- 642. Self-organization in Motor Neuroscience. (3-0). Credit 3.** Application of the concepts of non-linear dynamical systems theory and self-organization to the study of biological motion and learning; topics include perception-action coupling, phase transitions and stability, sensori-motor transformations. Prerequisites: KINE 406 and KINE 641.
- 646. Fundamentals of Space Life Sciences. (3-0). Credit 3.** Integrates nutrition, physiology, and radiation biology to define major biological problems in long duration space flight; provide an overview of the problems of bone loss, muscle wasting, and radiation-enhanced carcinogenesis along with potential countermeasures; focus on nutritional interventions and exercise protocols. Cross-listed with NUTR 646 and NUEN 646.
- 647. Instrumentation and Techniques in Exercise Physiology I. (1-3). Credit 2.** Theory, experiments and demonstrations in exercise physiology; laboratory experience in the use of metabolic and biochemical instrumentation commonly found in a modern exercise physiology laboratory. Prerequisite: Concurrent enrollment in KINE 637.
- 648. Instrumentation and Techniques in Exercise Physiology II. (1-3). Credit 2.** Theory, experiments and demonstrations in exercise physiology; laboratory experience in the use of metabolic and biochemical instrumentation commonly found in a modern exercise physiology laboratory. A continuation of KINE 647. Prerequisite: KINE 637 or concurrent enrollment.
- 649. Applied Exercise Physiology. (3-0). Credit 3.** Investigate how the acute physiological responses to exercise and the chronic physiological adaptations to exercise training are altered by environmental factors—heat, cold, altitude, and microgravity, and by age and sex; addresses the physiological bases for reducing the risk of cardiovascular, metabolic and bone disease through physical activity. Prerequisite: KINE 433 or equivalent.
- 650. Microcomputer Utilization in Sports Statistics. (3-0). Credit 3.** Microcomputer techniques for the development and maintenance of statistics in sports; determination of frequency, trends and tendencies in sports; knowledge of BASIC required. Prerequisite: KINE 425 or equivalent.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of topics of current interest in kinesiology.
- 682. Seminar in... (1-0). Credit 1.** Reports and discussions of topics of current interest in kinesiology. Students may register in up to but not more than four sections of this course in the same semester.
- 683. Practicum in Kinesiology. Credit 3.** Observation and study of rehabilitation and kinesiology programs in schools and other institutions. May be repeated twice for credit. Prerequisite: Approval of department head.
- 684. Professional Internship. Credit 1 to 6 each semester.** Supervised experiences in application of formal training to performing professional functions consistent with career goals. Prerequisites: 12 semester hours of selected graduate work; approval of department head.
- 685. Directed Studies. Credit 1 to 12 each semester.** Directed study of selected problems in kinesiology not related to thesis. May be repeated for credit. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of kinesiology. May be repeated for credit. Prerequisite: Approval of department head.
- 690. Theory of Research in Discipline. (3-0). Credit 3.** Theory and design of research problems and experiments in various subfields of the discipline; communication of research proposals and results; evaluation of current research of faculty and students and review of current literature. May be repeated for credit. Cross-listed with HLTH 690.

- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of committee chair.
- 692. Professional Study. Credit 1 or more each semester.** Approved professional study of project undertaken as the terminal requirement for Doctor of Education degree. Preparation of a record of study summarizing the rationale, procedure and results of the completed project. Prerequisite: Approval of committee chair.

Land and Property Development

The graduate program in Land and Property Development (MLPD) is designed for persons interested in entrepreneurial or management roles in the design, construction, development and real estate professions. The Master of Land and Property Development (MLPD) program focuses on both physical and financial aspects of land and real estate development and the creation of real estate asset value through the conceptualization, design, delivery and management of real estate assets.

Each individual's Master of Land and Property Development degree plan is structured to relate project design and venture structure to site ecology and market economy, and to stress both entrepreneurial interests of private enterprise and regulatory guidelines of public entities. Each student's degree plan includes both business and non-business courses, drawing upon resources of 17 different departments at Texas A&M, ranging from accounting, finance and marketing to landscape architecture and construction management. For more information, visit us on the website at archone.tamu.edu/laup.

This program offers the following dual degree programs:

- Master of Land and Property Development/Bachelor of Science in Urban and Regional Planning;
- Master of Land and Property Development/Bachelor of Landscape Architecture;
- Master of Land and Property Development/Master of Architecture;
- Master of Land and Property Development/Master of Urban Planning;
- Master of Land and Property Development/Master Science in Construction Management; and,
- Master of Land and Property Development/Master of Real Estate.

A student must be admitted into both degrees that form part of the dual degrees specified above before they can commence a dual degree program.

(LDEV)

(faculty, see [page 461](#))

- 661. Development and the Environment. (3-0). Credit 3.** Land development in the context of environment sustainability, human well being and business profitability to foster a restorative economy; environmental easement and site analysis; state, federal and international regulatory issues; and human ecology and the future of land development. Prerequisite: Graduate classification.
- 662. Land Development Law. (3-0). Credit 3.** Survey of real estate law with emphasis on Texas law; review of constitutional issues and basic legal concepts, including estates in land, contracts; private and public sector land use controls.
- 663. Introduction to Project Management. (3-0). Credit 3.** Project management processes for planning, scheduling, cost estimating resource leveling, cost control and post-completion evaluation; issues in project organizational environments, documentation, quality control safety. Prerequisite: Graduate classification.
- 664. Market Analysis for Development. (3-0). Credit 3.** Techniques and data sources for market analysis for development; analysis for housing development; trade area analysis and market analysis for retail development; analysis for office, industrial parks and for specialized development. Prerequisite: Graduate classification.
- 665. Land Development Trends. (3-0). Credit 3.** Exploration of a variety of specialized topics associated with emerging trends in the land development industry. Prerequisite: Graduate classification.
- 667. Design and Development Economy. (3-0). Credit 3.** Interface between the physical and financial dimensions in the design and development process to achieve building and project economics; creating a physical product and a financial venture that responds to social and environmental concerns and to market economy and feasibility analysis. Prerequisite: Graduate classification.
- 668. Land Development Practice. (3-0). Credit 3.** Strategies, methods and techniques of land development including: site selection criteria, urban infrastructure; market evaluation; conceptual arrangement of land uses and structures; conceptual design and regulatory considerations; lending institutions; location theory; value theories; regulatory agencies. Prerequisite: LDEV 667.

- 669. Income Property Land Development. (3-0). Credit 3.** Exploration of the characteristics of real estate as an investment, venture and capital structures, the development process, site and financial feasibility, and project funding; strategies, methods and technologies for investment property development utilizing current developments. Prerequisite: Graduate classification.
- 671. Sustainable Development. (3-0). Credit 3.** Sustainability perspectives about values, rights, property and what constitutes an optimum human environment; sustainability principles and case studies emphasizing on-the-ground, incentive-based land development that balances economic growth with environmental quality. Prerequisite: Graduate classification.
- 672. Public-Private Project Funding. (3-0). Credit 3.** Financing and related issues in public-private development projects; explores structuring, valuing and managing projects and investigates the interaction between suppliers, operators, lenders and contractors; introduction to financial tools: loans, credit, interest rates and financial models.
- 673. International Development Planning. (3-0). Credit 3.** International variations in urban growth and land development strategies: savings, aid and trade policy options for cities and regions; international co-development programs; application of planning and urban land development professions in contemporary global context. Prerequisite: Graduate classification.
- 681. Seminar. (1-0). Credit 1.** College of Architecture research activities pertaining to land and real estate development; preparation and presentation of required final paper for MS in Land Development examination. Prerequisite: Graduate classification in land development.
- 683. International Development Perspectives. (1-0). Credit 1.** Recent international conceptual frontiers in development and redevelopment; land and real estate development activities in the Far East, South America, Mexico and Eastern Europe; assessment of the future of global development. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 to 12.** Professional practice under approved arrangement with public or private land or real estate development agencies in the United States or abroad. Prerequisites: Approval of committee chair and program coordinator.
- 685. Directed Studies. Credit 1 to 12.** Individual and group problems dealing with application of strategic plan development theory in practice: opportunities to select international or domestic development projects of special interest. Prerequisite: Approval of instructor.
- 687. Development Feasibility and Design. (3-9). Credit 3.** Selected residential and non-residential development projects of varying size analyzed by student teams with respect to the following: economic feasibility and cash flow; site analysis; and design concept. Prerequisite: Approval of instructor.
- 688. Development Feasibility and Design II. (1-6). Credit 3.** Plans and venture structures for selected residential and non-residential development projects of varying size analyzed by student multidisciplinary teams with respect to the following; economic feasibility and cash flow and site and design plans and costs. Prerequisite: LDEV 687 or approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of land development. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** PhD research and preparation of dissertation. Prerequisite: Doctoral classification.
- 693. Professional Study. Credit 1 to 6.** Approved professional case study of project organization in the USA or abroad undertaken as terminal requirement for the Master of Science in land development degree, non-thesis option. Prerequisites: Approval of committee chair and associate department head.

Department of Landscape Architecture and Urban Planning

S. K. Anderson, S. I. Bame, E. K. Bardenhagen, G. Booth, E. M. Bright, S. D. Brody, B. Dvorak, C. Giusti, W. E. Highfield, C.-S. Huang, K. Joh, J. H. Kim, H. C. Landphair, C. Lee, M. Li, M. K. Lindell, M. D. Murphy, F. Ndubisi (Head), G. Newman, W. G. Peacock, J. E. Rodiek, G. O. Rogers, J. Saginor, A. L. Sullivan, D. A. Sweeney, S. Van Zandt, J. W. Varni, N. J. Volkman, Z. Wang, Y. Xiao

Department of Landscape Architecture and Urban Planning (LAUP) is one of the four departments located within the College of Architecture at Texas A&M University. The other departments are the Department of Architecture, the Department of Construction Science and the Department of Visualization Sciences. LAUP is one of the oldest and well established departments of its kind in the southern United States.

LAUP offers six degree programs in four different fields: landscape architecture, urban planning, land development, and urban and regional science. Today, approximately 200 undergraduate students, 118 master's students, and 55 doctoral students are enrolled full-time in the department. LAUP has a group of approximately 40 faculty and lecturers with a wide varying range of expertise. LAUP's mission is to create, apply, and disseminate knowledge to enhance functional, healthy, and sustainable human environments through instruction, research, and service in landscape architecture, urban planning, land development, and allied disciplines. This mission embodies the tri-partite mission of the Texas A&M University—teaching, research and service.

Because of the important role of computing in the disciplines housed within the College of Architecture, all entering students are required to possess a portable, network-ready personal computer capable of running software appropriate to their academic program. Financial aid is available to assist students in their computer purchases. No student will be denied admission to Texas A&M University based on inability to purchase a computer. Additional information is available on the college website at arch.tamu.edu.

Landscape Architecture

The program in Landscape Architecture offers graduate studies leading to the Master of Landscape Architecture. The program is designed to develop professional specialized skills in the field and to provide a unique educational experience. Issues dealing with design process, natural resource management, behavioral response, computer visualization and landscape planning are emphasized as separate specializations in response to the profession's leadership potentials. Programs are planned to encourage applications from a variety of backgrounds. Emphasis is placed on the development of communication, collaboration and problem solving skills associated with land design issues.

Students are required by the department to take an internship during the summer. However, this internship will be no credit/no pay, but is required.

(LAND)

- 601. Landscape Architectural Design Theory and Application I. (2-9). Credit 5.** First design studio course for career-change students; basic theories, principles, applications of landscape architectural design; design process; context-sensitive design; evidence based design; form-making skills; form-function-meaning relationships; spatial scale and dimensions; elements of natural and built environments; behavioral, psychosocial, policy and ecological factors in design; communication of design ideas. Prerequisites: Graduate classification and approval of instructor.
- 602. Landscape Architectural Design Theory and Application II. (2-9). Credit 5.** Application of ecological concepts to site planning and site design, form and space making using natural features, and practical issues including social and political, technological and economic influences on ecological design. Prerequisites: LAND 601.
- 603. Principle, Procedures and Techniques of Land Use. (2-12). Credit 6.** A continuation of LAND 601-LAND 602 sequence for career-change students; resolution of land problems that typically occur on a site; exploration of land use planning concepts and landscape ecology techniques; application of knowledge and skills acquired during the first year to a complex land development studio project. Prerequisites: LAND 602 and approval of instructor.
- 612. Landscape Architectural Site Engineering and Development. (2-6). Credit 4.** First construction studio course; concepts, theories and techniques of site development; aspects of site engineering and consideration of earth bound elements in land development; contours, landform, grading design, drainage principles, cut and fill computations, basic hydraulics and hydrology, stormwater management, landscape construction materials. Prerequisite: Approval of instructor.
- 614. Landscape Architectural Construction. (2-4). Credit 3.** Second construction studio course; sustainable water management techniques in landscape development; theory, principles and techniques of low impact development; basic elements of landscape architectural construction; construction document preparation, working drawings, project layout and design; theory and principles of irrigation and lighting design. Field trips required. Prerequisite: LAND 612.
- 620. Open Space and Land Use Planning I. (2-9). Credit 5.** Creation of land use planning strategies for large land parcels; site inventory, analysis program formulation and design detailing sequenced into the production of a comprehensive master plan; consideration of issues in sustainability, environmental protection, growth management and resource utilization. Prerequisite: LAND 601, LAND 602, LAND 603 or approval by instructor.

- 621. Open Space and Land Use Planning II. (2-9). Credit 5.** Projects with various scales; site selection, program formulation, theory, master planning and detailed design applied to topics of community design and development, and healthy communities; evidence based design methodology, techniques of professional design documentation and presentation. Prerequisite: LAND 620 or approval by instructor.
- 630. Development of Landscape Architecture. (3-0). Credit 3.** Overview of the history of human settlement, land use and landscape architecture outside of North America. Prerequisite: Graduate classification.
- 632. Design for Active Living. (3-0). Credit 3.** Understanding the forms and characteristics of the built environment and the influence on human behaviors, lifestyles and health; theoretical and empirical insights into the issues of physical activity, obesity, and automobile dependency; focus on how changes in the built environment help address these issues. Prerequisite: Graduate classification or approval of instructor. Cross-listed with PLAN 632.
- 640. Research Methods in Landscape Architecture. (3-0). Credit 3.** Research methods including theory, hypothesis formulation, design, data collection, measurement and report writing; equates research activity to landscape architecture and the interaction between people and their physical environment. Prerequisite: LAND 603 or equivalent.
- 645. Practice Diversity in Landscape Architecture. (3-0). Credit 3.** An exploration of the diversity of practice opportunities within the profession of Landscape Architecture; individual roles within those areas of practice and the skills required to function successfully within them. Prerequisites: Graduate classification and approval of instructor.
- 646. Professional Practice. (3-0). Credit 3.** Introduction to the procedures, management and ethical frameworks in which professional landscape architectural practice occurs; topics include forms of practice, employment issues, proposal preparation, fee and contract structures, project management, roles of the landscape architect, presentations and public participation, legal and ethical responsibilities. Prerequisites: Graduate classification and approval of instructor.
- 655. Landscape Architectural Communication. (2-4). Credit 3.** Graphic communication techniques required to expand landscape architectural concepts and designs including plan graphics, analysis and inventory graphics, perspective drawings, sketch composition, rendering media, color scanning, use of software and desktop.
- 661. Visual Quality for Design and Planning. (3-0). Credit 3.** Emphasis on social science perspectives for analyzing visual quality in built and natural landscapes, and effects of visual surroundings on human well-being and health; the content reflects a balance of theory, scientific research evidence and practical applications in areas of landscape architecture, architecture, urban planning and park design. Prerequisite: Graduate classification.
- 681. Seminar. Credit 1 each semester.** Analysis and criticism of selected landscape architectural projects. Lectures, reports and discussions. Prerequisite: Graduate classification in landscape architecture.
- 684. Professional Internship. Credit 1 to 8.** LAND 684 is sequenced for graduation; must be completed prior to the final year of advanced study in the summer; student is required to take a work position in an approved office for a minimum of ten weeks at forty hours/week. Prerequisite: approval of faculty.
- 685. Directed Studies. Credit 1 to 6.** Advanced study in an individual landscape architecture course with a selected faculty member; focus on a topic mutually derived by the student and faculty member; requires the production of a professional response solution. Prerequisite: Approval of faculty.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of landscape architecture. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for and preparation of dissertation. Prerequisite: Doctoral classification.
- 693. Professional Study. Credit 1 to 6 each semester.** Terminal studio to be taken by the qualified master of landscape architecture candidate; requires preparation of a proposal describing the topic, an outlined method, procedures and timeline to be submitted to committee; approved and completed study requires a defense and separate public presentation. Prerequisite: Approval of landscape architecture faculty.

College of Liberal Arts (LBAR)

- 600. Liberal Arts Study Abroad. (9-0). Credit 9.** For students in approved programs to study abroad. Prerequisites: Graduate classification; approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of liberal arts. May be repeated for credit.
- 698. Writing for Publication. (3-0). Credit 3.** Writing in academic disciplines and settings. Writing for different audiences and purposes, Style; planning and development of journal articles; grant proposals; correspondence; oral presentations; technical reports. Permission of departmental/college graduate advisor. Prerequisite: Advanced standing in master's/doctoral programs.

Linguistics

(faculty, see [page 408](#))

(LING)

- 602. Topics in Sociolinguistics. (3-0). Credit 3.** Topics in the study of language and society; may focus on language use and change; how social variable affect language use and change; different theoretical approaches; issues and controversies. May be taken three times for credit as content varies.
- 610. Topics in the History of the English Language. (3-0). Credit 3.** Topics in the development of the English language; may include phonological, grammatical and lexical histories; study of social and political contexts; relationships between English and other languages. Cross-listed with ENGL 610. May be taken three times for credit as content varies. Credit cannot be given for both ENGL 610 and LING 610 in the same semester.
- 670. Topics in Discourse Analysis. (3-0). Credit 3.** Topics in linguistic and discourse analysis; possible topics include discourse and identity, language and gender, register studies, ethnography of communication, linguistics and literature. May be taken three times for credit as content varies.
- 685. Directed Studies. Credit 1 to 6.** Readings to supplement the student's knowledge of English language and linguistics in areas not studied in other courses. Prerequisites: Graduate classification and approval of department head.

Department of Management

M. R. Barrick**, L. Bierman, W. R. Boswell*, D. S. Chiaburu, J. E. Coombs, S. H. Courtright, L. A. Eden, M. A. Fitza, L. R. Gomez-Mejia, R. W. Griffin (Head), K. T. Haynes, D. Hellriegel, M. A. Hitt, R. D. Ireland, B. L. Kirkman, H. A. Ndofo, R. L. Paetzold, C. O. Porter, M. W. Pustay, M. Schijven, D. J. Schleicher, A. J. Shipp, D. G. Sirmon, L. Tihanyi, J. Watt, B. D. Welch, M. J. Wesson, M. C. Withers, R. W. Woodman, A. Zardkoohi, R. D. Zimmerman

* Doctoral Student Advisor

** Master's Student Advisor

The Department of Management offers graduate studies leading to MS and PhD degrees and coursework supporting the Mays Business School's MBA degree.

The MS degree program in management consists of 37 credit hours, and up to 9 additional credit hours depending on prior completion of necessary preparatory coursework. Students pursuing the MS degree specialize in the area of human resource management. The PhD program emphasizes coursework in policy and strategy, organizational behavior and theory, human resource management, and business and public policy.

Additional information, including specific departmental requirements, may be obtained by contacting the master's student advisor or the doctoral student advisor in the Department of Management.

Management (MGMT)

- 602. Markets and Public Policy. (3-0). Credit 3.** Theoretical underpinnings of business decision making; function and structure of markets; effects of public policy on business activities; includes: antitrust; securities; labor discrimination; products liability. Prerequisite: Graduate classification.

- 610. Business and Public Policy. (3-0). Credit 3.** Role of business organizations in the United States and other countries; topics pertaining to the external political and social environment of business and the implications for business managers including market failures and political failures as well as equity and ethical issues; case studies with business/government problems. Prerequisite: Graduate classification. Cross-listed with BUSH 664.
- 611. Microfoundations of Business Behavior. Credit 1 to 3.** A multi-disciplinary analysis of the foundations of business behavior discussing business interaction with customers under alternative market conditions and interaction with suppliers, investors, employees and other stakeholders, considered in the context of alternative legal, political and social institutional arrangements. Classification 6 students may not enroll in this course. Prerequisites: Enrollment is limited to BUAD classification 7.
- 612. Business Applications of Price Theory. (3-0). Credit 3.** Application of price theory framework to decisions facing managers. Topics include political, legal and regulatory environments of business; corporate governance and antitakeover regulations; principal-agent problems in large corporations. Prerequisite: Doctoral classification required.
- 613. Managerial Macroeconomics. (3-0). Credit 3.** Analysis of domestic and global macroeconomic issues from a managerial perspective; analysis of current and historical macroeconomic events at the national and global levels; analysis of business cycles and monetary and fiscal policies; managerial decisions in the context of changing macroeconomic environment. Prerequisite: Enrollment is limited to BUAD classification 7.
- 614. Managing People in Organizations. Credit 1 to 3.** Procurement and management of people in organizations including human resource management principles and analysis of how organizations function; performance appraisal, compensation, training, leadership, group dynamics, decision-making, control mechanisms and organizational change processes. Classification 6 students may not enroll in this course. Prerequisite: Enrollment is limited to BUAD classification 7.
- 618. Corporate Strategy and the Political Environment of Business. Credit 1 to 3.** Formulation and implementation of corporate strategy with consideration of the political environment of business. Classification 6 students may not enroll in this course. Prerequisites: Enrollment is limited to BUAD classification 7.
- 620. Managing Human Resources. (3-0). Credit 3.** Survey of human resource management; formulation and implementation of human resource strategy addressed for areas including planning, recruitment, selection, job choice, training, development, appraisal, compensation, benefits, labor relations, international human resource issues and legal compliance. Prerequisite: Graduate classification.
- 621. Research Methods for HR Professionals. (3-0). Credit 3.** Direct experience in formulation of HRM issues as hypotheses and selection and implementation of appropriate research designs and statistical tools to evaluate such hypotheses; properties of appropriate criteria, measures, designs and statistical tests in context of contemporary HRM issues; ethical issues in HRM research. Prerequisites: STAT 651 or equivalent; graduate classification.
- 622. Organizational Staffing. (3-0). Credit 3.** Foundations and operating aspects of recruitment, selection and placement in various types of organizations; coverage of scientific and legal issues affecting human resource selection decisions from a managerial perspective; examination of the usefulness of various methods used in job analysis, selection, and performance appraisal; introduction to “job match” from various perspectives. Prerequisite: Graduate classification.
- 623. Compensation Management. (3-0). Credit 3.** Strategic and technical considerations in the management of employee compensation in organizations; including job evaluation systems, legal issues, comparable worth, rewards as a consideration in motivation and satisfaction, wage levels and structures, merit ratings, individual and group incentives and benefit plans. Prerequisite: Graduate classification.
- 624. Seminar in Human Resources. (3-0). Credit 3.** Seminar on theory and research in human resource management; includes: planning, search and decision theory, organizational entry and socialization, staffing theories, validity generalization, utility theory, performance measurement and evaluation, reward systems, organizational justice and employee rights, employee development and employee withdrawal. Prerequisite: Doctoral classification or approval of instructor.
- 625. Human Resource Development. (3-0). Credit 3.** Examination of training, education and development within organizations from both a strategic and operational perspective; analysis of needs, program design and methods, program implementation and evaluation, including transfer or learning issues; legal and ethical human resource development issues; implications and practices of human resource development for enhancing global competitiveness. Prerequisite: Graduate classification.

- 626. Teams in Organizations. (3-0). Credit 3.** Cutting edge thinking on leading in team-based organizations including the organizational changes required to move to a team-based structure and the organizational factors required to create successful work teams. Prerequisite: Graduate classification.
- 628. Contemporary Human Resource Management Issues. (3-0). Credit 3.** Application of human resource theory to contemporary human resource management issues; impact of these issues for the organization and on the strategic role of the human resource professional; guest speakers; student projects. Prerequisite: Second-year enrollment in the Master of Science in management program or approval of instructor.
- 630. Behavior in Organizations. (3-0). Credit 3.** Organizational behavior theory, research and applications; focuses on the individual and group levels of analysis; includes: learning principles, perceptions, attitudes and job satisfaction, work motivation, job design, group properties and processes, leadership, conflict, communication, personality influences on work attitudes and behaviors, work-life issues and job stress. Prerequisite: Graduate classification.
- 632. Technology Commercialization. (3-0). Credit 3.** Focus on technology, process of evaluating raw technology viability, converting raw technology into commercially viable products and services; course includes model on Small Business Innovation Research (SBIR) grant program; develops competencies skills to evaluate technology's commercial viability; brings viable technologies to commercial success. Prerequisite: Graduate classification.
- 633. Organizational Change and Development. (3-0). Credit 3.** Organizational change theory, processes and models; the role of change agents; organizational diagnosis and intervention; culture, process, strategy, structure and technology changes in organizations; evaluation research on organizational change; problems and issues in organizational change. Prerequisite: Graduate classification.
- 634. Seminar In Organizational Behavior. (3-0). Credit 3.** Theory and research in organizational behavior; includes: operant and social learning theories, work motivation, job satisfaction and affect at work, task design, absenteeism and turnover, prosocial behavior, leadership, group properties and processes and work linkages and job stress. Prerequisites: MGMT 630 or equivalent; doctoral classification or approval of instructor.
- 635. Employment Regulation. (3-0). Credit 3.** Overview of regulatory environment of human resource management; topics include: equal employment opportunity and affirmative action, benefits regulation, workplace safety, workers' compensation, labor relations, and international aspects of employment regulation. Prerequisite: Graduate classification.
- 636. Seminar in Organization Theory. (3-0). Credit 3.** Research literature in organization theory focusing on major theoretical perspectives and content areas; includes: design of organizational structure and control systems; analysis of organization-environment relations, including interorganizational relationships; managing organizational technology and innovation; information processing and decision making; and organizational culture, conflict and power. Prerequisite: Doctoral classification or approval of instructor.
- 637. Foundations of Entrepreneurship. (3-0). Credit 3.** Process of launching a new venture; process by which opportunities can be discovered and selected; attributes of entrepreneurs and new venture teams; process of developing business plan; core entrepreneurial strategies—business level, organizational design, marketing, financial; strives to develop competencies, concepts, operational tools relevant to creating, implementing new ventures. Prerequisite: Graduate classification.
- 638. Strategic Entrepreneurship. Credit 1 to 3.** Emphasis on a firm's need to be both entrepreneurial (identifying opportunities in the market) and strategic (taking actions to gain a competitive advantage) in order to create value for stakeholders; includes: developing an entrepreneurial mindset; building an entrepreneurial culture; managing resources (building a resource portfolio, bundling resources to create capabilities and leveraging the capabilities to exploit the opportunities identified); creating innovations. Prerequisite: Graduate classification.
- 639. Negotiations in Competitive Environments. Credit 1 to 3.** Understanding prescriptive and descriptive negotiation theory as it applies to dyadic and multi-party negotiations, to buyer-seller transactions, dispute resolution, development of negotiation strategy and management of integrative and distributive aspects of the negotiation process. Prerequisite: Graduate classification.
- 640. Managing for Creativity and Innovation. (3-0). Credit 3.** Examines factors that may foster or stifle individual, team, or organizational creative performance, and presents techniques that may improve the student's creative thinking skills. Prerequisite: Graduate classification.

- 641. Human Resource Information Systems. (3-0). Credit 3.** This course provides the foundation for understanding and using human resource information systems for managing employee data and emphasizes the features and functionality of specialized commercial software designed to support human resource professional end users. Topics include developing HRIS, data management and database design, and tracking people in organizations. Prerequisite: Graduate classification.
- 642. Legal Foundations for New Ventures. (3-0). Credit 3.** Basic legal relationships, organizational forms, issues likely to be encountered by technology developers and entrepreneurs; the American legal system, administrative law, intellectual property law, and the fundamentals of securities law; outside legal specialists. Prerequisite: Graduate classification.
- 643. Foundations of Managerial Law. (3-0). Credit 3.** Basic legal relationships and issues encountered by managers and organizations; American legal system, administrative law, alternative dispute resolution and selected substantive areas of law (e.g., environmental protection, discrimination, negotiable instruments). Prerequisite: Graduate classification.
- 645. Legal and Ethical Issues in Business. Credit 1 to 3.** An overview of legal compliance programs, business ethics and social responsibility issues. Prerequisite: Approval of instructor.
- 647. Law for Small and Family Owned Businesses. (3-0). Credit 3.** Basic legal principles and issues involved in the formation of a small, family owned or startup business, including: decisions on incorporation, business planning, franchising, capitalization, taxation, specific legal issues in (contracts, warranties, agency law, bankruptcy, and intellectual property), legalities surrounding the internet, employment and human resource concerns. Prerequisite: Graduate classification.
- 650. Human Relations and Collective Bargaining in Industry. (3-0). Credit 3.** Labor management relationship and human relations problems encountered during union administration; labor history; basic construction of the National Labor Relations Act; alternative dispute resolution; contemporary labor relations issues; international labor relations issues. Prerequisite: Graduate classification.
- 655. Survey of Management. (3-0). Credit 3.** Management concepts and applications important to managers in all types and sizes of organizations; includes: strategic planning, goal setting, control and managerial ethics; decision making, organizing, human resource management, including staffing, performance appraisal and compensation; leadership, motivation, communication and group processes; achieving organizational quality and managing in a global environment. Prerequisite: Graduate classification. Note: This course may not be used for elective credit by a master's candidate in business administration.
- 658. Managing Projects. (3-0). Credit 3.** Application of management processes to complex interdisciplinary organizational environments through the study of program and project management; adoptions of traditional management theories to the project environment; master typical project management micro-computer software for project planning; resource allocation; project budgeting; and control of project cost, schedule and performance. Prerequisite: Graduate classification.
- 659. Contemporary Issues in Telecommunications Management. (3-0). Credit 3.** Survey of the methods and techniques for managing organizations involved in the development, production, distribution and exhibition of information and entertainment to the public via electronic means. The course integrates descriptions of core delivery technologies, including broadcast, cable, telephone and the internet, with underlying business concepts to provide a comprehensive picture of the global telecommunications industry. Prerequisite: Graduate classification.
- 660. Global Human Resource Management. (3-0). Credit 3.** This course will examine HRM in a global context. Emphasis will be given to global HR functions such as international staffing, training, and compensation. The course will focus on global HRM trends and challenges and will also address issues and choices HR managers face in multinational enterprises. Prerequisite: Graduate classification.
- 663. International Transfer Pricing. (3-0). Credit 3.** Valuation of cross-border transactions between units of a multinational enterprise; includes internal and external motivations for transfer pricing, managerial and economic approaches, estimates of transfer manipulation, arm's length standard, U.S. and OECD rules and procedures, tax court cases, and ethical dilemmas. Prerequisite: Graduate classification. Cross-listed with INTA 663.
- 667. Multinational Enterprises. (3-0). Credit 3.** Graduate seminar in international business; multinational enterprises (MNEs) are studied from various perspectives including economics, management, entry and expansion strategies, contractual agreements, transfer pricing, impacts on home and host countries, MNE-state relations, regional integration, public policies towards MNEs. Prerequisite: Graduate classification. Cross-listed with IBUS 667.

- 673. Advanced Research Methods in Management. (3-0). Credit 3.** Introduces Ph.D. students in Management to the multivariate methods commonly used in management research. Applications emphasized; journal publications; projects and critiques required. Prerequisite: STAT 608.
- 675. Leadership in Organizations. Credit 1 to 3.** Review of research on procedures, styles and methods of leadership, supervision, management and administration; all aspects of leader role behavior, both in practice and in research; areas in need of further research. May be repeated for up to 3 hours credit. Prerequisite: Graduate classification.
- 676. Strategic Management Survey. (3-0). Credit 3.** Management concepts and applications important to strategy; includes: concept of strategy; the environment, and performance; the role of top management teams; business-level strategies; competitive strategy and dynamics; corporate strategy formulation and implementation; mergers; acquisitions; governance and control systems; international strategies; cooperative strategies; technology strategies; corporate entrepreneurship. Prerequisite: Doctoral classification or approval of instructor.
- 677. Strategy Implementation. (3-0). Credit 3.** Concepts, research and applications regarding issues central to strategy implementation; includes: the nature of managerial work; inertia, organizational change and adaptation; innovation; strategic leadership; power; top management teams in implementation roles; organizational cultures; the relationship between strategy and structure; executive succession; institutional contexts; governance; agency theory; boards of directors; executive compensation; use of leverage and cash flow; implementation of mergers, acquisitions, and restructuring. Prerequisite: Doctoral classification or approval of instructor.
- 678. International Management. (3-0). Credit 3.** Survey of the issues, problems, challenges and opportunities facing organizations competing in a global economy; includes: the environment of international management, international strategies, forms of organization design used by multinational firms, managing human resources in an international context, and cultural and control issues facing the international manager. Prerequisite: Graduate classification. Cross-listed with IBUS 678.
- 679. International Business Policy. (3-0). Credit 3.** Determinants of U.S. competitiveness in international markets; the international environment of business; introduction to multinational enterprises, global competition, international organizations, protection of intellectual property; international trade regulation; strategic trade theory. Prerequisite: Graduate classification. Cross-listed with IBUS 679.
- 680. Business and Corporate Strategy. (3-0). Credit 3.** The nature of strategy and its relationship with performance. Business level strategies, including: product and cost differentiation, cooperation, and imitation impeding strategies. Corporate level strategies, including: diversification, mergers and acquisitions, innovation and market share. Case analyses emphasized. Prerequisite: Graduate classification.
- 681. Seminar. Credit 1 each semester.** Critical examination of subject matter presented in current journals, monographs and bulletins in field of management. Classification 6 students may not enroll in this course. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 to 6.** Directed internship in an organization to provide students with on-the-job training with professionals in organizational settings appropriate to the students' professional objectives. Classification 6 students may not enroll in this course. Prerequisites: Approval of MS program coordinator and department head.
- 685. Directed Studies. Credit 1 to 6 each semester.** Directed study on selected problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisites: Graduate classification and approval of instructor.
- 686. Research Methods in Organizational Science II. (3-0). Credit 3.** Continuation of topics introduced in Management 687; additional topics include survey research methodology, quantitative and qualitative field methods; archival data collection; measurement and methods across time; issues in peer review and publication. Prerequisites: Doctoral classification and MGMT 687 or approval of instructor.
- 687. Research Methods in Organizational Science I. (3-0). Credit 3.** Philosophy of science, theory development; survey of research methodology applicable to the study of organizational phenomena; research strategy and design; measurement and sampling issues; data collection methods; problems and issues in organizational research. Prerequisites: Doctoral classification or approval of instructor; STAT 651 or equivalent.

- 689. Special Topics in...** **Credit 1 to 4.** Selected topics in an identified area of management. May be repeated for credit. Prerequisite: Graduate classification.
- 690. Theory of Research in Management. (3-0). Credit 3.** Research practicum; application of research methodology learned in MGMT 687; advanced readings in research methods; fundamental skills and concepts needed to design and conduct dissertation research. Classification 6 students may not enroll in this course. Prerequisites: Doctoral classification or approval of instructor; MGMT 687 or equivalent.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Classification 6 students may not enroll in this course. Prerequisite: Graduate classification.

Department of Marketing

L. L. Berry, P. S. Busch, H. Chen*, A. B. Cocanougher, C. M. Futrell, L. G. Gresham, K. Haws, S. Jain, R. Janakiraman, Y. Liu, S. W. McDaniel**, W. M. Pride, S. Ramanathan, R. Ramkumar, V. Shankar, A. Sorescu, L. Troy, P. R. Varadarajan (Head), M. S. Yadav

* Doctoral Student Advisor

** Master's Student Advisor

The Department of Marketing offers graduate studies leading to MS and PhD degrees and coursework supporting the Mays Business School's MBA degree. These programs provide training for students interested in marketing careers.

The MS degree program consists of 38 credit hours (provided students have the necessary preparatory coursework) and is designed to give a greater degree of specialization in marketing than the MBA program. The PhD program is designed to prepare students for careers in research and teaching as well as specialized staff positions in public and private organizations.

Additional information, including specific departmental requirements, may be obtained by contacting the department or the Office of the Dean, Mays Business School.

Marketing (MKTG)

- 613. Marketing Management. Credit 1 to 3.** Core MBA marketing class examines history of marketing, environment that impacts marketing decisions of firms and consumers, buyer behavior, marketing ethics, marketing research, market segmentation, product positioning, new product management, and strategic challenges associated with integrating major marketing mix decision elements; product, price, distribution, and promotion. May be repeated for up to 3 hours of credit. Classification 6 students may not enroll in this course. Prerequisite: Enrollment is limited to BUAD classification 7.
- 621. Survey of Marketing. (3-0). Credit 3.** Marketing concepts and decisions associated with developing marketing strategies; topics include product, pricing, distribution, and promotion. Note: This course may not be used for elective credit by a master's candidate in business administration.
- 625. Marketing Engineering. (3-0). Credit 3.** Analysis and management of popular statistical packages for the purpose of enhanced data-based and empirically-driven marketing decisions. Application of statistical software to marketing-related data sets. Prerequisite: MKTG 621 or equivalent.
- 635. Marketing Analytics and Pricing. (3-0). Credit 3.** Advanced quantitative techniques and analytical tools that provide insights into the nature of consumer demand and its response to changes in the marketing mix, with a focus on pricing. Prerequisite: MKTG 625.
- 638. Strategic Foundations of E-Commerce. (3-0). Credit 3.** Implications of increasing electronic interactivity between consumers and firms; migration of products to the electronic marketplace and its effects on the marketing channel; Internet's impact on marketing mix decisions; competitive advantage; public policy issues. Prerequisite: MKTG 613 or MKTG 621 or equivalent.
- 650. Analyzing Consumer Behavior. (3-0). Credit 3.** Concepts, theories, and techniques applicable to obtaining a sophisticated and empirically-based understanding of consumer motivation, attitudes, decision-making processes, and responses to marketers' actions; application of consumer psychology and behavioral decision making to managerial and public policy insights. Prerequisite: MKTG 613 or MKTG 621 or equivalent.

- 656. Branding and Marketing Communication. (3-0). Credit 3.** Customer-based brand equity and positioning, brand objectives, communication processes, customer decision stages, creative and media strategies including traditional, grassroots, and social media, measuring advertising effectiveness and return on marketing investment. Prerequisite: MKTG 613 or MKTG 621 or equivalent.
- 660. Marketing Consulting. (1-4). Credit 3.** Application of marketing knowledge through the planning and execution of marketing projects for businesses. May be repeated one time for credit. Prerequisite: MKTG 621 or equivalent.
- 665. Research for Marketing Decisions. (3-0). Credit 3.** Methodology for generating and using information related to problems in marketing decision-making; primary and secondary research methodology and analytical techniques; guidelines for designing and conducting research projects. Classification 6 students may not enroll in this course. Prerequisites: MKTG 613 or MKTG 621 or equivalent; basic statistics course.
- 670. Marketing Leadership. (1-0). Credit 1.** Seminar on the application of marketing concepts and theories through guest lectures and discussions with marketing-thought leaders in business and academia. May be repeated one time for credit. Prerequisite: MKTG 621 or equivalent.
- 671. Product Innovation. (3-0). Credit 3.** Strategy and management of the new product development process, portfolio management and innovation charters for new products; topics include creativity, trade-off analysis, concept testing, design and launch. Classification 6 students may not enroll in this course. Prerequisite: MKTG 613 or MKTG 621 or equivalent.
- 673. Services Marketing. (3-0). Credit 3.** Marketing concepts and strategy as applied to service organizations, unique characteristics of services, marketing challenges posed by those characteristics and ways to meet those challenges effectively. Special emphasis on service quality. Classification 6 students may not enroll in this course. Prerequisite: MKTG 613 or MKTG 621 or equivalent, or approval of instructor.
- 675. Marketing Strategy. Credit 1 to 3.** Marketing management as it relates to overall organizational goals: marketing strategy concepts and interdependencies with strategy at the corporate and business unit levels and in other functional areas; impact of digital technologies and environmental sustainability on marketing strategy. Classification 6 students may not enroll in this course. Prerequisites: MKTG 613 or MKTG 621 or equivalent; graduate classification in business administration.
- 677. Multinational Marketing Management. (3-0). Credit 3.** Theoretical and empirical materials on multinational marketing; nature and justification of international trade, analysis of environments faced by multinational firms and formulation of multinational marketing strategy. Classification 6 students may not enroll in this course. Prerequisite: MKTG 613 or MKTG 621 or equivalent. Cross-listed with IBUS 677.
- 680. Seminar in Buyer Behavior. (3-0). Credit 3.** Detailed examination of the literature in consumer and industrial buyer behavior with emphasis on conceptual and empirical issues; critical analysis of buyer behavior theory. Classification 6 students may not enroll in this course. Prerequisites: MKTG 650 or equivalent; doctoral classification.
- 682. Seminar in Marketing Strategy Research. (3-0). Credit 3.** Review of research on marketing strategy content; formulation process and implementation related issues; includes antecedents, outcomes, mediators and moderators of the relationship between marketing strategy and performance; strategic marketing alliances; market pioneering; multimarket competition; global competitive strategy; interdependencies between marketing, business and corporate strategy. Classification 6 students may not enroll in this course. Prerequisite: Doctoral classification.
- 684. Professional Internship. Credit 1 to 6.** Directed internship in an organization to provide students with on-the-job training with professionals in organizational settings appropriate to the students' professional objectives. Classification 6 students may not enroll in this course. Prerequisite: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed study of selected problems using recent developments in business research methods. Classification 6 students may not enroll in this course. Prerequisite: Approval of instructor.
- 687. Seminar in Marketing Models. (3-0). Credit 3.** Review and discussion of the foundations of modeling and recent developments in research using marketing models. The seminar is designed to provide participants with new ways to think about modeling marketing phenomena and enable them to generate new ideas, research topics, and modeling applications for marketing problems. Prerequisite: Doctoral classification.

- 688. Doctoral Seminar. (3-0). Credit 3.** Historical development of the conceptual framework of marketing theory and practices; analysis of current research and controversial issues in the field. May be repeated for credit three times. Students may take up to two sections of this course in the same semester. Classification 6 students may not enroll in this course. Prerequisite: Doctoral classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of marketing. Classification 6 students may not enroll in this course. May be repeated for credit.
- 690. Theory of Research in Marketing. (3-0). Credit 3.** Design of research in the various subfields of marketing and the evaluation of research results using examples from the current research literature. Classification 6 students may not enroll in this course. May be repeated for credit. Students may take up to two sections of this course in the same semester. Prerequisite: Graduate classification in marketing.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Classification 6 students may not enroll in this course.

Intercollegiate Faculty in Materials Science and Engineering

R. K. Abu Al-Rub, M. Akbulut, R. Arroyave, P. B. Balbuena, J. D. Batteas, A. A. Benzerga, T. Cagin, Z. Cheng, E. Cosgriff-Hernandez, T. S. Creasy, J. C. Grunlan, M. A. Grunlan, M. S. Hahn, H. R. Harris, K. T. Hartwig, P. R. Hemmer, A. K. Holzenburg, T. R. Hughbanks, W. Hwang, H. Jeong, J. Kameoka, I. Karaman (Faculty Chair), Y. Kuo, D. C. Lagoudas, H. Liang, J. Lutkenhaus, S. M. McDeavitt, M. J. McShane, II, D. J. Maitland, M. S. Mannan, K. E. Meissner, D. G. Naugle, M. Radovic, I. Roshchin, J. H. Ross, Jr., J. M. Seminario, L. Shao, H. J. Sue, R. R. Talreja, W. Teizer, S. Vaddiraju, H. Wang, J. D. Whitcomb, W. Wu, C. Yu, N. Zacharia, X. Zhang, H. Zhou

The intercollegiate Faculty of Materials Science and Engineering (MSEN) has members primarily in the College of Science and the Dwight Look College of Engineering. Degree programs are available leading to MEng, MS, and PhD degrees in Materials Science and Engineering. At the MS level, both thesis and nonthesis options are offered. Faculty members have appointments in the Departments of Aerospace Engineering, Biology, Biomedical Engineering, Chemistry, Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Nuclear Engineering, and Physics. Graduate training in Materials Science and Engineering is designed to provide advanced training for careers in the rapidly growing materials industry, national laboratories and academic (research and teaching) environments.

Degree programs for students are prepared by the students' graduate committee in consultation with the student. Courses for the degree program are selected from various departments and colleges which serve the needs of the materials scientist and engineers. Degree programs generally consist of two to four core courses (MSEN 601, MSEN 602, MSEN 603 and MSEN 604) plus other courses chosen to strengthen the specific interest of individual students.

Materials Science and Engineering (MSEN)

- 601. Fundamental Materials Science and Engineering. (4-0). Credit 4.** Fundamentals of microstructure- properties and relationship of materials. Topics will include: electronic and atomic structure of solids, structure of crystalline materials, imperfections in crystalline materials, introduction to dislocation theory, mechanical properties, fundamental thermodynamics of materials, phase equilibria and diagrams, diffusion, and kinetics of phase transformations. Prerequisite: Graduate classification.
- 602. Advanced Materials Science and Engineering. (4-0). Credit 4.** Fundamentals of quantum mechanics, physics of solid state, and physical electronics and photonics for advanced materials. Topics will include: basic quantum mechanical problems, quantum basis for structural and physical properties of solids, lattice vibrational effects in solids, free electron model for magnetism in solids, semiconductor materials and devices, nanostructures and mesoscopic phenomena, superconductivity, recent advances in new types of materials. Prerequisite: Undergraduate quantum mechanics or approval of instructor.
- 603. Fundamentals of Soft and Biomaterials. (3-0). Credit 3.** Introductory graduate-level survey on the general areas of soft materials and biomaterials; includes basic concepts of colloidal particle physics, polymer physics and chemistry, and general concepts in biomaterials. Prerequisites: Undergraduate general chemistry course; graduate classification.

- 604. Quantum Mechanics for Materials Scientists. (3-0). Credit 3.** Provides a background in quantum mechanics for graduate materials scientists or engineers with little or no quantum mechanics background. The following topics will be covered: origins of quantum theory, interpretation, Schrodinger equation and its applications, operator mechanics, approximation methods, angular momentum, the hydrogen atom, and quantum statistics. Prerequisites: MATH 601, MATH 311 or approval of instructor; graduate classification.
- 606. Multifunctional Materials. (3-0). Credit 3.** This course will present an in-depth analysis of multifunctional materials and composites, and their novel applications. Prerequisites: Theory of elasticity or Continuum Mechanics MEMA 601 or MEMA 602/AERO 603, MSEN 601 or MEMA 609. Cross-listed with AERO 606 and MEMA 606.
- 607. Polymer Physical Properties. (3-0). Credit 3.** Macromolecular concepts; molecular weight characterization; solubility parameters; phase diagrams; viscoelasticity; rheology; thermal behavior; damage phenomena; morphology; crystallization; liquid crystallinity; nanocomposites. Prerequisites: MEEN 222 (or other intro to materials science course). Cross-listed with MEEN 607.
- 608. Nanomechanics. (3-0). Credit 3.** Application of mechanics concepts to nano-scale behavior of materials. Review of continuum mechanics; Extensions to generalized continua; Nonlocal elasticity; Nano-scale plasticity. Focus on multi-scale modeling: Dislocation Dynamics; Quasi-Continuum method; Molecular dynamics with introductions to quantum mechanics and statistical mechanics. Prerequisite: AERO 603 or MEMA 601. Cross-listed with AERO 608 and MEMA 608.
- 616. Surface Science. (2-2). Credit 3.** Properties of surfaces, principles of classic and contemporary surface characterization techniques, recent development and roles of surface science in advanced technology. Prerequisite: Graduate classification. Cross-listed with MEEN 616.
- 619. Materials Modeling of Phase Transformation and Microstructural Evolution. (3-0). Credit 3.** Computer modeling and simulation of microstructural evolution during various phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic transformation, ferroelectric and ferromagnetic domain evolution, dislocation dynamics, and crack propagation. Prerequisites: Graduate classification and approval of instructor. Cross-listed with AERO 619 and MEMA 619.
- 625. Mechanical Behavior of Materials. (3-0). Credit 3.** Examination of deformation and microstructure mechanisms responsible for deformation and failure in metals; fatigue, creep, and fracture mechanisms of materials; emphasis on microstructural-mechanical property relationship. Prerequisite: Undergraduate-level materials science course. Cross-listed with MEEN 625.
- 640. Thermodynamics in Materials Science. (3-0). Credit 3.** Use of thermodynamic methods to predict behavior of materials; codification of thermodynamic properties into simplified models; principles, methods, and models to generate accurate equilibrium maps through computational thermodynamics software; applications to bulk metallic, polymeric and ceramic materials, defects, thin films, electrochemistry, magnetism. Prerequisites: MEEN 222 or equivalent; graduate classification. Cross-listed with MEEN 640.
- 656. Mechanical and Physical Properties of Thin Films. (3-0). Credit 3.** Mechanical properties (hardness, stress, strain, delamination, fracture) of films; nanomechanical testing techniques; electrical properties of thin films; electrical properties measurement techniques; magnetic properties of films; magnetic properties measurement techniques; laboratory includes (1) thin film fabrication (sputtering, PVD); (2) nanomechanical testing; (3) electrical/magnetic measurement. Prerequisite: MEEN 222, MSEN 601, or basic materials science background. Cross-listed with MEEN 656.
- 658. Fundamentals of Ceramics. (3-0). Credit 3.** Atomic bonding; crystalline and glassy structure; phase equilibria and ceramic reactions; mechanical, electrical, thermal, dielectric, magnetic, and optical properties; ceramic processing. Prerequisite: MEEN 222 or equivalent or approval of instructor. Cross-listed with MEEN 658.
- 670. Computational Materials Science and Engineering. (3-0). Credit 3.** Modern methods of computational modeling and simulation of materials properties and phenomena, including synthesis, characterization, and processing of materials, structures and devices; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input. Prerequisites: Approval of instructor approval; graduate classification. Cross-listed with CHEN 670 and MEMA 670.
- 681. Seminar. (1-0). Credit 1.** Selected research topics in materials science and engineering presented by faculty, students, and outside speakers. Prerequisite: Graduate classification.

- 684. Professional Internship. Credit 1 to 9.** Directed internship in an industrial or laboratory setting under the supervision of successful, experienced personnel; work related to the student's career aspirations and areas of specialization. May be taken 2 times for credit. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 12 each semester.** Special topics not within the scope of thesis research and not covered by other formal courses. Prerequisite: Graduate classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of materials science and engineering. Potential topics include: advanced phase transformations, advanced materials and processing, nanomaterials and nanotechnologies, computational modeling of materials, advanced techniques of spectroscopy, surface and interface phenomena, thin film processing, ceramic engineering, organic materials for electronic and photonic devices, biomedical microdevices, materials fabrication, processing and fabrication of semiconductors, and materials and processing for MEMS. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research toward thesis or dissertation.

The following courses are described in the Biology (BIOL) section on [page 332](#) and are a part of the Materials Science and Engineering curriculum.

- 602. Fundamentals of Transmission Electron Microscopy. (3-6). Credit 5.**
- 604. Fundamentals of Scanning Electron Microscopy (SEM) and Environmental Scanning Electron Microscopy (ESEM). (1-3). Credit 2.**

The following courses are described in the Biomedical Engineering (BMEN) section on [page 336](#) and are a part of the Materials Science and Engineering curriculum.

- 601. Foundations of Biomedical Engineering Analysis. (3-0) Credit 3.**
- 620. Bio-optical Imaging. (3-0). Credit 3.**
- 635. Biomaterials Compatibility. (3-0). Credit 3.**
- 660. Vascular Mechanics. (3-0). Credit 3.**
- 661. Cardiac Mechanics. (3-0). Credit 3.**
- 682. Polymeric Biomaterials. (3-0). Credit 3.**

The following courses are described in the Chemistry (CHEM) section on [page 348](#) and are a part of the Materials Science and Engineering curriculum.

- 601. Analytical Chemistry I. (3-0). Credit 3.**
- 602. Analytical Chemistry II. (3-0). Credit 3.**
- 619. Analytical Spectroscopy. (3-0). Credit 3.**
- 621. Chemical Kinetics. (3-0). Credit 3.**
- 623. Surface Chemistry. (3-0). Credit 3.**
- 626. Thermodynamics. (3-0). Credit 3.**
- 631. Statistical Thermodynamics. (3-0). Credit 3.**
- 634. Physical Methods in Inorganic Chemistry. (3-0). Credit 3.**
- 635. Introduction to X-ray Diffraction Methods. (3-0) Credit 3.**
- 647. Spectra of Organic Compounds. (3-0). Credit 3.**
- 671. Macromolecular Folding and Design. (1-0). Credit 1.**

The following courses are described in the Chemical Engineering (CHEN) section on [page 345](#) and are a part of the Materials Science and Engineering curriculum.

- 623. Applications of Thermodynamics to Chemical Engineering. (3-0). Credit 3.**
- 633. Theory of Mixtures. (3-0). Credit 3.**
- 640. Rheology. (3-0). Credit 3.**
- 641. Polymer Engineering. (3-0). Credit 3.**
- 643. Applied Statistical Mechanics of Fluids. (3-0). Credit 3.**
- 651. Biochemical Engineering. (3-0). Credit 3.**
- 675. Microelectronics Process Engineering. (3-0). Credit 3.**

The following courses are described in the Civil Engineering (CVEN) section on [page 351](#) and are a part of the Materials Science and Engineering curriculum.

- 614. **Stabilization of Soil-Aggregate Systems. (2-0). Credit 2.**
- 622. **Properties of Concrete. (3-0). Credit 3.**
- 653. **Bituminous Materials. (2-3). Credit 3.**

The following courses are described in the Electrical and Computer Engineering (ECEN) section on [page 399](#) and are a part of the Materials Science and Engineering curriculum.

- 631. **Fiber-Optic Devices. (3-0). Credit 3.**
- 640. **Thin Film Science and Technology. (3-0). Credit 3.**
- 656. **Physical Electronics. (3-0). Credit 3.**
- 657. **Quantum Electronics. (3-0). Credit 3.**
- 664. **Nanotechnology Fabrication. (3-0). Credit 3.**
- 671. **Solid State Devices. (3-0). Credit 3.**
- 672. **Semiconductor Lasers and Photo Detectors. (3-0). Credit 3.**
- 673. **Fundamentals of Microelectronics. (3-0). Credit 3.**
- 675. **Integrated Optoelectronics. (3-0). Credit 3.**
- 678. **Statistical Optics. (3-0). Credit 3.**

The following course is described in the Geology (GEOL) section on [page 426](#) and is a part of the Materials Science and Engineering curriculum.

- 643. **Introduction to Electron Microprobe Analysis. (1-3). Credit 2.**

The following courses are described in the Mechanical Engineering (MEEN) section on [page 481](#) and are a part of the Materials Science and Engineering curriculum.

- 467. **Mechanical Behavior of Materials. (3-0). Credit 3.**
- 475. **Materials in Design. (3-0). Credit 3.**
- 603. **Theory of Elasticity. (3-0). Credit 3.**
- 606. **Polymer Laboratories. (2-3). Credit 3.**
- 608. **Continuum Mechanics. (3-0). Credit 3.**
- 610. **Applied Polymer Science. (3-0). Credit 3.**
- 615. **Advanced Engineering Thermodynamics. (3-0). Credit 3.**
- 631. **Microscale Thermodynamics. (3-0). Credit 3.**

The following courses are described in the Mechanics and Materials (MEMA) section on [page 487](#) and are a part of the Materials Science and Engineering curriculum.

- 601. **Theory of Elasticity. (3-0). Credit 3.**
- 602. **Continuum Mechanics. (3-0). Credit 3.**
- 604. **Mathematical Foundations of Continuum Mechanics. (3-0). Credit 3.**
- 607. **Flow and Fracture of Polymeric Solids. (3-0). Credit 3.**
- 610. **Applied Polymer Science. (3-0). Credit 3.**
- 611. **Fundamentals of Engineering Fracture Mechanics. (3-0). Credit 3.**
- 613. **Principles of Composite Materials. (3-0). Credit 3.**
- 614. **Physical Phenomena in Materials. (3-0). Credit 3.**
- 616. **Damage and Failure in Composite Materials. (3-0). Credit 3.**
- 625. **Micromechanics. (3-0). Credit 3.**
- 626. **Mechanics of Active Materials. (3-0). Credit 3.**
- 635. **Structural Analysis of Composites. (3-0). Credit 3.**

641. **Plasticity Theory. (3-0). Credit 3.**
 646. **Introduction to the Finite Element Method. (3-0) Credit 3.**
 651. **Viscoelasticity of Solids and Structures I. (3-0). Credit 3.**

The following courses are described in the Physics (PHYS) section on [page 516](#) and are a part of the Materials Science and Engineering curriculum.

304. **Advanced Electricity and Magnetism I. (3-0). Credit 3.**
 305. **Advanced Electricity and Magnetism II. (3-0). Credit 3.**
 408. **Thermodynamics and Statistical Mechanics. (4-0). Credit 4.**
 412. **Quantum Mechanics I. (3-0). Credit 3.**
 414. **Quantum Mechanics II. (3-0). Credit 3.**
 603. **Electromagnetic Theory. (3-0). Credit 3.**
 606. **Quantum Mechanics. (4-0). Credit 4.**
 607. **Statistical Mechanics. (4-0). Credit 4.**
 611. **Electromagnetic Theory. (4-0). Credit 4.**
 617. **Physics of Solid State. (3-0). Credit 3.**
 624. **Quantum Mechanics. (4-0). Credit 4.**
 631. **Quantum Theory of Solids. (3-0). Credit 3.**
 632. **Condensed Matter Theory. (3-0). Credit 3.**
 633. **Advanced Quantum Mechanics. (3-0). Credit 3.**
 648. **Quantum Optics and Laser Physics. (3-0). Credit 3.**
 666. **Scientific Instrument Making. (2-2). Credit 3.**

Department of Mathematics

O. G. Aberth, M. Aguiar, G. D. Allen, M. V. Anshelevich, W. Bangerth, D. L. Barrow, G. A. Battle, III, G. Berkolaiko, G. R. Blakley, H. P. Boas, A. Boggess, A. Bonito, I. Borosh, L. Bowen, J. H. Bramble, G. Chen, C. K. T. Chui, A. Comech, P. Daripa, R. A. DeVore, R. G. Douglas, K. J. Dykema, Y. Efendiev, T. Erdelyi, C. Foias, S. A. Fulling, S. C. Geller, R. Grigorchuk, J.-L. Guermond, R. A. Gustafson, D. J. Hartfiel, D. A. Hensley, J. M. Herrmann, A. M. Hobbs, P. Howard, W. B. Johnson, G. Kanschat, D. Kerr, T. R. Kiffe, P. Kuchment, H. E. Lacey, J. Landsberg, D. R. Larson, R. D. Lazarov, D. R. Lewis, P. Lima-Filho*, B. D. Lowe, M. R. Masri, L. Matusevich, C. J. Maxson, F. J. Narcowich, V. Nekrashevych, P. Nelson, Jr., D. Panchenko, G. Paouris, M. Papanikolas, J. E. Pasciak, C. Pearcy, W. L. Perry, G. Petrova, M. S. Piant, G. Pisier, J. T. Pitts, A. Poltoratski, B. Popov, M. H. Rahe, K. R. Rajagopal, J. N. Reddy, C. Robles, J. M. Rojas, E. C. Rowell, W. Rundell, D. A. Sanchez, J. F. Schielack, V. P. Schielack, Jr., T. Schlumprecht, N. Sivakumar, J. C. Slattery, K. C. Smith, R. R. Smith, F. Sottile, M. J. Stecher, P. F. Stiller, E. J. Straube (Head), Z. Sunik, S. D. Taliaferro, P. Tretkoff, T. I. Vogel, Y. Vorobets, J. R. Walton, J. D. Ward, C. Wilkerson, S. Witherspoon, C. H. Yan, P. B. Yasskin, M. P. Young, I. Zelenko, J. Zhou, J. Zinn

* Graduate Advisor

The Department of Mathematics offers graduate studies leading to the MS and PhD degrees in mathematics. Many of the course offerings are also suitable for graduate students pursuing degrees in engineering, science, geosciences, business, economics and education.

At the MS level, a student can pursue either a thesis or non-thesis degree. For the MS degree, a specialization in scientific computation, applied mathematics, financial mathematics or mathematics teaching is possible.

Satisfactory completion of the departmental qualifying exams is required of all students pursuing a PhD. In addition, the PhD degree requires a reading knowledge of Chinese, French, German, Russian or Spanish.

Admission to the Department's graduate programs is decided by the Graduate Programs Committee. Among the factors considered in admission decisions are: GRE General Test, undergraduate and graduate GPR, undergraduate academic background and achievement, letters of recommendation, GRE Subject Test in Mathematics (encouraged but not required).

Detailed information concerning programs and financial assistance may be obtained by writing the Graduate Programs Office, Department of Mathematics.

Mathematics (MATH)

- 601. Methods of Applied Mathematics I. (3-0). Credit 3.** Methods of linear algebra, vector analysis and complex variables. Prerequisite: MATH 308 or equivalent.
- 602. Methods and Applications of Partial Differential Equations. (3-0). Credit 3.** Classification of linear partial differential equations of the second order; Fourier series, orthogonal functions, applications to partial differential equations; special functions, Sturm-Liouville theory, application to boundary value problems; introduction to Green's functions; finite Fourier transforms. Prerequisites: MATH 601 or MATH 308 and MATH 407.
- 603. Methods of Applied Mathematics II. (3-0). Credit 3.** Tensor algebra and analysis; partial differential equations and boundary value problems; Laplace and Fourier transform methods for partial differential equations. Prerequisite: MATH 601 or MATH 311.
- 604. Mathematical Foundations of Continuum Mechanics. (3-0). Credit 3.** Mathematical description of continuum mechanics principles, including: tensor analysis, generalized description of kinematics and motion, conservation laws for mass and momentum; invariance and symmetry principles; application to generalized formulation of constitutive expressions for various fluids and solids. Prerequisites: MATH 410; MATH 451 or equivalent. Cross-listed with MEMA 604.
- 605. Mathematical Fluid Dynamics. (3-0). Credit 3.** Derivation of basic equations of motion; Navier-Stokes equations; potential equations; some exact solutions in two and three dimensions; equations of boundary layer theory; vorticity-stream function formulation and vortex dynamics; introduction to hydrodynamic stability; introduction to equations of turbulence. Prerequisite: MATH 601 or equivalent.
- 606. Theory of Probability I. (3-0). Credit 3.** Measure and integration, convergence concepts, random variables, independence and conditional expectation, laws of large numbers, central limit theorems, applications. Prerequisite: MATH 607 or approval of instructor.
- 607. Real Variables I. (3-0). Credit 3.** Lebesgue measure and integration theory, differentiation, L_p -spaces, abstract integration, signed measures; Radon-Nikodym theorem, Riesz representation theorem, integration on product spaces. Prerequisite: MATH 447 or equivalent.
- 608. Real Variables II. (3-0). Credit 3.** Banach spaces, theorems of Hahn-Banach and Banach-Steinhaus, the closed graph and open mapping theorems, Hilbert spaces, topological vector spaces and weak topologies. Prerequisite: MATH 607.
- 609. Numerical Analysis. (3-3). Credit 4.** Interpolation, numerical evaluation of definite integrals and solution of ordinary differential equations; stability and convergence of methods and error estimates. Prerequisite: Knowledge of computer programming (C or FORTRAN).
- 610. Numerical Methods in Partial Differential Equations. (3-3). Credit 4.** Introduction to finite difference and finite element methods for solving partial differential equations; stability and convergence of methods and error bounds. Prerequisite: MATH 417 or MATH 609 or equivalent.
- 611. Introduction to Ordinary and Partial Differential Equations. (3-0). Credit 3.** Basic theory of ordinary differential equations; existence and uniqueness, dependence on parameters, phase portraits, vector fields. Partial differential equations of first order, method of characteristics. Basic linear partial differential equations: Laplace equation, heat (diffusion) equation, wave equation and transport equation. Solution techniques and qualitative properties. Prerequisite: MATH 410 or equivalent or instructor's approval.
- 612. Partial Differential Equations. (3-0). Credit 3.** Theory of linear partial differential equations; Sobolev spaces; elliptic equations (including boundary value problems and spectral theory); linear evolution equations of parabolic and hyperbolic types (including initial and boundary value problems). As time permits, additional topics might be included. Prerequisite: MATH 611 and MATH 607 or MATH 641, or approval of instructor.
- 613. Graph Theory. (3-0). Credit 3.** One or more broad areas of graph theory or network theory, such as planarity, connectivity, Hamiltonian graphs, colorings of graphs, automorphisms of graphs, or network theory. Prerequisite: MATH 431 or equivalent or approval of instructor.
- 614. Dynamical Systems and Chaos. (3-0). Credit 3.** Discrete maps; continuous flows; dynamical systems; Poincaré maps; symbolic dynamics; chaos, strange attractors; fractals; computer simulation of dynamical systems. Prerequisites: MATH 308; MATH 601 or equivalent.

- 615. Introduction to Classical Analysis. (3-0). Credit 3.** Set-theoretic preliminaries; Cantor-Schröder-Bernstein Theorem; review of sequences; limit inferior and limit superior; infinite products; metric spaces; convergence of functions; Dini's Theorem, Weierstrass Approximation Theorem; Monotone functions; bounded variation; Helly's Selection Theorem; Riemann-Stieltjes integration; Fourier series; Fejer's Theorem; Parseval's Identify; Bernstein's Theorem on absolutely convergent Fourier series. Prerequisite: Math 409 or equivalent.
- 617. Theory of Functions of a Complex Variable I. (3-0). Credit 3.** Holomorphic functions, complex integral theorems, Runge's theorem, residue theorem, Laurent series, conformal mapping, harmonic functions. Prerequisite: MATH 410.
- 618. Theory of Functions of a Complex Variable II. (3-0). Credit 3.** Infinite products, Weierstrass factorization theorem, Mittag-Leffler's theorem, normal families, Riemann mapping theorem, analytic continuation, Picard's theorems and selected topics. Prerequisite: MATH 617.
- 619. Applied Probability. (3-0). Credit 3.** Measure Theory; Lebesgue integration; random variables; expectation; condition expectation martingales and random walks; designed for beginning graduate students in mathematics, statistics, the sciences and engineering and students in economics and finance with a strong mathematical background. Prerequisites: MATH 409 and MATH 411.
- 620. Algebraic Geometry I. (3-0). Credit 3.** Affine and projective varieties; sheaves; cohomology; Riemann-Roch Theorem for curves. Prerequisite: MATH 653 or approval of instructor.
- 622. Differential Geometry I. (3-0). Credit 3.** Surfaces in 3-D space and generalizations to submanifolds of Euclidean space; smooth manifolds and mappings; tensors; differential forms; Lie groups and algebras; Stokes' theorem; deRham cohomology; Frobenius theorem; Riemannian manifolds. Prerequisites: MATH 304 or equivalent; approval of instructor.
- 623. Differential Geometry II. (3-0). Credit 3.** Curvature of Riemannian manifolds; vector bundles; connections; Maurer-Cartan Form; Laplacian; geodesics; Chern-Gauss-Bonnet theorem; additional topics to be selected by the instructor. Prerequisites: MATH 622 or approval of instructor.
- 625. Applied Stochastic Differential Equations. (3-0). Credit 3.** Stochastic integration, Ito Calculus and applications of stochastic differential equations to finance and engineering. Prerequisite: MATH 619.
- 626. Analytic Number Theory. (3-0). Credit 3.** Analytic properties of the Riemann zeta function and Dirichlet L-functions; Dirichlet characters; prime number theorem; distribution of primes in arithmetic progressions; Siegel's theorem; the large sieve inequalities; Bombieri-Vinogradov theorem. Prerequisite: MATH 617.
- 627. Algebraic Number Theory. (3-0). Credit 3.** Algebraic number fields and rings of algebraic integers; arithmetic in algebraic number fields; ideals; unique factorization of ideals; ideal classes and the class group; finiteness of the class number; Minkowski's theorem; Dirichlet's unit theorem; quadratic and cyclotomic number fields; splitting of primes in extension fields. Prerequisite: MATH 653 or approval of instructor.
- 628. Mathematics of Finance. (3-0). Credit 3.** Pricing of financial derivatives in different market models; discrete models Arrow-Debreu, Binomial model, Hedging; Stochastic calculus; Brownian Motion, stochastic integrals, Ito formula; continuous model: Black-Scholes formula for pricing European and American options; equivalent Martingale Measures, pricing of exotic options. Prerequisite: MATH 606 or MATH 619 or approval of instructor.
- 629. History of Mathematics. (3-0). Credit 3.** Major events in the evolution of mathematical thought from ancient times to the present, the development of various important branches of mathematics, including numeration, geometry, algebra, analysis, number theory, probability, and applied mathematics. Prerequisite: MATH 304 or equivalent.
- 630. Combinatorics. (3-0). Credit 3.** This is an introduction at the graduate level to the fundamental ideas and results of combinatorics, including enumerative techniques, sieve methods, partially ordered sets and generating functions. Prerequisite: undergraduate discrete math course or permission of instructor.
- 636. Topology I. (3-0). Credit 3.** Set theory, topological spaces, generalized convergence, compactness, metrization, connectedness, uniform spaces, function spaces. Prerequisite: Approval of instructor.
- 637. Topology II. (3-0). Credit 3.** Continuation of MATH 636. Prerequisite: MATH 636 or approval of instructor.

- 638. Hyperbolic Conservation Laws. (3-0). Credit 3.** Introduction to basic theory and numerical methods for first order nonlinear partial differential equations; basic existence-uniqueness theory for scalar conservation laws; special equations and systems of interest in various applications and Riemann problem solutions for such systems; design of numerical methods for general hyperbolic systems; stability and convergence properties of numerical methods. Prerequisite: MATH 610 or MATH 612 or approval of instructor.
- 639. Iterative Techniques. (3-3). Credit 4.** Numerical methods for solving linear and nonlinear equations and systems of equations; eigenvalue problems. Prerequisites: Elementary linear algebra and knowledge of computer programming (C or FORTRAN).
- 640. Linear Algebra for Applications. (3-0). Credit 3.** Review of linear algebra; spectral theory in inner product spaces; decomposition theorems; duality theory and multilinear algebra; tensor products; applications. May be taken concurrently with MATH 641. Prerequisite: MATH 304 or equivalent.
- 641. Analysis for Applications I. (3-0). Credit 3.** Review of preliminary concepts; sequence and function spaces; normed linear spaces, inner product spaces; spectral theory for compact operators; fixed point theorems; applications to integral equations and the calculus of variations. Prerequisites: MATH 447 and MATH 640 or approval of instructor.
- 642. Analysis for Applications II. (3-0). Credit 3.** Distributions and differential operators; transform theory; spectral theory for unbounded self-adjoint operators; applications to partial differential equations; asymptotics and perturbation theory. Prerequisite: MATH 641.
- 643. Algebraic Topology I. (3-0). Credit 3.** Fundamental ideas of algebraic topology, homotopy and fundamental group, covering spaces, polyhedra. Prerequisite: Approval of instructor.
- 644. Algebraic Topology II. (3-0). Credit 3.** Homology and cohomology theory. Prerequisite: MATH 643.
- 645. A Survey of Mathematical Problems I. (3-0). Credit 3.** A survey of problems in various branches of mathematics, such as logic, probability, graph theory, number theory, algebra and geometry. Prerequisites: MATH 409, MATH 415, MATH 423 or approval of instructor.
- 646. A Survey of Mathematical Problems II. (3-0). Credit 3.** A survey of problems in various branches of mathematics such as algebra, geometry, differential equations, real analysis, complex analysis, calculus of variations. Prerequisite: MATH 645 or approval of instructor.
- 647. Mathematical Modeling. (3-0). Credit 3.** The process and techniques of mathematical modeling; covers a variety of application areas and models such as ordinary and partial differential equations, stochastic models, discrete models and problems involving optimization. Prerequisite: MATH 442 or approval of instructor.
- 648. Computational Algebraic Geometry. (3-0). Credit 3.** Broad introduction to algorithmic algebraic geometry, including numerical and complexity theoretic aspects; theory behind the most efficient modern algorithms for polynomial system solving and the best current quantitative/geometric estimates on algebraic sets over various rings is derived. Prerequisite: MATH 653 or approval of instructor.
- 650. Several Complex Variables. (3-0). Credit 3.** Introduction to function theory in several complex variables with an emphasis on the analytic and partial differential equations aspects of the subject. Prerequisites: MATH 608 and MATH 618 or equivalents.
- 651. Optimization I. (3-0). Credit 3.** Fundamentals of mathematical analysis underlying theory of constrained optimizations for a finite number of variables, necessary and sufficient conditions for constrained extrema of equality constraint problems, sufficient conditions for fulfillment of constraint qualification, computational methods for concave programming problems and applications. Prerequisite: MATH 410 or approval of instructor.
- 652. Optimization II. (3-0). Credit 3.** Necessary conditions of calculus of variations, elementary theory of games, formulation of basic control problem, Hestenes' necessary conditions for optimal control, transformations, methods of computation and applications. Prerequisite: MATH 651.
- 653. Algebra I. (3-0). Credit 3.** Survey of groups, rings, ideals. Prerequisite: MATH 415 or approval of instructor.
- 654. Algebra II. (3-0). Credit 3.** Survey of modules, field extensions, Galois theory. Prerequisite: MATH 653 or approval of instructor.
- 655. Functional Analysis I. (3-0). Credit 3.** Normed linear spaces, duality theory, reflexivity, operator theory. Banach algebras, spectral theory, representation theory. Prerequisite: MATH 608.

- 656. Functional Analysis II. (3-0). Credit 3.** Topological linear spaces, locally convex spaces, duality in locally convex spaces, ordered topological vector spaces, distribution theory, applications to analysis. Prerequisite: MATH 655.
- 657. Spline Analysis and Applications. (3-0). Credit 3.** Review of fundamental concepts of approximation, polynomials and other tools; basic univariate spline theory including bases, computational algorithms and approximation power; Bezier curves; applications to interpolation, discrete approximation, data fitting; computer-aided geometric design (CAGD), nonlinear rational B-splines (NURBS). Prerequisite: MATH 304 or equivalent.
- 658. Applied Harmonic Analysis. (3-0). Credit 3.** Fourier series and Fourier Transform; discrete (fast) Fourier transform; discrete cosine transform; local cosine transform; Radon transform; filters; harmonic analysis on the sphere; radial, periodic and spherical basis functions; applications. Prerequisites: MATH 304; MATH 308 or equivalent.
- 660. Computational Linear Algebra. (3-0). Credit 3.** Techniques in matrix computation: elimination methods, matrix decomposition, generalized inverses, orthogonalization and least-squares, eigenvalue problems and singular value decomposition, iterative methods and error analysis. Prerequisite: MATH 417 or equivalent or CSCE 442 or equivalent. Cross-listed with CSCE 660.
- 661. Mathematical Theory of Finite Element Methods. (3-0). Credit 3.** Will develop basic mathematical theory of finite element method; construction of finite element spaces and piece-wise polynomial approximation; Ritz-Galerkin methods and variational crimes; energy and maximum norm estimates; mixed finite element method; applications to diffusion-reaction problems.
- 662. Seminar in Algebra. (3-0). Credit 3.** Problems, methods and recent developments in algebra. May be taken five times for credit as content varies. Prerequisite: Approval of instructor.
- 663. Seminar in Analysis. (3-0). Credit 3.** Problems, methods and recent developments in analysis. May be taken five times for credit as content varies. Prerequisite: Approval of instructor.
- 664. Seminar in Applied Mathematics. (3-0). Credit 3.** Problems, methods and recent developments in applied mathematics. May be taken five times for credit as content varies. Prerequisite: Approval of instructor.
- 666. Seminar in Geometry. (3-0). Credit 3.** Problems, methods and recent developments in geometry. May be taken five times for credit as content varies. Prerequisite: Approval of instructor.
- 667. Foundations and Methods of Approximation. (3-0). Credit 3.** Existence, uniqueness and characterization of best approximations; polynomial and rational approximants; Bernstein polynomials; Bernstein and Markov inequalities; ridge functions; approximation from shift-invariant subspaces; orthogonal polynomials; neural networks, radial basis functions, scattered-data surface fitting; subdivision analysis. Prerequisites: MATH 407 and MATH 409.
- 668. Wavelet Analysis. (3-0). Credit 3.** Time-frequency analysis, integral wavelet transform, multiresolutional analysis, dyadic wavelets and inversions, frames, classification of wavelets, dual basis and a duality principle, wavelet decompositions and reconstructions, spline-wavelets, zero-crossings of spline-wavelet series, wavelet packets, multivariate wavelets. Prerequisites: MATH 304, MATH 409, MATH 417 or equivalents.
- 669. Seminar in Mathematical Biology. (3-0). Credit 3.** Problems, methods and recent developments in Mathematical Biology. Prerequisite: Approval of instructor.
- 670. Applied Mathematics I. (3-0). Credit 3.** Mathematical tools of applied mathematics; Fredholm alternative; integral operators; Green's functions; unbounded operators; Stone's theorem; distributions; convolutions; Fourier transforms; applications. Prerequisite: MATH 642 or equivalent.
- 671. Applied Mathematics II. (3-0). Credit 3.** Mathematical tools of applied mathematics; Sobolev spaces; convexity; variational inequalities; variational methods for partial differential equations; maximum principles; elements of nonlinear analysis; compact operators; fixed point theorems; applications. Prerequisite: MATH 670 or equivalent.
- 672. Hydrodynamic Stability. (3-0). Credit 3.** Instability mechanisms; instability of interfacial and free surface flows; thermal instability, centrifugal instability, instability of inviscid and viscous parallel shear flows; fundamental concepts and applications of nonlinear instability; the onset of turbulence; various transitions to turbulence. Prerequisites: MATH 601 or equivalent; MATH 605 or equivalent.

- 673. Information, Secrecy and Authentication I. (3-0). Credit 3.** Preliminaries; probability, information, entropy, signals, channels: group-theoretic view of messages: contemporary secrecy and digital signature systems; one-time pads, DES, RSA, DSS, wheels, LFSR-based systems; analog scramblers; key exchange, key management, secret sharing, access structures; measures of security. Prerequisites: Graduate classification and approval of instructor. Cross-listed with CSCE 673.
- 674. Information, Secrecy and Authentication II. (3-0). Credit 3.** Classical and recent attacks: login, compression, error control and genetic codes; finite and infinite codes; matrices, graphs, duals, groups, morphisms, composites, products, rates and classification of codes; the confusion/diffusion/arithmetic/calculus extension of Shannon's two design primitives. Prerequisites: MATH 673; graduate classification or approval of instructor. Cross-listed with CSCE 674.
- 676. Finite Element Methods in Scientific Computing. (3-0). Credit 3.** Basic finite element methods; structure of finite element codes; assembling linear systems of equations and algorithmic aspects; linear iterative solvers; adaptive mesh refinement; vector-valued and mixed problems; nonlinear problems; visualization; parallelization aspects. Additional topics may be chosen by instructor. Prerequisites: MATH 610, ENGR finite element class or MATH 419/ MATH 609 plus instructor approval. Knowledge of C++.
- 684. Professional Internship. Credit 1 to 6.** Directed internship in an organization to provide students with professional experience in organization settings appropriate to the student's career objectives. Prerequisite: Approval of department head.
- 685. Directed Studies. Credit 1 to 6 each semester.** Offered to enable students to undertake and complete, with credit, limited investigations not within their thesis research and not covered by any other courses in the curriculum. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of mathematics. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.
- 694. Mathematical Laboratory. (0-2). Credit 1.** Generic computing or problem-solving laboratory. May be taken multiple times for credit. Taken concurrently with a lecture course for which it will serve as the laboratory section. Prerequisite: Graduate classification.
- 695. Frontiers in Mathematical Research. (3-0). Credit 3.** This course is designed to acquaint the graduate student with the present status of investigative work in a variety of mathematical fields. Content will depend on the availability of visiting lecturers who will be selected because of distinguished international recognition in their fields of research. May be taken two times for credit. Prerequisite: Graduate classification.
- 696. Mathematical Communication and Technology. (3-0). Credit 3.** Techniques of oral, written and electronic communication of mathematics; effective classroom and seminar presentation; TEX, AMS-TEX, and LATEX, hypertext; Internet application; Maple and Matlab; classroom use of computer graphics. Prerequisite: Approval of instructor.

Department of Mechanical Engineering

R. M. Alexander, J. A. Alvarado, A. D. Ames, N. K. Anand, M. J. Andrews, K. Annamalai, R. Arroyave, D. Banerjee, M. A. Bevan, R. M. Bowen, D. E. Bray, T. Cagin, J. A. Caton (Interim Head), D. W. Childs, D. E. Claridge, M. A. Colaluca, L. R. Cornwell, T. S. Creasy, J. C. Criscione, C. H. Culp, S. V. Darbha, A. T. Duggleby, L. S. Fletcher, X. Gao, M. Gentleman, R. E. Goforth, R. B. Griffin, J. C. Grunlan, B. Guo, J. C. Han, R. A. Handler, K. T. Hartwig, Y. A. Hassan, W. M. Heffington, H. A. Hogan, S. Hsieh, J. D. Humphrey, W. N. P. Hung, T. J. Jacobs, S. Jayasuriya, I. Karaman, D. Kim, W. Kim, Y. Kim, T. J. Kozik, T. R. Lalk, R. Langari, S. C. Lau*, O. Ley, H. Liang, J. S. Linsey, E. Marotta, H. Masudi, J. E. Mayer, Jr., D. A. McAdams, M. McDermott, R. J. Malak, A. R. McFarland, J. E. Moore, Jr., G. L. Morrison, P. P. Mukherjee, A. Muliani, K. B. Nakshatrala, D. L. O'Neal, O. O. Ochoa, R. H. Page, A. B. Palazzolo, A. G. Parlos, M. B. Pate, J. V. Perry, E. L. Peterson, M. J. Rabins, M. Radovic, K. R. Rajagopal, D. Ranjan, B. Rasmussen, S. Rathinam, J. N. Reddy, H. H. Richardson, L. A. San Andres, W. C. Schneider, T. M. Schobeiri, C. J. Schwartz, A. R. Srinivasa, D. Staack, A. Strzelec, K. Subbarao, H.-J. Sue, C. Suh, H. R. Thornton, W. D. Turner, J. M. Vance, J. Wang, J. A. Weese, S. Wen, C. Yu, N. Zacharia, X. Zhang

* Graduate Advisor

The graduate program in mechanical engineering is designed to offer a choice in curriculum depending upon career objectives. Students interested in research and/or teaching may follow the Master of Science and

Doctor of Philosophy route. Those interested in practicing engineering at an advanced level in government or industry may pursue the Master of Engineering. This degree is offered in those areas of mechanical engineering which have a prescribed plan of study on file in the department. The department also offers courses and faculty supervision for students pursuing the Doctor of Engineering degree. The following courses are provided to enable each student to tailor an individual program consistent with a degree choice.

Each mechanical engineering graduate course is designed to provide a clear presentation of the underlying principles and theories essential to an understanding of the subject. Analytical and experimental techniques are described when required to apply the subject material to modern problems facing the engineers of today. In many cases, the course material supplements active research in mechanical engineering areas currently conducted at Texas A&M and other prominent research centers around the world. Active research facilities are available for mechanical testing, fracture testing, metallurgical studies, experimental stress analysis, vibrations and rotating machinery, turbomachinery, fluid dynamics, power generation, combustion, in situ lignite gasification, heat transfer, energy management, corrosion, solar energy and wind tunnel studies. In addition, new research programs have begun in manufacturing processes, nondestructive testing, computer-aided design, manufacturing, plastics engineering, artificial intelligence and robotics.

There is no foreign language requirement for the PhD program in mechanical engineering. Each student, with the advice of his or her chosen advisory committee, selects courses to develop a strength in an area of specialization composed of the following mechanical engineering subgroups: thermal science, fluid mechanics, solid mechanics, materials science and mechanical systems.

Mechanical Engineering (MEEN)

- 601. **Advanced Product Design. (3-0). Credit 3.** Design methodology, functional design, innovation, parameter analysis, design for reliability, manufacturability and strength; design project. Prerequisite: MEEN 402 or equivalent.
- 603. **Theory of Elasticity. (3-0). Credit 3.** Analysis of stress and strain in two and three dimensions, equilibrium and compatibility equations, strain energy methods; torsion of noncircular sections; flexure; axially symmetric problems. Prerequisite: Mechanics of Materials, Advanced Calc Different Equations. Cross-listed with MEMA 601.
- 606. **Polymer Laboratories. (2-3). Credit 3.** Introduction to basic experimental skills relating to Polymers. Experiments to be performed include polymerization, Molecular weight determination, FTIR, tensile test, NMR, DSC, swelling index, viscosity, x-ray diffraction.
- 607. **Polymer Physical Properties. (3-0). Credit 3.** Macromolecular concepts; molecular weight characterization; solubility parameters; phase diagrams; viscoelasticity; rheology; thermal behavior; damage phenomena, morphology; crystallization; liquid crystallinity; nanocomposites. Prerequisite: MEEN 222 (or other intro to materials science course.) Cross-listed with MSEN 607.
- 608. **Continuum Mechanics. (3-0). Credit 3.** Development of field equations for analysis of continua (solids as well as fluids); conservation laws: kinematics, constitutive behavior of solids and fluids; applications to aerospace engineering problems involving solids and fluids. Prerequisite: Graduate Classification. Cross-listed with MEMA 602.
- 609. **Materials Science. (3-0). Credit 3.** Structure and properties of solid materials. Prerequisites: an undergraduate level Materials, Science and Engr. course. Cross-listed with MEMA 609.
- 610. **Applied Polymer Science. (3-0). Credit 3.** Macromolecular concepts, molecular weight, tacticity, theory of solutions, rubber elasticity, thermal transitions, rheology, crystallinity, heterogeneous systems and relation of mechanical and physical characteristics to chemical structure; applications to polymer blends, thermosetting resins, structural adhesives and composites; design and processing of fibrous composites. Prerequisite: Graduate Classification, ENGR 213. Cross-listed with MEMA 610.
- 612. **Mechanics of Robot Manipulators. (3-0). Credit 3.** Kinematics, dynamics and control of industrial robot manipulators. Prerequisites: MEEN 364 and MEEN 411 or approval of instructor.
- 613. **Engineering Dynamics. (3-0). Credit 3.** Three dimensional study of dynamics of particles and rigid bodies and application to engineering problems; introduction to Lagrange equations of motion and Hamilton's principle. Prerequisites: MEEN 363; MATH 308.
- 614. **Design and Modeling of Viscoelastic Structures. (3-0). Credit 3.** To provide the mechanical and mathematical basis for modeling linear viscoelastic materials. Prerequisite: CVEN 305 or equivalent.

- 615. Advanced Engineering Thermodynamics. (3-0). Credit 3.** Theories of thermodynamics and their application to more involved problems in engineering practice and design; equilibrium, Gibbs' function, nonideal gases and various equations of state; second law analysis and statistical theory. Prerequisite: MEEN 421 or equivalent.
- 616. Surface Science. (2-2). Credit 3.** Properties of surfaces, principles of classic and contemporary surface characterization techniques, recent development and roles of surface science in advanced technology. Prerequisite: Graduate classification. Cross-listed with MSEN 616.
- 617. Mechanical Vibrations. (3-0). Credit 3.** Theory of linear vibrations of finite and infinite number of degree of freedom systems via Lagrange, Newtonian and Energy approaches. Engineering applications. Prerequisites: MEEN 364; MATH 308.
- 618. Energy Methods. (3-0). Credit 3.** Principles of virtual work, minimum total potential energy and extremum mixed variational principles; energy theorems of structural mechanics; Hamilton's principle for dynamical systems; Rayleigh-Ritz Galerkin, and weighted-residual methods; applications to linear and nonlinear problems in mechanics (bars, beams, frames, plates and general boundary value problems). Prerequisites: MATH 601 or registration therein. Cross-listed with MEMA 605.
- 619. Conduction and Radiation. (3-0). Credit 3.** Solutions of steady and transient problems with method of separation of variables, finite difference numerical methods, Duhamel's Theorem, Green's function, and Laplace transform, the phase change problems. View factors; radiative properties of surfaces and participating media, radiative exchange; gas radiation; and advanced solution methods for thermal radiation. Prerequisite: MEEN 461.
- 621. Fluid Mechanics. (3-0). Credit 3.** Dynamics of two-dimensional incompressible and compressible fluids; viscous flow in laminar and turbulent layers, the Navier-Stokes equations and boundary layer theory. Prerequisite: MEEN 344 or equivalent.
- 622. Advanced Fluid Mechanics. (3-0). Credit 3.** Laminar viscous flows; hydrodynamic stability; transition to turbulence; special topics include atomization, two-phase flows and non-linear theories. Prerequisites: MEEN 621 or equivalent; MATH 601 or equivalent.
- 624. Two-Phase Flow and Heat Transfer. (3-0). Credit 3.** Current status of two-phase flow and heat transfer for application to design; basic one dimensional treatment of two-phase flows and the current state of the art in liquid-vapor phase change heat transfer. Prerequisite: Undergraduate courses in fluid mechanics and heat transfer.
- 625. Mechanical Behavior of Materials. (3-0). Credit 3.** Examination of deformation and microstructure mechanisms responsible for deformation and failure in metals; fatigue, creep, and fracture mechanisms of materials; emphasis on microstructural-mechanical property relationship. Prerequisite: Undergraduate-level materials science course. Cross-listed with MSEN 625.
- 626. Lubrication Theory. (3-0). Credit 3.** Development of Reynolds equation from Navier-Stokes equation for study of hydrodynamic lubrication theory as basis for bearing design; application to simple thrust and journal bearings and pads of various geometries; hydrostatic lubrication, floating ring bearing, compressible fluid (gas) lubrication, grease lubrication, dynamically loaded bearings, half speed whirl and stability. Prerequisites: MEEN 344 or equivalent; MATH 308.
- 627. Heat Transfer-Conduction. (3-0). Credit 3.** Mathematical theory of steady-state and transient heat conduction; solution of the governing differential equations by analytical and numerical methods; applications to various geometric configurations. Prerequisites: MEEN 461; MATH 601 or registration therein.
- 628. Heat Transfer-Convection. (3-0). Credit 3.** Mathematical theory of convection energy transport; applications to the design of heat-transfer apparatus. Prerequisites: MEEN 461; MATH 601 or registration therein.
- 629. Heat Transfer-Radiation. (3-0). Credit 3.** Mathematical theory of thermal radiation with design applications; ideal and nonideal radiating surfaces, heat transfer in enclosures, solar radiation; analytical, numerical and analogical methods stressed in problem solving. Prerequisites: MEEN 461; MATH 601 or registration therein.
- 630. Intermediate Heat Transfer. (3-0). Credit 3.** Application of basic laws to the analysis of heat and mass transfer; exact and approximate solutions to conduction, convection and radiation problems; current status of single and two-phase heat transfer for application to design. Prerequisites: Undergraduate courses in fluid mechanics and heat transfer.

- 631. Microscale Thermodynamics. (3-0). Credit 3.** An understanding of thermodynamics and transport properties from a microscopic viewpoint; principles of quantum mechanics; atomic and molecular contribution to thermodynamic properties; kinetic theory and transport properties. Prerequisite: Graduate classification.
- 632. Advanced Computer-Aided Engineering. (3-0). Credit 3.** An integrated learning environment that is responsive to industrial need for mechanical engineers with multi-disciplinary design skills; three essentials emphasized in strong teamwork environment; design concept development, design optimization and effective communication via engineering drawings. Prerequisite: Graduate classification in mechanical engineering.
- 633. Combustion Science and Engineering. (3-0). Credit 3.** Fuels and combustion, mass transfer, transport properties, conservation laws, droplet, particle and slurry combustion, sprays, combustion in flow systems flammability, ignition, extinction, flame stability, laminar and detonation waves, premixed flames, application to burners—residential, utility and transportation, fluidized bed combustors, and fire and flame spread of modern building materials. Prerequisites: MEEN 421, MEEN 344, MEEN 461 or equivalents.
- 634. Dynamics and Modeling of Mechatronic Systems. (3-0). Credit 3.** Mechatronic interactions in lumped-parameter and continuum systems. Review of integral and differential electromagnetic laws, including motions. Lumped elements and dynamic equations of motion. Linear and non-linear actuators and transducers. Field transformation and moving media. Electromagnetic force densities and stress tensors. Prerequisites: MEEN 364, MATH 308, MEEN 357.
- 635. Flow and Fracture of Polymeric Solids. (3-0). Credit 3.** Relationship of molecular structure to flow and fracture in polymeric materials; introduction of viscoelastic fracture mechanics; micromechanisms of fracture including crazing; fatigue behavior of polymeric materials. Cross-listed with MEMA 607.
- 636. Turbulence: Theory and Engineering Applications. (3-0). Credit 3.** Characteristics, concepts, and relationships of detailed turbulent flow analysis and measurement; turbulence origin, energy production, cascade and dissipation; correlation functions, spectra and length scales; closure modeling of the Reynolds-averaged governing equations. Prerequisites: MEEN 621.
- 637. Turbulence Measurement and Analysis. (3-0). Credit 3.** Instrumentation and measurement techniques used in turbulent flow field analysis with emphasis on understanding the characteristics of the turbulence. Pressure probes, hot-wire/hot-film anemometry, laser anemometry, spectral and temporal analysis techniques, conditional sampling and computer applications. Prerequisite: MEEN 344.
- 638. Mechanics of Non-Linear Fluids. (3-0). Credit 3.** Introduction to classifications of flows, constitutive theory, fluids of the differential type. Prerequisites: Graduate classification and approval of instructor.
- 639. Dynamics of Rotating Machinery. (3-0). Credit 3.** Dynamic stability, critical speeds and unbalanced response of rotor-bearing systems; special problems encountered in modern applications operating through and above critical speeds. Prerequisites: MEEN 363 or equivalent and graduate classification or approval of the instructor.
- 640. Thermodynamics in Materials Science. (3-0). Credit 3.** Use of thermodynamic methods to predict behavior of materials; codification of thermodynamic properties into simplified models; principles, methods, and models to generate accurate equilibrium maps through computational thermodynamics software; applications to bulk metallic, polymeric and ceramic materials, defects, thin films, electrochemistry, magnetism. Prerequisites: MEEN 222 or equivalent; graduate classification. Cross-listed with MSEN 640.
- 641. Quantitative Feedback Theory. (3-0). Credit 3.** Benefits of feedback and cost of feedback; understanding extent to which available design theories meet realistic design constraints; treating the synthesis problem from a quantitative viewpoint; quantitative feedback theory as an effective tool for realistic feedback design problems for multivariable systems having both minimum and non-minimum phase zeros. Prerequisite: MEEN 651 or equivalent.
- 642. Gas Turbine Heat Transfer and Cooling Technology. (3-0). Credit 3.** Focus on the range of gas turbine heat transfer issues and associated cooling technologies. Fundamentals, turbine heat transfer, turbine film cooling, turbine internal cooling with rotation, experimental methods, numerical modeling and final remarks. Provide students with solid background for research and design in turbomachinery heat transfer. Prerequisites: MEEN 344, MEEN 461, and graduate standing.

- 643. Experimental Methods in Heat Transfer and Fluid Mechanics. (3-0). Credit 3.** Experimental methods including experiment planning and design, mechanics of measurements, error and uncertainty analysis, standards and calibration, temperature measurement, interferometry, flow rate measurement, hot wire anemometry, subsonic and supersonic flow visualization and data analysis; selected experiments conducted. Prerequisite: Graduate classification.
- 644. Numerical Heat Transfer and Fluid Flow. (3-0). Credit 3.** Convection-diffusion, up-wind, exponential, exact solution, power law schemes, false diffusion; staggered grid concept; development of simple and simpler algorithms; periodically developed flows. Prerequisites: MEEN 357 and MEEN 461; NUEN 430 or equivalent. Cross-listed with NUEN 644.
- 646. Aerothermodynamics of Turbomachines. (3-0). Credit 3.** Fluid mechanics and thermodynamics as applied to the design of rotating systems; development of turbomachinery equations; detailed aerodynamic design of compressors and turbines. Prerequisites: MEEN 414 and MEEN 472; MATH 601 or approval of instructor.
- 648. Manufacturing Systems Planning and Analysis. (3-0). Credit 3.** The system perspective of a computer integrated manufacturing system; manufacturing and its various levels and the planning and control of product movement through the production system in the context of using realtime control, multiprocessor systems, network architectures and databases. Prerequisite: ISEN 420. Cross-listed with ISEN 654.
- 649. Nonlinear Vibrations. (3-0). Credit 3.** Exact and approximate solutions to nonlinear differential equations in mechanical vibrations; application of classical methods in nonlinear analysis such as the Method of Perturbations and Variation of Parameters; virtual Work Technique and the Modified Galerkin Method; applications to selected nonlinear problems. Prerequisites: Course in differential equations; graduate classification.
- 650. Control Issues in Computer Integrated Manufacturing. (3-0). Credit 3.** Examines the nature of computer aided manufacturing systems with emphasis in control; presentation of architecture for control of CAM systems; control issues; study and development of problems and procedures to control CAM systems. Prerequisite: ISEN 654 or approval of instructor. Cross-listed with ISEN 655.
- 651. Control System Design. (3-0). Credit 3.** Frequency domain design of SISO systems for performance and sensitivity reduction; applications of Kalman filter and LQG/LTR techniques; design of sample-data systems; active control of vibration in distributed parameter systems; describing function and relay controls; application of control principles to engineering design. Prerequisite: MEEN 411.
- 652. Multivariable Control System Design. (3-0). Credit 3.** Advanced issues relevant to the design of multivariable control systems using hybrid (time and frequency domain) design methodologies; design using the LQG/LTR method and advanced practical applications using various robust control system design techniques. Prerequisite: MEEN 651 or ECEN 605. Cross-listed with NUEN 619.
- 653. Scientific Writing. (3-0). Credit 3.** Topics covered include origin and development of scientific writing, research methods, outlines, paper organization, journal selection, strategies to build a productive personal writing culture, effective communication, critical reviews and submission. Each student prepares an original manuscript for submission to a peer-reviewed journal by the end of the semester. Prerequisites: Graduate classification and approval of instructor.
- 655. Design of Nonlinear Control Systems. (3-0). Credit 3.** To enable the students to design controllers for nonlinear and uncertain systems; and apply their designs to mechanical systems. Prerequisites: Graduate classification, MEEN 651 or equivalent.
- 656. Mechanical and Physical Properties of Thin Films. (3-0). Credit 3.** Mechanical properties (hardness, stress, strain, delamination, fracture) of films; nanomechanical testing techniques; electrical properties of thin films; electrical properties measurement techniques; magnetic properties of films; magnetic properties measurement techniques; laboratory includes (1) thin film fabrication (sputtering, PVD); (2) nanomechanical testing; (3) electrical/magnetic measurement. Prerequisite: MEEN 222, MSEN 601, or basic materials science background. Cross-listed with MSEN 656.
- 657. Viscoelasticity of Solids and Structures I. (3-0). Credit 3.** Linear, viscoelastic mechanical property characterization methods, time-temperature equivalence, multiaxial stress-strain equations; viscoelastic stress analysis; the correspondence principle, approximate methods of analysis and Laplace transform inversion, special methods; static and dynamic engineering applications; nonlinear behavior. Prerequisite: Mechanics of Materials (CVEN 305 or equiv) Cross-listed with MEMA 651.

- 658. Fundamentals of Ceramics. (3-0). Credit 3.** Atomic bonding; crystalline and glassy structure; phase equilibria and ceramic reactions; mechanical, electrical, thermal, dielectric, magnetic, and optical properties; ceramic processing. Prerequisite: MEEN 222 or equivalent or approval of instructor. Cross-listed with MSEN 658.
- 659. Vibration Measurement in Rotating Machinery and Machine Structures. (3-0). Credit 3.** Transducers, instruments, measurement techniques, data acquisition methods, data reduction methods for modal analysis, applications to rotating machines, turbomachinery rotordynamics, bearings, gears and machine foundations. Prerequisites: MEEN 459, MEEN 617 or MEEN 639; graduate classification.
- 661. Principles of Composite Materials. (3-0). Credit 3.** Classification and characteristics of composite materials; micromechanical and macromechanical behavior of composite laminae; macromechanical behavior of laminates using classical laminate theory; interlaminar stresses and failure modes; structural design concepts, testing and manufacturing techniques. Prerequisites: Mechanics of Materials (CVEN 305 or equivalent). Cross-listed with MEMA 613.
- 662. Energy Management in Industry. (3-0). Credit 3.** Energy systems and components frequently encountered in industrial environments; application of basic principles of thermodynamics, heat transfer, fluid mechanics and electrical machinery to the analysis and design of industrial system components and systems. Improved energy utilization. Prerequisites: MEEN 421 and MEEN 461 or approval of instructor.
- 663. Cogeneration Systems. (3-0). Credit 3.** Design and analysis of cogeneration systems; selection of prime mover-steam turbine, gas turbine, or reciprocating engine; environmental assessments; economic and financial evaluations; legal and institutional considerations; case studies. Prerequisite: MEEN 421 or equivalent.
- 664. Energy Management in Commercial Buildings. (3-0). Credit 3.** Basic heating, ventilating and air conditioning system design/selection criteria for air conditioning and heat system and design/selection of central plant components and equipment. Prerequisites: MEEN 421 and MEEN 461 or approval of instructor.
- 665. Application of Energy Management. (3-0). Credit 3.** Continuation of MEEN 662 and MEEN 664; case studies by students of energy conservation opportunities using energy audits and building load computer simulation. Prerequisites: MEEN 662 and MEEN 664 or approval of instructor.
- 666. Plasticity Theory. (3-0). Credit 3.** Theory of plastic yield and flow of two and three-dimensional bodies; classical plasticity theories, unified viscoplastic theories, numerical considerations; applications and comparisons of theory to experiment. Prerequisite: MEMA 601 or equivalent and MEMA 602, MEEN 689 (Fundamentals of Solid and Fluid Motion) or equivalent. Cross-listed with MEMA 641.
- 667. Mechatronics. (3-0). Credit 3.** Mechatronics; logic circuits in mechanical systems; electrical-mechanical interfacing; analysis and applications of computerized machinery. Prerequisite: Graduate classification in engineering.
- 668. Rotordynamics. (3-0). Credit 3.** This course teaches the phenomena which occur in rotordynamics of turbomachinery, modeling techniques for turbomachines, and analysis techniques for rotordynamics analysis of real machines. Prerequisite: Graduate classification.
- 672. Introduction to Finite Element Method. (3-0). Credit 3.** Weak or variational formulation of differential equations governing one- and two- dimensional problems of engineering; finite element model development and analysis of standard problems of solid mechanics (bars, beams, and plane elasticity), heat transfer and fluid mechanics; time-dependent problems; computer implementation and use of simple finite element codes in solving engineering problems. Prerequisite: Senior or graduate classification.
- 673. Nonlinear Finite Element Methods in Structural Mechanics. (3-0). Credit 3.** Tensor definitions of stress and strain, finite strain, geometric and material nonlinearities; development on nonlinear finite element equations from virtual work; total and updated Lagrangian formulations; solution methods for nonlinear equations; computational considerations; applications using existing computer programs. Prerequisites: MEMA 647/MEEN 670. Cross-listed with MEMA 648.
- 674. Modern Control. (3-0). Credit 3.** Vector Norms, Induced Operator Norm; L_p stability; the small gain theorem; performance/robustness tradeoffs; H_1 and H_0 optimal control as operator norm minimization; H_2 optimal control. Prerequisite: ECEN 605 or equivalent. Cross-listed with ECEN 608.
- 675. Adaptive Control. (3-0). Credit 3.** Basic principles of parameter identification and parameter adaptive control; robustness and examples of instability; development of a unified approach to the design of robust adaptive schemes. Prerequisite: ECEN 605 or equivalent. Cross-listed with ECEN 609.

- 676. Fuzzy Logic and Intelligent Systems. (3-0). Credit 3.** Introduces the basics of fuzzy logic and its role in developing intelligent systems; topics include fuzzy set theory, fuzzy rule inference, fuzzy logic in control, fuzzy pattern recognition, neural fuzzy systems, and fuzzy model identification using genetic algorithms. Prerequisite: CSCE 625 or approval of instructor. Cross-listed with CSCE 639.
- 677. Aerosol Science. (3-0). Credit 3.** Multidisciplinary survey of methods for describing aerosol particles and systems: gas kinetics and transport theory, formation and growth thermodynamics, electrical properties, coagulation, light scattering; selected topics from current literature. Prerequisite: Graduate classification in engineering or approval of instructor. Cross-listed with NUEN 677.
- 678. Aerosol Mechanics. (3-0). Credit 3.** Provides the basis for understanding and modeling aerosol behavior; mechanical, fluid dynamical, electrical, optical and molecular effects are considered; applications include sprays and atomization, aerosol collection, aerosol sampling and visibility. Prerequisite: Graduate classification in engineering or approval of instructor.
- 679. Spectral Methods in Heat Transfer and Fluid Flow. (3-0). Credit 3.** Introduces theoretical and applications aspects of spectral and multi-domain spectral methods for computational heat transfer and fluid flow problems. Prerequisites: MEEN 357, MEEN 344, MEEN 461; graduate classification.
- 680. Optical Techniques for Engineers. (3-0). Credit 3.** The course will discuss basic optical theories and their practical applications with an emphasis on flow visualization for thermal and fluid engineering. The course will also discuss the operating principles and applications of at least seven different optical diagnostic instruments. Prerequisite: graduate standing.
- 681. Seminar. (0-1). Credit 1.** Current research in a wide range of fields described by guest lecturers who are prominent in their fields. Discussion period at the end of each lecture will permit the students to learn more about the lecturer and his/her work. Prerequisite: Graduate classification in mechanical engineering.
- 684. Professional Internship. Credit 1 or more each semester.** Supervised work in an area closely related to the specialized field of study undertaken by a Master of Engineering candidate. Prerequisite: Admission to a specialized Master of Engineering program in mechanical engineering.
- 685. Directed Studies. Credit 1 to 12.** Content will be adapted to interest and needs of group enrolled.
- 686. Composite Materials Processing and Performance. (3-0). Credit 3.** Fundamental science and design. Processing and design interaction regarding multiphase composites. Processing science, experimental characterization, laminate analysis. Design structure and process. Prerequisite: Elasticity, continuum mechanics, or equivalent.
- 688. Advanced Solid Mechanics. (3-0). Credit 3.** To learn to derive approximate solutions of engineering mechanics problems by using suitable assumptions. To understand the nature of the approximations and their effects on the accuracy of the resulting mechanics-of-materials solutions. To apply the principles of advanced mechanics of materials to analyze deformation and failure problems common in engineering design and materials science. To get prepared for success in more advanced mechanics courses such as elasticity, energy methods, continuum mechanics and plasticity. Prerequisite: Mechanics of materials, advanced calculus, differential equations.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of mechanical engineering. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Methods and practice in mechanical engineering research for thesis or dissertation.
- 692. Professional Study. Credit 1 to 9.** Approved professional study or project; may be taken more than once, but not to exceed 6 hours of credit toward a degree. Must be taken on a satisfactory/unsatisfactory basis. Prerequisite: Approval of instructor.

The following courses are described in the section entitled Mechanics and Materials (MEMA) below and are part of the curriculum in mechanical engineering.

- 601. Theory of Elasticity. (3-0). Credit 3.**
- 605. Energy Methods. (3-0). Credit 3.**
- 607. Flow and Fracture of Polymeric Solids. (3-0). Credit 3.**
- 609. Materials Science. (3-0). Credit 3.**
- 610. Applied Polymer Science. (3-0). Credit 3.**
- 611. Fundamentals of Engineering Fracture Mechanics. (3-0). Credit 3.**

- 613. **Principles of Composite Materials. (3-0). Credit 3.**
- 625. **Micromechanics. (3-0). Credit 3.**
- 626. **Mechanics of Active Materials. (3-0). Credit 3.**
- 633. **Theory of Plates and Shells. (3-0). Credit 3.**
- 635. **Structural Analysis of Composites. (3-0). Credit 3.**
- 641. **Plasticity Theory. (3-0). Credit 3.**
- 646. **Introduction to the Finite Element Method. (3-0). Credit 3.**
- 647. **Theory of Finite Element Analysis. (3-0). Credit 3.**
- 648. **Nonlinear Finite Element Methods in Structural Mechanics. (3-0). Credit 3.**
- 651. **Viscoelasticity of Solids and Structures I. (3-0). Credit 3.**

Mechanics and Materials

The mechanics and materials course offerings perform three major functions. First, and most importantly, they are interdisciplinary vehicles for staff and students who study and conduct research in those increasingly important areas requiring a blending of mechanics and materials. Second, they provide the support base for graduate students to pursue studies in the traditional areas of either applied mechanics or materials science. Third, they provide a coordinated set of service courses for the engineering departments. Interested students should contact their department's graduate advisor.

(MEMA)

- 601. **Theory of Elasticity. (3-0). Credit 3.** Analysis of stress and strain in two and three dimensions, equilibrium and compatibility equations, strain energy methods; torsion of noncircular sections; flexure; axially symmetric problems. Prerequisite: MATH 601 or registration therein. Cross-listed with AERO 605 and MEEN 603.
- 602. **Continuum Mechanics. (3-0). Credit 3.** Development of field equations for analysis of continua (solids as well as fluids); conservation laws; kinematics, constitutive behavior of solids and fluids; applications to aerospace engineering problems involving solids and fluids. Prerequisite: Graduate classification. Cross-listed with AERO 603.
- 604. **Mathematical Foundations of Continuum Mechanics. (3-0). Credit 3.** Mathematical description of continuum mechanics principles, including: tensor analysis, generalized description of kinematics and motion, conservation laws for mass and momentum; invariance and symmetry principles; application to generalized formulation of constitutive expressions for various fluids and solids. Prerequisites: MATH 410; MATH 451 or equivalent. Cross-listed with MATH 604.
- 605. **Energy Methods. (3-0). Credit 3.** Principles of virtual work, minimum total potential energy and extremum mixed variational principles; energy theorems of structural mechanics; Hamilton's principle for dynamical systems; Rayleigh-Ritz Galerkin, and weighted-residual methods; applications to linear and nonlinear problems in mechanics (bars, beams, frames, plates and general boundary value problems). Prerequisite: MATH 601 or registration therein.
- 606. **Multifunctional Materials. (3-0). Credit 3.** This course will present an in-depth analysis of multifunctional materials and composites, and their novel applications. Prerequisites: Theory of elasticity or Continuum Mechanics MEMA 601 or MEMA 602/AERO 603, MSEN 601 or MEMA 609. Cross-listed with AERO 606 and MSEN 606.
- 607. **Flow and Fracture of Polymeric Solids. (3-0). Credit 3.** Relationship of molecular structure to flow and fracture in polymeric materials; introduction to viscoelastic fracture mechanics; micromechanisms of fracture including crazing; fatigue behavior of polymeric materials.
- 608. **Nanomechanics. (3-0). Credit 3.** Application of mechanics concepts to nano-scale behavior of materials. Review of continuum mechanics; Extensions to generalized continua; Nonlocal elasticity; Nano-scale plasticity. Focus on multi-scale modeling: Dislocation Dynamics; Quasi-Continuum method; Molecular dynamics with introductions to quantum mechanics and statistical mechanics. Prerequisite: AERO 603 or MEMA 601. Cross-listed with AERO 608 and MSEN 608.
- 609. **Materials Science. (3-0). Credit 3.** Structure and properties of solid materials. Prerequisites: Graduate classification and approval of instructor.

- 610. Applied Polymer Science. (3-0). Credit 3.** Macromolecular concepts, molecular weight, tacticity, theory of solutions, rubber elasticity, thermal transitions, rheology, crystallinity, heterogeneous systems and relation of mechanical and physical characteristics to chemical structure; applications to polymer blends, thermosetting resins, structural adhesives and composites; design and processing of fibrous composites. Prerequisite: Graduate classification.
- 611. Fundamentals of Engineering Fracture Mechanics. (3-0). Credit 3.** Understanding of the failure of structures containing cracks with emphasis on mechanics; linear elastic fracture mechanics, complex potentials of Muskhelishvili and Westergaard, J-integral, energy release rate, R-curve analysis, crack opening displacement, plane strain fracture toughness testing, fatigue crack propagation, fracture criteria, fracture of composite materials. Prerequisite: MEMA 601 or AERO 603.
- 612. Wave Propagation in Isotropic and Anisotropic Solids. (3-0). Credit 3.** Mathematical and experimental methods of studying stress waves with emphasis on anisotropic solids, e.g., fiber-reinforced composite materials; waves in an unbounded medium, in a half-space, in rods; waves in a general anisotropic medium; wave surface, slowness surface, velocity surface, energy velocity and group velocity. Prerequisite: MEMA 601 or AERO 603. Cross-listed with AERO 612.
- 613. Principles of Composite Materials. (3-0). Credit 3.** Classification and characteristics of composite materials; micromechanical and macromechanical behavior of composite laminae; macromechanical behavior of laminates using classical laminate theory; interlaminar stresses and failure modes; structural design concepts, testing and manufacturing techniques. Prerequisite: MEMA 601 or MEMA 602.
- 614. Physical Phenomena in Materials. (3-0). Credit 3.** Physical principles governing behavior in materials; emphasis on crystalline materials, particularly in metals; includes crystal structures, vacancies, solid diagrams, diffusion and transformations. Prerequisite: MEEN 340 or equivalent.
- 616. Damage and Failure in Composite Materials. (3-0). Credit 3.** Mechanisms and models related to damage and failure in composite materials subjected to mechanical loads. Prerequisite: Courses in composite materials, elasticity. Cross-listed with AERO 616.
- 619. Materials Modeling of Phase Transformation and Microstructural Evolution. (3-0). Credit 3.** Computer modeling and simulation of microstructural evolution during various phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic transformation, ferroelectric and ferromagnetic domain evolution, dislocation dynamics, and crack propagation. Prerequisite: Graduate classification and approval of instructor. Cross-listed with AERO 619 and MSEN 619.
- 625. Micromechanics. (3-0). Credit 3.** Eigenstrains; inclusions, and inhomogeneities; Eshelby's solution for an ellipsoidal inclusion; Eshelby's equivalent inclusion method. Effective elastic properties of composites; composite spheres and cylinders models; bounds on effective moduli; Hashin-Shtrikman bounds; applications to fiber, whisker and particulate reinforced composites; introduction to micromechanics of inelastic composites and solids with damage. Prerequisite: MEMA 601 or MEMA 602. Cross-listed with AERO 617.
- 626. Mechanics of Active Materials. (3-0). Credit 3.** Introduction to coupled field theories: constitutive response of materials with thermal and electromagnetic coupling; microstructural changes due to phase transformations; shape memory alloys; piezoelectric and magnetostrictive materials; active polymers and solutions. Micromechanics of active composites. Prerequisite: MEMA 601 or MEMA 602. Cross-listed with AERO 618.
- 633. Theory of Plates and Shells. (3-0). Credit 3.** Theoretical formulations of thin and thick plates (classical and shear deformation theories); analytical solutions of plates and various shapes and support conditions, bending, vibration and stability of plates; numerical solutions using the energy methods and the finite element method; theory and analysis of cylindrical shells. Prerequisite: MEMA 601, MEMA 602 or MEMA 605.
- 634. Damage Mechanics of Solids and Structures. (3-0). Credit 3.** Damage mechanics; constitutive modeling of damage behavior of materials; application of thermodynamic laws; computational techniques for predicting progressive damage and failure; plasticity; viscoplasticity; viscoelasticity; cohesive zone modeling; fatigue and creep damage; damage in various brittle and ductile materials (e.g., metal, concrete, polymer, ceramic, asphalt, biomaterial, composites). Prerequisite: CVEN 633 or approval of instructor. Cross-listed with CVEN 753.

- 635. Structural Analysis of Composites. (3-0). Credit 3.** Formulation and analysis structural response of laminated composite components; bending, vibration and stability of laminated composite plates; inter-laminar stresses, effect of shear deformation on structural response; numerical modeling of laminated plates. Prerequisite: MEMA 613.
- 641. Plasticity Theory. (3-0). Credit 3.** Theory of plastic yield and flow of two and three-dimensional bodies; classical plasticity theories, unified viscoplastic theories, numerical considerations; applications and comparisons of theory to experiment. Prerequisite: MEMA 601 or MEMA 602.
- 646. Introduction to the Finite Element Method. (3-0). Credit 3.** Weak or variational formulation of differential equations governing one- and two-dimensional problems of engineering; finite element model development and analysis of standard problems of solid mechanics (bars, beams and plane elasticity), heat transfer and fluid mechanics; time-dependent problems; computer implementation and use of simple finite element codes in solving engineering problems. Prerequisite: Senior or graduate classification.
- 647. Theory of Finite Element Analysis. (3-0). Credit 3.** Finite elements models of a continuum; virtual work principle; plane stress and plane strain finite element models; bending of plates; axisymmetric problems; three-dimensional stress analysis; isoparametric formulations; finite element computer programs to solve typical structural problems. Prerequisite: Graduate classification or approval of instructor.
- 648. Nonlinear Finite Element Methods in Structural Mechanics. (3-0). Credit 3.** Tensor definitions of stress and strain, finite strain, geometric and material nonlinearities; development of nonlinear finite element equations from virtual work; total and updated Lagrangian formulations; solution methods for nonlinear equations; computational considerations; applications using existing computer programs. Prerequisite: MEMA 647 or equivalent.
- 649. Generalized Finite Element Methods. (3-0). Credit 3.** Systemic introduction to the theory and practice of generalized finite element (FE) methods, including GFEM, the hp-cloud method, particle methods and various meshless methods with similar character; precise formulation of the methods are presented; known theoretical results for convergence; important issues related to implementation, issues of numerical integration. Prerequisite: Graduate student status. Cross-listed with AERO 649.
- 651. Viscoelasticity of Solids and Structures I. (3-0). Credit 3.** Linear, viscoelastic mechanical property characterization methods, time-temperature equivalence, multiaxial stress-strain equations; viscoelastic stress analysis: the correspondence principle, approximate methods of analysis and Laplace transform inversion, special methods; static and dynamic engineering applications; nonlinear behavior. Prerequisite: Approval of instructor.
- 670. Computational Materials Science and Engineering. (3-0). Credit 3.** Modern methods of computational modeling and simulation of materials properties and phenomena, including synthesis, characterization, and processing of materials, structures and devices; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input. Prerequisites: Approval of instructor; graduate classification. Cross-listed with MSEN 670 and CHEN 670.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of mechanics and materials. May be repeated for credit. Prerequisite: Approval of instructor.

Microbiology

The PhD program in Microbiology is designed to train students in laboratory science, to provide the factual background necessary for research, and to develop the critical faculties with which to judge scientific findings. The Department of Biology offers the opportunity for research in classical and molecular genetics, biochemistry and physiology of microorganisms. Opportunities are available for students wishing to prepare for independent scientific research in medical, industrial and academic disciplines.

Microbiology PhD students must demonstrate competence in their specific area of research and are expected to develop proficiency in at least four of the following broad areas: biochemistry/physiology, cell biology, genetics, microbiology/immunology, molecular biology, developmental biology and computational/mathematical biology. An MS student must demonstrate competence in at least three of the above seven areas at the time of the final examination.

(MICR)(faculty and courses are listed under BIOL, see [page 332](#))

- 681. Seminar. (1-0). Credit 1.** Detailed reports on specific topics in field chosen. Students may register in up to but no more than three sections of this course in the same semester.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigations in fields other than those chosen for thesis or dissertation.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of microbiology.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Other related graduate courses offered by the Department of Biology that may be of interest to microbiology students include BIOL 602 Transmission Electron Microscopy, BIOL 617 Cell Biology and BIOL 689 Special Topics in...

Modern Languages**(MODL)**

- 645. Studies in Modern and Classical Literatures. (3-0). Credit 3.** Rotating topics in an identified area of French, German, Italian, Russian, or Classical literature. May be taken two times for credit. Prerequisite: Graduate classification.

Intercollegiate Faculty in**Molecular and Environmental Plant Sciences**

J. Awika, T. W. Boutton, D. D. Briske, B. G. Cobb, J. T. Cothren, H. T. Cralle, F. T. Davies, Jr., P. J. de Figueiredo, T. Devarenne, M. B. Dickman, S. A. Finlayson, E. A. Funkhouser, T. J. Gentry, J. H. Gould, L. R. Griffing, T. C. Hall, D. B. Hays (Chair, MEPS Program), P. He, J. L. Heilman, K. D. Hirschi, M. A. Hussey, T. S. Isakeit, S. R. King, P. E. Klein, H. Koiwa, M. V. Kolomiets, K. V. Krutovsky, R. E. Lacey, L. Lombardini, C. A. Loopstra, C. W. Magill, T. D. McKnight, G. W. Moore, J. E. Mullet, W. D. Park, B. S. Patil, C. O. Patterson, A. E. Pepper, E. Pierson, K. S. Rathore, P. J. Rizzo, G. W. Schade, S. A. Senseman, L. Shan, D. M. Stelly, L. Tarpley, T. L. Thomas, M. G. Tjoelker, W. K. Versaw, D. M. Victor, A. Volder, R. Washington-Allen, J. B. West, R. H. White, L. T. Wilson, S. Yuan, H. Zhang, X. Zhang, K. Zhu-Salzman

The Faculty of Molecular and Environmental Plant Sciences (MEPS) has members in the Colleges of Agriculture and Life Sciences, Geosciences, and Science and is administered through the Department of Soil and Crop Sciences. Degree programs are available leading to MS and PhD degree in molecular and environmental plant sciences. Program requirements are determined and supervised by MEPS faculty. Degree programs are prepared on an individual basis by the graduate students in consultation with their advisory committee. Students hold appointments, for administrative purposes, in the department of their major professors.

Molecular and environmental plant sciences seeks to understand the molecular basis for functions and behavior of plants in natural environments. It blends botany, ecology, molecular biology, chemistry, genetics and physics. Traditionally, plant scientists have been interested in the improvement of agriculture, and many of the most basic findings on photoperiodism, mineral nutrition, plant growth regulators, morphogenesis, postharvest physiology and plant competition have had major effects on modern agriculture. Today the unifying goal of plant science is to understand and improve plants. This goal involves significant interdisciplinary interactions with molecular genetics, plant breeding, environmental physics, agronomy and other plant-agriculture disciplines.

Graduate degree programs are individually designed to prepare graduates for careers in specialized areas of the discipline including molecular biology, metabolism, development, physiological ecology and environmental or crop physiology. Faculty members hold appointments in the Departments of Atmospheric Sciences, Biochemistry and Biophysics, Biology, Ecosystem Science and Management, Entomology, Horticultural Sciences, Plant Pathology and Microbiology, and Soil and Crop Sciences. Courses in these departments support the curriculum along with those in chemistry, genetics, mathematics, physics and statistics.

All graduate students participate in the student seminar program, the faculty-sponsored visiting scientist seminar program, other faculty-sponsored special programs, the core curriculum of courses and regional and national scientific meetings. These activities lend continuity and unity to the graduate student group just as research topics and the selection of supporting courses lend diversity to individual programs.

Molecular and Environmental Plant Sciences (MEPS)

- 601. Physiology of Plants. (3-0). Credit 3.** Advanced physiology of higher plants, includes water relations, mineral metabolism, biochemistry, growth, development, hormones, environmental signals and stress physiology. Emphasis on current literature and research trends; cellular and sub-cellular mechanisms related to whole plant behavior. Prerequisites: BICH 410 and MEPS 313 or approval of instructor.
- 605. Plant Biochemistry. (3-0). Credit 3.** Major metabolic pathways in plant metabolism; emphasis on biochemistry unique to plants. Prerequisites: BICH 410; MEPS 313.
- 610. Physiological and Molecular Basis for Plant Stress Response. (3-0). Credit 3.** Provide the student with tools to understand the molecular and physiological consequences caused by environmental factors (abiotic and biotic) on plant growth and development and the mechanisms of stress adaptation to stress. Prerequisite: MEPS 313 or equivalent. Cross-listed with HORT 610.
- 611. Plant Nutrition. (3-0). Credit 3.** Inorganic nutrition of plants; solute absorption, accumulation and translocation, growth in artificial media, physiological roles of various elements, and biophysical/molecular aspects of solute transport; genetic regulation of mineral nutrition and transport. Prerequisite: MEPS 313 or equivalent.
- 612. Phytohormones and Plant Growth Regulators. (3-0). Credit 3.** Biosynthesis mechanisms of action and developmental roles of the classes or groups of plant hormones; uses of hormones and synthetic growth regulators in plant production. Prerequisite: MEPS 313.
- 618. Root Biology. (3-0). Credit 3.** Basic concepts and current topics in root-soil ecology; managed and natural ecosystems including grasslands, cropping systems and forests; role of roots in the rhizosphere, the effects of soil, nutrient and water stress and climate change in C and N cycling and carbon sequestration; participate in discussions and critique recent literature. Prerequisite: Approval of instructor. Cross-listed with HORT 618.
- 620. Plant Cell Structure and Function. (3-0). Credit 3.** Overview of plant cell organization, function and physiology to incorporate whole-plant processes with sub-cellular, molecular and genetic mechanisms; origin of eukaryotic cells, nuclear organization and processes, cell cycle, organelle biogenesis and inheritance, photosynthesis, endomembrane system, cell trafficking, symplast, cytoskeleton, extracellular matrix, cell wall, disease, plant microbe interaction, development and differentiation. Prerequisites: MEPS 313 or equivalent, graduate classification, or permission of the instructor.
- 630. Post-Harvest Biology, Physiology and Genetics of Plants. (3-0). Credit 3.** Overview of biological, physiological and genetic mechanisms which impart phenotypes associated with quality and value of plant products; current emphasis in areas of ripening, senescence, fruit and flower development, and relevant applications of biotechnology will be focus of course. Prerequisite: Approval of instructor. Cross-listed with HORT 630.
- 650. Plant Cell Culture for Crop Improvement. (3-1). Credit 3.** Focus on techniques in plant cell culture which can be applied to all crop plants, including agronomic crops, horticulture and forestry crops for germplasm improvement. Prerequisites: MEPS 313; CHEM 101; graduate classification.
- 654. Analysis of Complex Genomes. (3-0). Credit 3.** History and current status of genetic and molecular analysis of higher eukaryotic genomes; coverage of techniques for dissection of genomes into manageable parts; investigations in genetics, breeding and evolution; emphasis on quantitative inheritance, genetic mapping, physical mapping, map-based cloning, with examples drawn from a wide range of organisms. Prerequisite: GENE 603. Cross-listed with GENE 654 and SCSC 654.
- 655. Analysis of Complex Genomes—Lab. (0-7). Credit 3.** Laboratory methods in molecular genetic techniques for genetic mapping, physical mapping, and map-based cloning of both qualitative and quantitative phenotypes. Prerequisite: GENE 603 or equivalent or approval of instructor. Cross-listed with SCSC 655 and GENE 655.
- 671. Plant Growth and Development. (3-0). Credit 3.** The course is a comprehensive analysis of plant development primarily focused on the molecular and cellular processes underlying morphogenesis, vegetative growth and reproduction. The role of the major phytohormones as coordinators of development will be analyzed. Plastic development responses to conditioning environmental signals will also be considered. Prerequisites: MEPS 601 or approval of instructor. Cross-listed with SCSC 671.

- 673. Environmental Mechanisms of Plant Growth. (4-0). Credit 1.** Analysis of physical and molecular mechanisms of whole plant responses to environment. Prerequisites: MEPS 313 and BICH 410 or concurrent registration or approval of instructor. (Four weeks)
- 676. Solute Transport and Utilization in Plants. (4-0). Credit 1.** Analysis of inorganic nutrient uptake, long distance transportation and genetic control of nutrient acquisition. Prerequisites: MEPS 313 and BICH 410 (or concurrent registration) or approval of instructor. (Four weeks)
- 677. Plant Growth and Development. (4-0). Credit 1.** Analysis of mechanisms of hormone action during vegetative and reproductive development, gene expression during development, photomorphogenesis and photoperiodism, dormancy and tropisms. Prerequisites: MEPS 313 and BICH 410 or concurrent registration or approval of instructor. (Four weeks)
- 681. Seminar. Credit 1 each semester.** Professional development for students pursuing careers in plant physiology; oral and poster presentations, writing skills, grantsmanship, job search and the promotion and tenure process.
- 685. Directed Studies. Credit 1 to 4 each semester.** Individual problems or research not pertaining to thesis or dissertation. Prerequisite: MEPS 313.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of plant physiology. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Original investigations in support of thesis or dissertation.

Intercollegiate Faculty in Neuroscience

L. C. Abbott, H. Amrein, M. Amstalden, S. T. Behmer, L. R. Berghman, G. J. Bix, P. C. Brandt, G. R. Bratton, J. J. Buchanan, G. E. Carney, A. Cepeda-Benito, W. A. Chen, Y. Choe, E. Christou, T. A. Cudd, W. L. Dees, S. V. Dindot, D. J. Earnest, S. Eitan, G. D. Frye, L. R. Garcia, L. Geraci, J. Grau, W. H. Griffith, A. Han, P. Hardin, M. Harlow, E. Harmon-Jones, P. G. Harms, M. Hook, S. C. Kerwin, W. R. Klemm, G. Y. Ko, J. M. Levine, J. Li, P. Li, R. Lints, T. Lints, U. J. McMahan, M. Meagher, R. C. G. Miranda, C. Morgan, M. G. Packard, V. M. Panin, B. D. Perkins, M. Pine, B. F. Porter, F. B. Rattoni, D. S. Reddy, C. A. Riccio, M. Rimer, G. Rosenthal, G. A. Russell, I. S. Russell, C. H. Shea, M. Smotherman, F. Sohrabji, G. Stoica, R. W. Storts, L. G. Tassinary, E. Tiffany-Castiglioni, J. Vaid, P. J. Wellman, G. B. Wells, T. Wilcox, U. Winzer-Serhan, K. A. Young, D. B. Zimmer, M. Zoran

Neuroscience is a field devoted to the scientific study of the nervous system, from its molecular/cellular underpinnings to the organization of neural circuits, and the manifestation of this biological/neurochemical machinery as behavioral, physiological and psychological processes. It aims to detail both how the normal system operates and how alterations in function contribute to clinical diseases, such as mental illness, dementia, developmental disorders, neurodegenerative diseases, chronic pain, drug addiction, and the loss of function with aging or neural injury.

The graduate program in Neuroscience is jointly administered through both Texas A&M University and the Texas A&M Health Science Center. The program brings together researchers across multiple colleges and departments, with expertise in Biology, Psychology, Veterinary Integrative Biosciences, Health/Kinesiology, Engineering, and Experimental Therapeutics.

Students who wish to work with a faculty member at Texas A&M should apply for admission through the Texas A&M Office of Graduate Admissions. Students select a faculty mentor upon entering the graduate program or at the end of their first year (after laboratory rotations). Graduate assistantships and fellowships are available from the Neuroscience program and participating departments.

Neuroscience (NRSC)

- 601. Principles of Neuroscience I. (3-0). Credit 3.** This course presents a detailed introduction to the basic fundamentals of cellular and molecular neuroscience. Topics will include membrane potentials, action potential generation, and the mechanisms underlying synaptic transmission, as well as their molecular basis. Prerequisites: Graduate standing or approval of instructor. Cross-listed with BIOL 627.

- 602. Principles of Neuroscience II. (3-0). Credit 3.** This course presents a fully integrated overview of nervous system organization and systems-level neurobiology. Broad topics to be covered include sensory systems and sensory systems function, motor systems and neuromuscular function, central pattern generation and locomotion, homeostatic regulation, motivation, emotions, learning and memory, and circadian rhythms. Prerequisites: Graduate standing or approval of instructor. Cross-listed with: BIOL 628.
- 603. Neuroanatomy. (2-6). Credit 4.** Gross, developmental and microscopic anatomy of nervous system of selected laboratory and domestic animals. Prerequisite: Approval of instructor. Cross-listed with VIBS 603.
- 604. Biomedical Neuroendocrinology and Endocrine Disorders. (3-0). Credit 3.** Gross and functional anatomy and endocrine functions of neuroendocrine systems, hypothalamus and pituitary. Neuroendocrine control of puberty, sexual behavior, menstruation, ovulation, pregnancy, labor, lactation, testis, thyroid, growth, stress, diabetes, obesity, sleep, memory, learning and aging and their disorders. Overview biosynthesis, transport and signaling of neuropeptides, prostaglandins, peptide and steroid hormones. Prerequisite: Approval of instructor. Cross-listed with VIBS 604.
- 605. Neuroanatomical Systems. (3-0). Credit 3.** Course emphasis is on major neural systems that govern identifiable physiological functions, behavior and neurodegenerative disease. Whole-brain anatomy is approached from a “systems” perspective, wherein components of defined functional systems are described in terms of their location, inputs and outputs, and physiological/behavioral significance in health and disease. Prerequisite: Approval of instructor. Cross-listed with VIBS 606.
- 606. Learning. (3-0). Credit 3.** Procedural and theoretical issues in study of basic learning mechanisms in animals and humans, including Pavlovian and instrumental conditioning. Application of this work to other domains and relevant biological mechanisms also discussed. Prerequisites: PSYC 340 or approval of instructor. Cross-listed with PSYC 606.
- 609. Physiological Psychology. (3-0). Credit 3.** Current research and methodological procedures on physiological bases of sensation-perception, memory and learning, arousal-sleep attention, emotions and motivation. Prerequisite: PSYC 335. Cross-listed with PSYC 609.
- 611. Molecular Biology of Differentiation and Development. (3-0). Credit 3.** Major paradigms of eukaryotic gene regulation in terms of the role of gene expression during ontogeny and the effect of dysfunction in these processes on the neoplastic state. Cross-listed with BIOL 611.
- 615. Perpetual Processes. (3-0). Credit 3.** Complex sensory and perceptual phenomena with emphasis on the relationship between perception and motivation, cognition, creativity and instinctive/ethological; learning/experiential factors in higher level perceptual processes. Cross-listed with PSYC 615.
- 634. Comparative Neurobiology. (3-0). Credit 3.** Cellular, molecular and systems neurobiology, together with neuroethology. A comparative approach to subject matter is stressed. Topics such as evolution of nervous systems and their diverse structure and complex functions are dealt with. Cross-listed with BIOL 634.
- 635. Biological Clocks. (3-0). Credit 3.** Introduction to the formal properties of biological rhythms; cellular and molecular bases for rhythmicity; temporal adaptations of organisms using clocks. Prerequisites: Graduate classification or approval of instructor. Cross-listed with BIOL 601.
- 636. Signaling in Behavior and Development. (3-0). Credit 3.** Will focus on signaling pathways used in multicellular animals. In each lecture, major signaling pathways used in behavior, physiology, and development will be introduced at the molecular level, and then be discussed in the context of organismal biology. Prerequisite: Graduate classification. Cross-listed with BIOL 615.
- 640. Neurobiology. Credit 1 to 5.** Biology of the mammalian central nervous system with emphasis on cellular and molecular interactions; contemporary research topics in areas such as neuron-glia interactions, neuroimmunology, neuroendocrinology, developmental neurobiology and neurogenetics; extensive readings from primary literature. Prerequisites: Undergraduate or graduate cell biology, genetics and biochemistry or approval of instructor. Cross-listed with VIBS 640.
- 641. Principles of Neuropsychology. (3-0). Credit 3.** Review of major areas of cognitive functioning including concentration, memory, language, visuospatial/construction skills and executive functions; review of neurobehavioral syndromes including dementia, epilepsy, head injury, stroke, drug toxicity, etc.; assessment of deficits associated with disorders. Prerequisites: PSYC 624 or PSYC 627 or equivalent as approved by instructor. Cross-listed with PSYC 641.

- 644. Neural Development. (3-0). Credit 3.** Classical and current research literature to explore the major events in the development of a nervous system, including topics ranging from neurogenesis to synapse information. Prerequisite: Graduate classification. Cross-listed with BIOL 644.
- 649. Seminar in Behavioral Neuroscience. (3-0). Credit 3.** Behavioral neuroscience; including behavioral pharmacology, neuropharmacology, methods and techniques, drug reinforcement, behavioral toxicology, pain-perception and ingestive behavior. May be repeated up to three times for credit. Prerequisite: PSYC 606 or equivalent; PSYC 609; graduate classification. Cross-listed with PSYC 649.
- 671. Experimental Design for Behavioral Scientists. (2-3). Credit 3.** Intensive practical study of designs of special interest to behavioral scientists; repeated measures designs. Prerequisites: STAT 652 or equivalent. Cross-listed with PSYC 671.
- 681. Seminar. Credit 1 to 3.** Presentation of current research in neuroscience and related areas. May be taken 4 times for credit. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 4.** Directed individual study of selected problems in the field of neuroscience. Prerequisites: Graduate classification and approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of neuroscience. May be repeated for credit. Prerequisite: Graduate classification.
- 691. Research. Credit 1 or more each semester.** Research in neuroscience for thesis or dissertation credit. Prerequisite: Graduate classification.
- 698. Behavior, Genes, and Evolution. (3-0). Credit 3.** Introduces an integrative approach to the study of animal behavior, complementing evolutionary and ecological perspectives with molecular and genetic approaches and methodologies. Prerequisite: Graduate classification; Cross-listed with BIOL 698.

Department of Nuclear Engineering

M. L. Adams, G. Akabani, F. R. Best, D. R. Boyle, L. A. Braby, W. S. Charlton, S. Chirayath, J. R. Ford, Jr., S. Guetersloh, R. R. Hart, Y. A. Hassan (Head), C. Marianno, R. G. McClarren, W. H. Marlow, S. M. McDeavitt, J. E. Morel*, P. Nelson, Jr., K. L. Peddicord, J. W. Poston, Sr., J. C. Ragusa, W. D. Reece, L. Shao, P. V. Tsvetkova, K. Vierow*

* Graduate Advisor

The nuclear engineer applies radiation and energy from nuclear sources to fields such as electricity generation, space craft propulsion, sterilization, food processing, industrial measurements and medical diagnostic and therapeutic treatments. Nuclear engineering is based on the principles of nuclear physics that govern radioactivity, fission and fusion; the production of heat and radiation in those processes; and the interaction of radiation with matter. The function of the nuclear engineer is to apply these principles to a wide range of challenging technological problems.

The Department of Nuclear Engineering offers the Master of Engineering, Master of Science and Doctor of Philosophy degrees. The department also offers courses and faculty supervision for students pursuing the Doctor of Engineering degree. Admission to nuclear engineering requires a bachelor's degree in engineering, chemistry, mathematics or physics. Some nuclear physics background is highly desirable. Mathematics through differential equations is required.

Degree programs that include a minor field of study are encouraged. This minor field would normally include graduate study in the area of the student's baccalaureate degree. If the baccalaureate degree is nuclear engineering, the student with the advice of his or her committee will select a suitable minor area of study. The department does not have a foreign language requirement for the PhD degree; however, successful completion of a departmental qualifying exam is required.

Research opportunities are varied, with emphasis on nuclear fuels, solid/ion interactions, particle transport, large-scale scientific computing, materials and extreme environments, reactor safety, design of advanced nuclear reactors, thermal hydraulics, computational fluid mechanics, reactor kinetics and control, plutonium disposition, space nuclear power systems, radiation interactions with living tissue, dosimetry and medical radionuclides.

The department offers a wide variety of facilities for instructional and research purposes. These include a well-equipped radiation measurements laboratory, a sub-critical reactor laboratory, access to a supercomputer facility and a University-wide UNIX network, a departmental computer facility including interconnected UNIX and Windows workstations with an extensive software library, a radiochemistry laboratory, thermal hydraulics laboratories, materials research laboratories, an AGN-201M low power nuclear reactor, five low-energy ion accelerators and a large TRIGA research reactor located at the Texas A&M University Nuclear

Science Center. An 88-inch cyclotron is also available for research in nuclear physics and engineering at the Cyclotron Institute.

Professional Educational Program in Health Physics

Students interested in doctoral level studies in health physics can pursue these through the PhD program in nuclear engineering. In addition, a professional education program in health physics, leading to the Master of Science degree in health physics, is available in the department.

This area of specialized study in the Department of Nuclear Engineering is based strongly on the fundamental aspects of radiation effects on matter, internal and external dosimetry and environmental aspects of nuclear power. The curriculum is such that students are educated at a professional level in the field of radiation safety or health physics.

A student is required to spend the initial academic year taking formal coursework in the Department of Nuclear Engineering and in other cooperating departments of the University. The summer is spent in opportunities providing on-the-job training in health physics as well as funded research projects suitable for the MS thesis. At least one additional semester is normally required to complete the coursework and a research project for the Master of Science degree in Health Physics.

Nuclear Engineering (NUEN)

- 601. **Nuclear Reactor Theory. (3-0). Credit 3.** Neutron-nucleus interactions; neutron energy spectra; transport and diffusion theory; multigroup approximation; criticality calculations; cross-section processing; buildup and depletion calculations; modern reactor analysis methods and codes. Prerequisite: Approval of instructor.
- 604. **Radiation Interactions and Shielding. (3-0). Credit 3.** Basic principles of radiation interactions and transport, especially as related to the design of radiation shields. Radiation sources, nuclear reactions, radiation transport, photon interactions, dosimetry, buildup factors and fast neutron shielding. Prerequisites: NUEN 302 or equivalent; MATH 308; BS in engineering or physical sciences.
- 605. **Radiation Detection and Nuclear Materials Measurement. (2-3). Credit 3.** This is a laboratory-based course studying the fundamentals of nuclear materials measurements. The course covers advanced radiation detection instrumentation with a specific focus on measuring nuclear materials (uranium, plutonium, and other actinides). Nuclear material measurements include detection, identification, and quantification of the materials in a fuel cycle facility and in the field. Prerequisite: Graduate standing.
- 606. **Reactor Analysis and Experimentation. (3-3). Credit 4.** Perturbation theory; delayed neutrons and reactor kinetics; lattice physics calculations; full core calculations; analysis and measurement of reactivity coefficients; analysis and measurement of flux distribution; analysis and measurement of rod worths; critical and subcritical experiments. Prerequisite: Approval of instructor.
- 607. **Plasma and Thermonuclear Engineering. (3-0). Credit 3.** Fusion reactions, orbit theory in magnetic and electric fields, coulomb interactions, formulation of Boltzmann equation; magnetohydrodynamics, plasma waves and application configurations. Prerequisites: MATH 601 or registration therein; basic circuits; NUEN 417 or approval of instructor; nuclear engineering, electrical engineering or physics majors recommended.
- 609. **Nuclear Reactor Safety. (3-0). Credit 3.** Analysis and evaluation applied to reactor design for accident prevention and mitigation; protective systems and their reliability, containment design, emergency cooling requirements, reactivity excursions and the atmospheric dispersion of radioactive material; safety problems associated with light-water power reactors and proposed fast reactor systems. Prerequisites: NUEN 601 and NUEN 623 or approval of instructor.
- 610. **Design of Nuclear Reactors. (4-0). Credit 4.** Application of fundamentals of nuclear physics and reactor theory with engineering fundamentals to design of nuclear reactors. Prerequisites: NUEN 602 or registration therein; NUEN 410 or approval of instructor.
- 611. **Radiation Detection and Measurement. (2-3). Credit 3.** Interaction of radiation with matter behavior of various nuclear radiation detectors studied both theoretically and experimentally in the laboratory; properties of radioisotopes useful to industry considered and evaluated from an engineering point of view. Prerequisite: Graduate classification, enrollment in NUEN 613 or instructor approval.

- 612. Radiological Safety and Hazards Evaluation. (3-0). Credit 3.** State and federal regulations concerning radioactive materials; radiation safety as applied to accelerators, nuclear reactors and radioactive byproducts; rigorous methods of analysis applied to computation of biological radiation dose and dose rates from various sources and geometries; radiation effects on physical systems. Prerequisites: NUEN 613; MATH 308.
- 613. Principles of Radiological Safety. (3-0). Credit 3.** Rigorous mathematical and physical approach to various aspects of radiological safety; derivation of equations involving radiation absorption, radiation dosimetry and calculations of radiation dose due to internal emitters; mathematical models developed for determination of maximum permissible body burdens and concentrations in air and water. Prerequisite: NUEN 409.
- 614. Probabilistic Risk Assessment Techniques in Nuclear Systems. (3-0). Credit 3.** Current and proposed techniques for determining the reliability of nuclear plant systems and the risk associated with the operation of these advanced technology systems. Prerequisites: NUEN 612 and NUEN 613.
- 615. Theory and Applications of Microdosimetry. (3-0). Credit 3.** Theory, measurement, and calculation of microdosimetric spectra; practical applications of microdosimetry in the determination of absorbed dose distribution within tissue, the statistical fluctuations of absorbed dose at the cellular and subcellular level, and the impact of microdosimetry on radiation protection guidelines. Prerequisite: NUEN 613.
- 618. Multiphysics Computations in Nuclear Science and Engineering. (2-2). Credit 3.** Tightly coupled multiphysics simulation techniques and application to typical problems arising in nuclear science and engineering (reactor dynamics and safety transients, conjugate heat transfer, radiative transfer, fluid structure interaction). Prerequisites: MATH 609 and NUEN 602.
- 619. Multivariable Control System Design. (3-0). Credit 3.** Advanced issues relevant to the design of multivariable control systems using hybrid (time and frequency domain) design methodologies; design using the LQG/LTR method and advanced practical applications using various robust control system design techniques. Prerequisite: MEEN 651 or ECEN 605. Cross-listed with MEEN 652.
- 623. Nuclear Engineering Heat Transfer and Fluid Flow. (3-0). Credit 3.** Thermodynamics and unified treatment of mass, momentum and energy transport with applications to nuclear engineering systems; velocity and temperature distributions in laminar and turbulent flow; flow and thermal stability. Prerequisites: MEEN 334, MEEN 346 or MEEN 461 and MATH 601 or registration therein or approval of instructor.
- 624. Nuclear Thermal Hydraulics and Stress Analysis. (3-0). Credit 3.** Unified treatment of advanced heat transport in solids and fluids including boiling phenomena; thermal stress phenomena with applications to nuclear sources; isothermal elasticity; thermoelasticity; viscoelasticity; plasticity. Prerequisites: NUEN 623 or equivalent; MATH 601 or registration therein.
- 625. Neutron Transport Theory. (4-0). Credit 4.** Analytical treatment of neutron transport theory; solution methods of integrodifferential and integral Boltzmann equations, adjoints; energy dependent methods using singular eigenfunctions, variational methods, orthogonal polynomials and thermalization; current analytical techniques in transport theory. Prerequisites: NUEN 606; MATH 602.
- 627. Radiation-Hydrodynamics. (3-0). Credit 3.** Coupling of the Euler equations of compressible fluid dynamics with the equations of thermal radiation transport; the equilibrium-diffusion limit; radiative shock waves; and numerical methods for one-dimensional calculations. Prerequisite: MATH 602.
- 629. Numerical Methods in Reactor Analysis. (4-0). Credit 4.** Solution of variable dimension multi-group discrete representation problems including S_n , P_n , A_n , variational and Monte Carlo techniques; techniques in reactor kinetics, fuel cycle and optimization. Prerequisites: NUEN 430; NUEN 606 or equivalent.
- 630. Monte Carlo Methods for Particle Transport. (2-2). Credit 3.** Principles of Monte Carlo method; random number generation; random variable sampling; particle tracking; statistical error estimation; ACE format cross-sections; introduction to MCNP code; MCNP applied to radiation shielding, criticality safety, reactor physics and detector modeling; MCNP output analysis, statistical tests, and tallying procedures; variance reduction techniques; Monte Carlo algorithm development. Prerequisites: Approval of Instructor, MCNP/MCNPX code single user license from RSICC, ORNL, USA.

- 633. Radiation Measurements and Calibrations. (3-0). Credit 3.** Measurement of radiation dose and protection quantities in realistic radiation fields will be studied; specific characteristics of radiation sources will be discussed in the context of accurate measurement and radiation protection; examples from a wide variety of radiation environments will illustrate radiation measurement requirements for medical, industrial, and research sources. Prerequisite: NUEN 613.
- 644. Numerical Heat Transfer and Fluid Flow. (3-0). Credit 3.** Convection-diffusion, up-wind, exponential, exact solution, power law schemes, false diffusion; staggered grid concept; development of simple and simpler algorithms; periodically developed flows. Prerequisites: NUEN 430 or equivalent; MEEN 357 and MEEN 461. Cross-listed with MEEN 644.
- 646. Fundamentals of Space Life Sciences. (3-0). Credit 3.** Integrates nutrition, physiology, and radiation biology to define major biological problems in long duration space flight; provide an overview of the problems of bone loss, muscle wasting, and radiation-enhanced carcinogenesis along with potential countermeasures; focus on nutritional interventions and exercise protocols. Cross-listed with NUTR 646 and KINE 646.
- 650. Nuclear Nonproliferation and Arms Control. (3-0). Credit 3.** Studies the political and technological issues associated with nuclear proliferation and arms control; history of arms control treaties and verification, proliferation resistance in the nuclear fuel cycle, international and domestic safeguards, material accountancy, containment and surveillance, and physical protection. Prerequisite: NUEN 601.
- 651. Nuclear Fuel Cycles and Nuclear Material Safeguards. (3-0). Credit 3.** Study of civilian and military nuclear fuel cycles and application of nuclear material safeguards to secure these cycles; topics include the physics of the fundamental fuel cycle components; the application of nuclear material measurements systems; and the technical and legal basis for material protection, control and accounting systems. Prerequisite: NUEN 601 or equivalent.
- 656. Critical Analysis of Nuclear Security Data. (4-0). Credit 4.** A project-based course studying the analysis of nuclear security events, threats, and data. Students will each be assigned a project which requires an analysis of data for a hypothetical case of interest to U.S. national security. The course focuses on detailed technical analysis using diverse datasets and country/organization profiles. Prerequisites: NUEN 650, NUEN 601 or equivalent.
- 661. Nuclear Fuel Performance. (3-0). Credit 3.** This course will review the basic phenomena that govern nuclear fuel performance. This includes structural changes and rate controlling phenomena for oxide and metal fuels as well as cladding and other structural materials. Prerequisites: Graduate classification or consent of the instructor.
- 662. Nuclear Materials Under Extreme Conditions. (3-0). Credit 3.** Fundamentals of materials degradation under reactor environments; linkage from radiation induced microstructure changes to materials thermal properties, mechanical properties, corrosion resistance, swelling, creep, and overall integrities; materials issues of nuclear fuel, cladding, out-core structural components and waste storage management. Prerequisite: Graduate classification or approval of instructor.
- 663. Fundamentals of Ion Solid Interactions. (3-0). Credit 3.** Fundamentals of neutron and ion interactions with solid state materials, and subsequent damage cascade formation, defect clustering, and structural changes; electronic stopping and nuclear stopping mechanisms based on classic and quantum mechanics treatments; development of basic modeling capabilities to carry out simulations for relevant research topics. Prerequisite: Graduate classification or approval of instructor.
- 670. Introduction to Radiotherapy Physics. (3-4). Credit 4.** Examination of radiation physics necessary for understanding modern radiation therapy; perform theoretical foundations of physical dose calculation for megavoltage energy photons and electrons, biological predictions of therapy outcomes, and brachytherapy; methods of modeling and implementing radiation therapy treatment includes planning, evaluation, and delivery; emphasis on intensity modulated radiation therapy and TomoTherapy. Prerequisites: Graduate classification; NUEN 613 or approval from academic advisor.
- 672. Operational Health Physics of Advanced Reactors. (1-0). Credit 1.** This course covers some of the unique operational challenges for radiation protection professionals at the next generation of nuclear power plants and proposed nuclear power plants. Prerequisite: Senior or Graduate standing.

- 673. Radiation Biology. (3-0). Credit 3.** The response of biological systems to ionizing radiation at the molecular, cellular, and organismal levels; effects of different dose levels with emphasis on the underlying mechanisms relevant to long term health effects at low doses. Prerequisite: NUEN 409 or graduate classification.
- 674. Radiation Carcinogenesis. (3-0). Credit 3.** Examines the experimental models and mathematical simulations for the investigation of radiation-induced cancer, the current scientific literature concerning the intersection of risk analysis and the interpretation of disparate data from varied biological systems. Prerequisite: Graduate classification.
- 675. Internal Dose Techniques. (3-0). Credit 3.** Current and proposed techniques for assessing the absorbed dose due to internally deposited radionuclides; techniques recommended for international and national bodies, as well as those used in nuclear medicine. Prerequisites: NUEN 612 and NUEN 613.
- 676. Health Physics Instrumentation. (1-6). Credit 3.** Advanced course in health physics instrumentation intended for students pursuing graduate study in health physics; provides an in-depth knowledge of the components of radiation monitoring and measurement systems. Prerequisite: NUEN 402.
- 677. Aerosol Science. (3-0). Credit 3.** Multidisciplinary survey of methods for describing aerosol particles and systems: gas kinetics and transport theory, formation and growth thermodynamics, electrical properties, coagulation, light scattering; selected topics from current literature. Prerequisite: Graduate classification in engineering or approval of instructor. Cross-listed with MEEN 677.
- 678. Waste Management in the Nuclear Industry. (3-0). Credit 3.** Management of radioactive, hazardous and mixed waste generated by all segments of the nuclear fuel cycle and users of radioisotopes; includes treatment, storage and disposal technologies and the political and socioeconomic issues; evaluation of current practices and regulations using a holistic approach. Prerequisites: Graduate classification and approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Special topics in nuclear engineering not covered by formal coursework. Whenever possible, guest lecturers will discuss topics which they have personally investigated. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 to 6.** Training under the supervision of practicing engineers in settings appropriate to the student's professional objectives. Prerequisites: Approval of chair of student's advisory committee and department head.
- 685. Directed Studies. Credit 1 to 12 each semester.** Offered to enable students to undertake and complete limited investigations not within their thesis research and not covered by any other courses in curriculum. Prerequisite: Graduate classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of nuclear engineering. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research toward thesis or dissertation.

Department of Nutrition and Food Science

C. D. Allred, J. D. Anding, C. A. Bailey, J. E. Bauer, S. A. Bloomfield, R. J. Carroll, G. E. Carstens, R. S. Chapkin, J. A. Coverdale, C. R. Creger, S. F. Crouse, D. M. Gatlin, J. M. Gunn, E. D. Harris, D. A. Knabe, K. S. Kubena, J. M. Lawler, J. R. Lupton, W. A. McIntosh, W. L. McKeehan, D. N. McMurray, R. K. Miller, R. Misra, C. Morgan, P. S. Murano, B. S. Patil, S. E. Riechman, H. W. Sampson, J. E. Sawyer, F. Schroeder, J. R. Sharkey, S. B. Smith, J. M. Sturino, S. U. Talcott, L. O. Tedeschi, N. D. Turner, A. R. Villalobos, R. L. Walzem (Faculty Chair), T. A. Wickersham, L. E. Wright, C. Wu, G. Wu, D. L. Zoran

The graduate program in nutrition at Texas A&M University offers the opportunity for advanced studies in both human and animal nutrition. The program is designed to allow students to build a strong research expertise in nutritional sciences as well as obtain advanced knowledge of basic and practical nutrition.

Participating faculty members have research programs that address nutrient bioavailability, energy metabolism and performance, biochemical interactions and molecular nutrition. Programs are also available in social nutrition. The graduate program is administered by the Department of Nutrition and Food Science (J. Keeton, Head), and its membership includes faculty from Animal Science, Poultry Science, Wildlife and Fisheries Sciences, Veterinary Medicine, Biochemistry and Biophysics, Health and Kinesiology, Statistics, Sociology, Anthropology, Soil and Crop Sciences, Horticulture, Nutrition and Food Science, Health Science Center and the School of Rural Public Health.

Nutrition (NUTR)

- 601. General Animal Nutrition. (3-0). Credit 3.** Comparative nutrition of animal species contrasting digestive, metabolic and physiological functions involved in processing and using nutrients. Prerequisite: ANSC 303 or ANSC 318 or equivalent. Cross-listed with ANSC 601.
- 602. Energetics of Metabolism and Growth. (3-0). Credit 3.** Current fundamental concepts in protein and energy metabolism relating to nutrients required for maintenance, growth and development of animals. Prerequisite: BICH 410 or approval of instructor. Cross-listed with ANSC 602.
- 610. Nutritional Pharmacometrics of Food Compounds. (3-0). Credit 3.** Introduction into nutritional pharmacokinetics and pharmacodynamics of food compounds; specific examples of toxicological and pharmacological effects of food compounds. Prerequisite: NUTR 202 or NUTR 203 or FSTC 201 or CHEM 227 or CHEM 222 or instructor approval. Cross-listed with FSTC 610.
- 613. Protein Metabolism. (3-0). Credit 3.** Basic concepts and recent advances in protein metabolism in animals with emphasis on physiological and nutritional significances; discussion of protein digestion; absorption of peptides; absorption, synthesis and degradation of amino acids; hormonal and nutritional regulation of protein turnover; determination of protein quality and requirements. Prerequisite: BICH 411 or BICH 601 or equivalent or approval of instructor. Cross-listed with ANSC 613.
- 614. Fermentation and Gastrointestinal Microbiology. (3-0). Credit 3.** Fermentation and gastrointestinal ecosystems in terms of microorganisms present, their activities and requirements and their interactions in a dynamic system. Prerequisite: Beginning microbiology and/or biochemistry or approval of instructor. Cross-listed with POSC 614 and VTMI 614.
- 617. Experimental Techniques in Meat Science. (1-6). Credit 3.** Methods used in separating and identifying muscle proteins and fats; techniques for determining postmortem changes of muscle tissue as a result of antemortem treatments. Prerequisite: ANSC 607; BICH 411. Cross-listed with ANSC 617.
- 618. Lipids and Lipid Metabolism. (3-0). Credit 3.** Chemical nature of various classes of lipids and lipid-derived hormones; absorption and metabolism of fatty-acids and lipids; regulation of lipid biosynthesis and obesity; relationship between lipid metabolism and cholesterol homeostasis; lipids as hormones. Prerequisite: BICH 410 or approval of instructor. Cross-listed with ANSC 618.
- 630. Nutrition in Disease. (3-0). Credit 3.** Human nutritional requirements in health and disease, emphasizing effects of disease states on intake, digestion, absorption, metabolism and excretion of nutrients; relationship of diet to development of certain diseases. Prerequisites: NUTR 202; BICH 410 or equivalent.
- 640. Therapeutic Microbiology I. (3-0). Credit 3.** Alimentary (gastrointestinal) microbiology including: (i) the "normal" intestinal microbiota; (ii) probiotic and prebiotic nutritional supplements; (iii) recombinant pharmabiotics; (iv) gut-associated lymphoid tissue and mucosal immunity; (v) foodborne gastrointestinal pathogens; and (vi) fermented products as functional foods. Prerequisite: Undergraduate survey course in microbiology (or instructor's consent). Cross-listed with FSTC 640.
- 641. Nutritional Biochemistry I. (3-0). Credit 3.** Integration of the intermediary metabolism of glucose, amino acids and lipids with nutrition, physiology and pathophysiology in animals; regulation of metabolic pathways in cells, tissues and the whole body under normal and disease conditions; functions of vitamins and minerals in nutrient metabolism and health. Prerequisite: BICH 411 or BICH 604. Offered during the Fall semester.
- 642. Nutritional Biochemistry II. (3-0). Credit 3.** Mechanisms through which specific nutrients modulate intracellular signal transduction and gene expression; molecular mechanisms by which nutrition modulates disease states such as atherosclerosis, cancer and arthritis. Prerequisites: BICH 411; BICH 431 or equivalent.
- 645. Nutrition and Metabolism of Vitamins. (3-0). Credit 3.** Chemistry and metabolism of the fat soluble and water soluble vitamins and their roles in animals; integrates cellular biochemistry and metabolism of the vitamins in vertebrate animal. Prerequisites: POSC 411 or ANSC 303; BICH 410 or BICH 603. Cross-listed with POSC 645.

- 646. Fundamentals of Space Life Sciences. (3-0). Credit 3.** Integrates nutrition, physiology, and radiation biology to define major biological problems in long duration space flight; provide an overview of the problems of bone loss, muscle wasting, and radiation-enhanced carcinogenesis along with potential countermeasures; focus on nutritional interventions and exercise protocols. Cross-listed with NUEN 646 and KINE 646.
- 647. Nutritional Biochemistry of Fishes. (3-0). Credit 3.** Principles of nutritional biochemistry including nutrient metabolism and biochemical energetics with special emphasis on finfish and shell fish. Prerequisite: BICH 410 or equivalent. Cross-listed with WFSC 647.
- 650. Nutrition and Metabolism of Minerals. (3-0). Credit 3.** Nutritional significance of minerals in animal metabolism; chemical, biochemical and physiological role of minerals and homeostatic control in animal metabolism. Prerequisites: POSC 411 or ANSC 303; BICH 410 or BICH 603. Cross-listed with POSC 650.
- 669. Experimental Nutrition & Food Science Laboratory. (1-6). Credit 4.** Nutritional intervention in animal models of metabolic or emotional disorders; genetic modifications or pathogens in food products; analyses of gene expression and behavior. Prerequisite: BICH 432/GENE 432 recommended; graduate in nutrition or related major. Cross-listed with FSTC 669.
- 671. Critical Evaluation of Nutrition and Food Science Literature: Evidence Based Reviews. (3-0). Credit 3.** Evaluation of scientific literature, research methods within the literature, and the quality of scientific studies to produce an evidence-based review in areas specific to nutrition and food science. Prerequisites: NUTR 202 or NUTR 203 and STAT 302; knowledge of nutrition, statistics, and technical writing helpful. Cross-listed with FSTC 671.
- 681. Seminar. (1-0). Credit 1.** Current developments in the field of nutrition; review of current literature and oral presentation of scientific papers on selected nutrition topics. Prerequisite: Graduate classification.
- 684. Professional Internship. Credit 1 or more each semester.** Experience in application of formal training to applied nutrition under supervision of nutritionists, dietitians and faculty member. Student will investigate matter of mutual interest and report results in a professional paper approved by the graduate committee. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 4 each semester.** Nutrition problems and procedures; problems assigned according to experience, interest and need of individual student. Prerequisite: Approval of instructor prior to registration.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of nutrition. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.
- 691. Research. Credit 1 or more each semester.** Investigations leading to thesis or dissertation in various areas of nutrition. Prerequisite: Graduate classification.

Ocean Engineering

Ocean engineering is the application of basic engineering principles to the analysis, design, construction, and management of systems that operate in the ocean environment. The graduate ocean engineering program is broad-based and is designed to fit the needs of graduates from most engineering disciplines and naval architecture. Typical ocean engineering application areas include: beach protection and nourishment, coastal structures, coastal erosion, development of ocean energy resources, instrumentation for coastal and offshore measurements, marine dredging and dredged material placement, moored and towed systems, ocean mining, offshore petroleum recovery, offshore structures, ports and harbors, search and salvage, suspended and dissolved constituent transport, subsea pipelines and cables, and submersible vehicles.

The graduate degree programs include coursework leading to the Master of Science (MS), Master of Engineering (ME), Doctor of Engineering (DEng), and Doctor of Philosophy (PhD) degrees in Ocean Engineering. Students entering the graduate degree program have widely varied engineering backgrounds. Each graduate student is expected to become well versed in the appropriate support disciplines, particularly mathematics, ocean wave mechanics, and hydromechanics. The student is expected to achieve reasonable competence in the principal areas of offshore structures, coastal and port engineering, coastal and estuarine processes, dredging and/or mining processes, or marine hydrodynamics. The graduate program is designed to provide students with knowledge of engineering in the ocean environment and to establish a base for ocean engineering research. Graduate courses are given in ocean wave theory, hydromechanics, oceanography, mathematics, coastal engineering, estuary hydrodynamics, sediment transport, dynamics of offshore

structures, marine dredging, port and harbor design, laboratory modeling, nonlinear hydrodynamics, computational fluid dynamics, and advanced offshore and coastal numerical methods.

The laboratory facilities for the Ocean Engineering Program are among the most comprehensive in the nation for testing offshore and coastal systems. The facilities are located in the Reta and Bill Haynes '46 Coastal Engineering Laboratory, Offshore Technology Research Center, Civil Engineering Laboratory Building, and the Hydromechanics Laboratory.

No foreign language is required for the PhD in ocean engineering or DEng. Students pursuing PhD or DEng are required to pass the Ocean Engineering qualifying exam.

(OCEN)

(faculty, see [page 351](#))

- 630. Dynamics of Ocean Vehicles. (3-0). Credit 3.** Dynamics and stability of motion of immersed and floating structures and ocean vehicles; maneuverability and control; behavior of ocean vehicles and stationary platforms in waves. Design considerations leading to motion reduction; applications to surface vessels, submersibles and drilling rigs. Prerequisites: CVEN 311, MEEN 459 or equivalent, or approval of instructor.
- 671. Ocean Wave Mechanics. (3-0). Credit 3.** Wave theory and applications to engineering problems; linear and non-linear theories of regular gravity waves; wave properties and transformation in shoaling water; spectral analysis of irregular waves; forecasting, hindcasting and theoretical spectra. Prerequisite: Prerequisite: CVEN 311 or equivalent.
- 672. Coastal Engineering. (3-0). Credit 3.** Effects of waves on coastal structures; design of seawalls breakwaters, jetties, harbors, ship channels and pipelines; intentional and accidental discharge of pollutants; diffusion and spreading; oil spill containment and collection. Prerequisite: OCEN 671.
- 673. Nonlinear Hydrodynamic Problems in Ocean Engineering. (3-0). Credit 3.** Nonlinear hydrodynamic problems involved with the complex offshore structures in high sea environment; nonlinear waves application of Volterra model to weakly nonlinear systems; generation of nonlinear model waves; nonlinear hydrodynamic interaction between waves and structure; dynamic analysis of nonlinear response of integrated offshore structures. Prerequisites: OCEN 671 and OCEN 678.
- 674. Ports and Harbors. (3-0). Credit 3.** Basic port planning including site selection, environmental factors and economic conditions; design of wharves, quays, jetties, breakwaters, terminals, navigational channels and fenders; harbor sedimentation and maintenance dredging; design of fishing, small craft and recreation boat harbors. Prerequisite: Approval of instructor.
- 675. Nonlinear Wave Dynamics. (3-0). Credit 3.** Nonlinear wave-wave interactions in steep ocean waves significantly affect wave properties and long-term wave evolution. Strong and weak wave interactions and their respective effects on waves are studied, using various perturbation methods. Applications are shown through using Hybrid Wave Models to analyze wave measurements and predict wave loads on structures. Prerequisite: OCEN 671.
- 676. Dynamics of Offshore Structures. (3-0). Credit 3.** Review of concepts of linear structural dynamic analysis for time and frequency domain simulations, functional design of off-shore platforms, pipelines, floating structures and moorings; environmental loading problems; hydrodynamic phenomena including wind and current interaction, vortex shedding and wave forces; structure-fluid interaction models. Prerequisites: OCEN 671 or approval of the instructor.
- 677. Environmental Fluid Mechanics. (3-0). Credit 3.** Introduction to fluid and mass transport in naturally occurring flows; topics include molecular and turbulent diffusion; dispersion; river, estuary, and ocean mixing; dissolution boundary layers; tidal mixing; offshore wastewater outfalls; introduction to environmental quality numerical modeling. Prerequisite: CVEN 311 or equivalent.
- 678. Fluid Dynamics for Ocean and Environmental Engineering. (3-0). Credit 3.** General conservation laws; Navier-Stokes equations; steady and unsteady Bernoulli's equation; potential flow theory and basics of panel methods; laminar and turbulent boundary layer; dispersion and diffusion processes in laminar and turbulent flow; flow past a body of any shape. Prerequisite: Prerequisite: CVEN 311 or equivalent.
- 681. Seminar. (0-2). Credit 1.** Reports and discussion of current research and selected published technical articles.

- 682. Coastal Sediment Processes. (3-0). Credit 3.** Sediment properties and size distribution, fluvial sediment transport equations, movement of material by the sea, review of pertinent wave theories, littoral drift, inlet stability, coastal protection structures, similarity in sediment transport, movable bed models, sediment tracing, Aeolian sand transport, case studies. Prerequisite: OCEN 671 or approval of instructor.
- 683. Estuary Hydrodynamics. (3-0). Credit 3.** Development of applicable equations for tidal dynamics applied to real estuaries; technology for determination of mean velocities, circulation patterns, water depths, turbulent dispersion patterns, etc. for solution of environmental problems in estuaries; physical and mathematical models. Prerequisites: OCEN 678 or approval of instructor.
- 685. Directed Studies. Credit 1 to 12 each semester.** Special topics not within scope of thesis research and not covered by other formal courses.
- 688. Marine Dredging. (3-0). Credit 3.** Dredge pump selection; pump and system characteristics; cavitation; types of dredges; continental shelf and deep-ocean dredging; head loss in horizontal and vertical pipes for two and three-phase flow; design of disposal methods for dredged material; environmental effects of dredging. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of ocean engineering. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Department of Oceanography

R. Amon, A. Anis, J. G. Baldauf, T. S. Bianchi, D. C. Biggs, R. L. Brinkmeyer, D. A. Brooks, W. R. Bryant, L. Campbell, P. Chang, P. Chapman (Head), T. M. Dellapenna, S. F. DiMarco, W. D. Gardner, B. S. Giese, N. L. Guinasso, Jr., R. D. Hetland, T. M. Iliffe, G. A. Jackson, M. C. Kennicutt, J. D. Kessler, D. J. Klein, P. Louchouart, M. W. Lyle, H. J. Mills, G. R. North, A. H. Orsi, P. T. Plotkin, A. Quigg, M. J. Richardson, G. T. Rowe, W. W. Sager, P. H. Santschi, F. C. Schlemmer, T. G. Schmalz, M. W. Schmidt, A. Schulze, J. R. Schwarz, W. A. Seitz, J. L. Sericano, N. C. Slowey, R. R. Stickney, A. Stoessel*, D. J. Thomas, D. C. Thornton*, A. C. Vastano, W. M. von Zharen, T. L. Wade, J. H. Wormuth, S. Yvon-Lewis*

Degrees. Degrees of Master of Science and Doctor of Philosophy are offered in oceanography. The Department of Oceanography can also serve as the “home” department for the Master of Geoscience degree. The MGsc is a non-thesis degree that provides a multidisciplinary background in the geosciences, appropriate for science teachers in public schools, or for individuals interested in environmental issues, for example.

Oceanography. Oceanography is the interdisciplinary science that focuses on the ocean, its contents and its boundaries. Whereas typical graduate programs lead to progressively greater amounts of specialization, oceanography as an interdisciplinary field admits graduates of specialized areas such as biology, chemistry, geology, geophysics, mathematics, physics or engineering and initially generalizes and broadens their education with a core of required courses. These core courses include the four specializations of the oceanography program—biological, chemical, geological/geophysical and physical oceanography—as well as a seminar covering the state of the science. After this exposure to the interdisciplinary nature of oceanography, the graduate student refocuses in his or her particular subject area to pursue research at the leading edge of the science.

Required prerequisites are the equivalent of a BS degree and basic courses in the fields mentioned above. All students are expected to have had mathematics through integral calculus, at least one year each of physics and chemistry, and at least one survey course in biology and geology. These are in addition to the usual amount of coursework in their major field of science or engineering.

To qualify for an advanced degree in oceanography, the student must demonstrate an ability to apply basic science to the marine environment. This capability requires a combination of principles and methods and a certain body of knowledge unique to oceanography; a student of oceanography must become conversant in all of the marine sciences.

Facilities and Participation in Research. Facilities include office, laboratory and classroom space in the 15-story David G. Eller Building for Oceanography and Meteorology on the College Station campus; the Geochemical and Environmental Research Group, which occupies 20,000 square feet of laboratory and office space and a warehouse-shop area of 8,000 square feet; space at the Texas A&M University Riverside Campus; office, shop and dock facilities on Pelican Island in Galveston, Texas. The department maintains a network of high performance workstations, personal computers and data storage facilities for use in the collection and analysis of data and for ocean modeling and marine geophysical studies. High speed internet connections allow faculty and students to connect to outside supercomputer centers such as those at NCAR. Two computer labs with Apple Macs, PCs and workstations are available for student use. Graduate students usu-

ally take an active part in research grants and contracts awarded to individual professors or research teams by federal and state agencies, industry and private foundations.

Required Courses. OCNG 608, OCNG 620, OCNG 630, OCNG 640 and two hours of oceanography seminar (OCNG 681) are required of all graduate students who are candidates for MS and PhD degrees. Further information is available from the department or the website at ocean.tamu.edu.

Oceanography (OCNG)

600. **Survey of Oceanography. (3-0). Credit 3.** General survey of the scientific framework of oceanographic study; applications of ocean research to social and economic problems; interrelations between the ocean disciplines and other fields of study. Prerequisite: Approval of instructor.
602. **Ocean Research and Operational Techniques. (1-5). Credit 3.** Technical, operational and legal aspects of sea-going research operations; planning and executing ocean research operations; practice in techniques and equipment regularly used aboard ships; familiarization with acquisition and processing of data. Prerequisite: Approval of instructor.
604. **Ocean Observing Systems. Credit 3.** Investigate the rationale behind ocean observing systems; familiarize students with the relevant social, scientific design, technology, and policy issues associated with observing systems. Prerequisite: Approval of instructor.
605. **Oceanography Cruise. Credit 2.** Specialized experience in research methods and analysis in oceanography via preparation for and participation in a research cruise of at least two weeks duration under the supervision of a Texas A&M oceanography faculty member. May be taken up to two times for MS candidates and four times for PhD candidates. Prerequisite: Approval of instructor.
608. **Physical Oceanography. (3-0). Credit 3.** Observations, instruments; physical properties of seawater; property distributions; characteristics of water masses; heat budget; kinematics; gravity, pressure, hydrostatics, stability; horizontal flow; Coriolis force, geostrophy; friction, wind drift; general circulation; wave motions; tides. Prerequisite: MATH 172 or equivalent; PHYS 219.
609. **Dynamical Oceanography. (3-0). Credit 3.** Systematic treatment of the kinematics, dynamics and thermodynamics of the ocean; integral conservation relations; solenoidal versus conservative vector fields; potential vorticity; geostrophic adjustment; inertial and buoyancy modes; Bernoulli-Montgomery potential; energetics in a rotating system; available potential energy; natural temporal and spatial scales. Prerequisites: OCNG 608 or ATMO 435; MATH 601.
610. **Mathematical Modeling of Marine Ecosystems. (3-2). Credit 4.** Theory and technique of model development for marine ecosystems; mathematical representation of interactions among nutrients, phytoplankton, zooplankton, fish and the physical environment; scrutiny of biological concepts and mathematical structure of existing models; laboratory segment to focus on computational techniques applicable to classroom problems. Prerequisites: OCNG 608 and OCNG 620, calculus or approval of instructor.
611. **Global Scale Oceanography. (3-0). Credit 3.** A balanced description of the ocean's large-scale circulation and water mass structure based on the interpretation of modern observations, with emphasis on the ocean's role in global climate, and physical-chemical property fluxes in basin to global scale budgets.
612. **Elements of Ocean Wave Theory. (3-0). Credit 3.** Theories of simple harmonic surface gravity, capillary and internal waves. Wave propagation, dispersion and energy; modifications due to rotation, variable depth and finite amplitude. Prerequisites: OCNG 608 and MATH 601 or approval of instructor.
614. **Dynamics of the Ocean and Atmosphere. (3-0). Credit 3.** Time-dependent motions in rotating, stratified fluids, with application to the ocean; Boussinesq and betaplane approximations; circulation, vorticity and energy conservation; Kelvin, Poincaré and Rossby waves; tidal forcing and response; quasi-geostrophic potential vorticity; concepts of barotropic and baroclinic instability.
615. **Numerical Modeling of Ocean Circulation I. (3-2). Credit 4.** Mathematical theory and numerical technique of model development for ocean circulation; concepts of numerical consistency and stability; Lax equivalence theorem; commonly used finite difference schemes in ocean modeling; finite element and spectral methods as alternative means of discretisation; positivity and CFT method; relaxation and direct methods for solving elliptic equations. Prerequisite: OCNG 608.

- 616. Numerical Modeling of Ocean Circulation II. (3-2). Credit 4.** Quasigeostrophic ocean circulation models; Arakawa's energy and enstrophy conserving scheme; spectral barotropic vorticity model on sphere; shallow water primitive equation models; geostrophic adjustment on different numerical grids; boundary conditions in numerical models; introduction to ocean general circulation models; mixed models and sub-gridscale parameterization; oceanic data assimilation. Prerequisite: OCNG 615.
- 617. Theories of Ocean Circulation. (3-0). Credit 3.** Theories of wind-driven circulation, Sverdrup solution, frictional and inertial boundary regimes; instabilities, meanders and mesoscale features; role of stratification, topography and time dependence; Thermohaline circulation. Prerequisite: Graduate classification.
- 620. Biological Oceanography. (3-0). Credit 3.** Critical analysis of contribution of biological science to our understanding of sea; discernible interrelationships between organisms and physicochemical parameters. Prerequisites: General prerequisites for oceanography.
- 622. Analysis of Benthic Communities. (2-3). Credit 3.** Comprehensive study of marine benthos with principal emphasis upon Gulf of Mexico and Caribbean Sea. Prerequisite: OCNG 620 or equivalent.
- 625. Current Topics in Biological Oceanography. (1-0). Credit 1.** Areas of current research; plankton processes; microbial food web; benthic communities; fisheries; global change. May be taken up to three times. Prerequisite: OCNG 620 or approval of instructor.
- 627. Ecology of the Continental Shelf. (3-0). Credit 3.** Environments, populations and communities of the continental shelf. Interactions of the shelf with the estuaries and the deep sea; man's impact on the shelf ecosystems. Prerequisite: Approval of instructor.
- 629. Lower Foodweb Dynamics of Aquatic Ecosystems. (2-3). Credit 3.** Dynamics of the lower foodweb in estuaries, rivers and lakes, detailing the role and interactions between biota and how they are influenced by abiotic processes; effect of man's activities on natural succession patterns and ecosystem productivity, elucidating the potential for new management practices. Prerequisite: Graduate classification. Cross-listed with WFSC 629.
- 630. Geological Oceanography. (3-0). Credit 3.** Survey of marine geology, structure and composition of ocean basins and continental margins, properties of marine sediments. Prerequisites: General prerequisites for oceanography.
- 632. Sea-Level Change. (3-0). Credit 3.** Modern sea level; topography, measurement, meteorologic and oceanographic contributions, periodic and non-periodic changes; long-term changes: determination, Cenozoic history, Quaternary glacial-interglacial fluctuations; changes during the past century and decade; observations, natural and anthropogenic influences; estimates of future changes and societal implications. Prerequisite: Graduate classification; approval of instructor.
- 640. Chemical Oceanography. (3-0). Credit 3.** Chemical composition and properties of seawater, evaluation of salinity, pH, excess base and carbon dioxide in sea. Marine nutrients, oxygen and other dissolved gases, organic constituents. Prerequisites: General prerequisites for oceanography.
- 641. Inorganic Aquatic Geochemistry. (3-0). Credit 3.** Chemical composition and properties of waters in the near Earth surface environment and their interactions with sedimentary minerals; major topics: thermochemical properties of natural waters, equilibrium and kinetic controlling ion speciation; geochemical processes at mineral surfaces; kinetics of mineral-water interactions; applications to modeling early diagenesis. Prerequisite: Approval of instructor.
- 642. Marine Biochemistry Lab. (0-2). Credit 1.** Laboratory exercises including analyses of salinity, oxygen, nutrients, carbon dioxide system, organics; focus on both dissolved and solid phases; measurements of phytoplankton biomass, productivity, growth and mortality; determination of water column and benthic biomass and respiration; microbial biomarkers; overview of field instrumentation. Prerequisites: General prerequisites for oceanography; graduate classification.
- 644. Isotope Geochemistry. (3-0). Credit 3.** Stable and radioactive isotope variations in natural materials; applications to geochronometric, geothermometric and paleoclimatologic studies of the marine environment. Prerequisite: Approval of the instructor.
- 645. Marine Organic Geochemistry. (3-0). Credit 3.** Origins, fates and distribution of organic compounds in contemporary marine environments and in recent and ancient sediments. Specific analytical techniques. Prerequisite: Approval of instructor.

- 646. Dynamics of Colloids in the Environment. (3-0). Credit 3.** This course is a description of the equilibrium and dynamic aspects of the physics and chemistry of such colloidal particles and macromolecules and the implications for environmental systems, relevant for organic carbon flux and cycling, fate and transport of pollutants, bioavailability of pollutants, or mobility of pollutants in groundwater. Prerequisites: Physical Chemistry, Thermodynamics, Aquatic and Organic Chemistry.
- 647. Chemical Contamination of the Marine Environment. (3-0). Credit 3.** Assessment of the inputs, transfers, effects and fates of heavy metals, radio-nuclides, petroleum hydrocarbons, chlorinated hydrocarbons and other chemicals in the ocean; models developed to predict the future viability of the ocean with particular emphasis on the Gulf of Mexico. Prerequisite: Approval of instructor.
- 649. Estuarine Biogeochemistry. (3-0). Credit 3.** Geomorphology; physical oceanography and sedimentation dynamics of estuaries; chemistry of nutrients; trace metals and organic matter; major controls in estuarine productivity and interactions among estuaries, marshes and coastal waters. Prerequisites: OCNG 620 and OCNG 640.
- 650. Aquatic Microbial Ecology. (3-0). Credit 3.** Microbes in natural environments, including both water and sediment habitats in marine, fresh and ground water systems; process studies of microbial foodwebs and biogeochemical cycling; current methods and research directions. Prerequisites: OCNG 620 and WFSC 414 or approval of instructor. Cross-listed with WFSC 650.
- 651. Meteorological Oceanography. (3-0). Credit 3.** Interaction between the ocean and atmosphere; major features of the two systems; heat budget, teleconnections between ocean and atmosphere, El Niño and related phenomena. Prerequisite: OCNG 608.
- 652. Sedimentary Biogeochemistry. (3-0). Credit 3.** An interdisciplinary approach to understanding complex processes that occur near the marine sediment-water interface in marine and estuarine environments. Composition of marine sediments, pore water chemistry, role of organisms in chemical transformations and pelagic-benthic coupling. Carbon, nitrogen and sulfur cycling in sediments. Modeling biogeochemical processes at the sediment-water interface and during early burial diagenesis. Prerequisites: OCNG 620 and OCNG 640 or approval of instructor.
- 654. Plankton Ecology. (2-2). Credit 3.** Elective course, overview of phytoplankton and zooplankton; taxonomy; physiology; ecology; sampling design; current methods of investigation. Prerequisite: OCNG 620.
- 657. Data Methods and Graphical Representation in Oceanography. (3-0). Credit 3.** Provide the basic tools and techniques to process, analyze, and visualize oceanographic data sets; multi-disciplinary approach; real-world applications to physical, biological, chemical and geological oceanographic data; basic instruction in the MATLAB programming language. Prerequisite: Knowledge of vector calculus and basic statistics.
- 658. Ocean Computational Analysis Lab. (0-4). Credit 1.** This laboratory course is designed to train students in computational techniques using modern (python) and classic (FORTRAN) programming languages and scientific software packages (Generic Mapping Tools and MATLAB). The labs will focus on real oceanographic applications. Prerequisites: encour. Concurrent with OCNG 657.
- 659. Ocean Observing Applications. (3-0). Credit 3.** Conceptualization, design, and construction of oceanographic observing systems; practical experience with the Texas Automated Buoy System including system design, instrumentation setup and calibration, telecommunication systems, and data management. Prerequisites: Master or doctoral classification in OCNG or related field by approval of instructor.
- 660. Implementing Marine Ecosystem Models. (3-0). Credit 3.** Examination of examples of implementations of models of marine ecosystems in the most influential papers; students expected to code the simpler examples and analyze them; review of important nutrient-phytoplankton-zooplankton (NPZ) models as well as other approaches to studying aquatic ecosystems. Prerequisite: OCNG 610.
- 662. Coastal and Marine Sedimentary Processes. (3-2). Credit 4.** Sedimentary processes (erosion, transport and deposition) from the coastline to the deep sea; development of estuaries, deltas, continental shelves, submarine canyons, fans; behavior of fluids and particles in boundary layers. Lab: recirculating flume, field and lab instrumentation. Prerequisite: Approval of instructor.
- 663. Particle Dynamics and Fluxes. (3-0). Credit 3.** Particle dynamics and processes from the sea surface to the seafloor; global distribution, dynamics and fluxes of particles from microns to millimeters (marine snow); results from sediment traps, optical sensors, particle counters applied to biogeochemical cycles in the ocean. Prerequisite: Approval of instructor.

- 666. Principles of Geodynamics. (4-0). Credit 4.** Geological and geophysical methods and phenomena pertinent to geodynamics; plate tectonics; seismicity and seismology; magnetics; gravity; heat flow; igneous, metamorphic and sedimentary petrology; paleontology; and rock mechanics. Prerequisite: Approval of instructor. Cross-listed with GEOP 666.
- 668. Geology and Geophysics of Small Ocean Basins. (3-0). Credit 3.** Geology and geophysics of the Gulf of Mexico, Caribbean, Mediterranean, Arctic Ocean, Red Sea and Philippine Sea; the regional geology, sediment distribution, general structure and origin of each basin. Prerequisite: OCNG 630.
- 670. Deep Sea Sediments. (3-0). Credit 3.** Formation process, core description, physical properties, lithostratigraphy, seismic stratigraphy and paleoceanographic significance of deep marine sediments.
- 673. High-Resolution Marine Geophysics. (2-2). Credit 3.** Introductory course on the geophysical nature of the seafloor and marine subbottom to 1.5 seconds two-way travel time; generation, use and interpretation of reflection and side-scan sonar records and magnetic anomalies of various marine environments and seafloor features. Prerequisite: Approval of instructor.
- 674. Paleoceanography. (3-0). Credit 3.** History of oceans through geologic time; marine paleontological, geochemical, sedimentological and geophysical evidence; inferred changes in seawater properties, ocean circulation and sea level; relation to climate, tectonic processes, atmospheric chemistry and evolution of life. Prerequisite: OCNG 630 or approval of instructor.
- 675. Environmental Management System Strategies for the Scientist. (2-0). Credit 2.** Provide students with EMS strategy skills: environmental laws that may be triggered by activities; fundamental structure of an EMS; EMS alternatives; concepts in an audit; alternative dispute resolution; how effectively EMS can reduce costs and increase profits. Prerequisite: Approval of instructor. Cross-listed with MARS 675 at Texas A&M University at Galveston.
- 676. Marine Environmental Policy: A Survey. (3-0). Credit 3.** Basic concepts and mechanisms of international and U.S. federal environmental law and policy; survey of the field and focus on case studies illustrating basic types of environmental problems. Prerequisite: Approval of instructor. Cross-listed with MARS 675 at Texas A&M University at Galveston.
- 677. Geophysical Data Assimilation. (3-2). Credit 4.** Modern data assimilation methods applied to oceanic and atmospheric circulation models, as well as in other simple models; methods to interpolate one-, two- and three-dimensional randomly spaced data to regular grids for use in numerical models of atmospheric and oceanic circulation. Prerequisites: OCNG 657, ATMO 632, STAT 601. Cross-listed with ATMO 677.
- 678. Coastal Dynamics. (3-0). Credit 3.** Surveys dynamical processes that determine estuarine and continental shelf circulation; geophysical scale flow where Earth's rotation and buoyancy effects are important; analytical and numerical methods used to isolate and study these processes. Prerequisite: OCNG 609.
- 681. Seminar. (1-0). Credit 1.** Presented by faculty, students, staff and visiting scientists; based on recent scientific research. Cross-listed with MARB 681 and MARS 681.
- 684. Professional Internship. Credit 1 to 6.** A directed internship in a professional setting to provide on-the-job training in ocean observing systems skills appropriate to the student's professional objectives. Prerequisites: Approval of student's committee chair; OCNG 684, OCNG 657.
- 685. Directed Studies. Credit 1 to 6 each semester.** Special topics to suit small group requirements. Problems not within thesis research and not covered by any other course in established curriculum. Prerequisites: General prerequisites for oceanography.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of oceanography. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** For thesis or dissertation.

Department of Performance Studies

J. Beaster-Jones, H. M. Berger (Head), D. A. Donkor, D. Dox, M. L. Greenwald, J. Hamera, H. A. Houtchens, P. E. Lieuwen, K. Pullen*, M. Regan, R. H. Schultz, D. F. Wilborn

* Graduate Advisor

Performance Studies (PERF)

600. **Graduate Scholarship in Performance Studies. (3-0). Credit 3.** Overview of history, key issues, and major arguments in performance studies. Prerequisite(s): Admission to the MA in Performance Studies or permission of instructor.
601. **Theories of Performance Studies. (3-0). Credit 3.** Overview of major theories of performance studies and related disciplines; also includes major critical and cultural theories that contribute to the field. Prerequisite(s): Admission to the MA in Performance Studies or permission of instructor.
602. **Research Methods in Performance Studies. (3-0). Credit 3.** Examination and assessment of primary research methods in performance studies; emphasis on post-positivist methods; includes examination of ethical imperatives in research. Prerequisite: Admission to the MA in Performance Studies or permission of instructor.
603. **Performance, Power, and Identity. (3-0). Credit 3.** Issues in, and production of, power and identity in expressive culture, examines how forms of power and varieties of social identity shape, and are shaped by, performance. Prerequisite(s): PERF 600 or permission of instructor.
604. **Performing Vernacular Culture. (3-0). Credit 3.** Examines populist and counter-traditions in expressive culture; emphasis on contemporary cultures of performance and/as practices of everyday life. Prerequisite(s): PERF 600 or permission of instructor.
605. **Topics in Globalization and Performance Studies. (3-0). Credit 3.** Examines expressive cultures in global contexts; theoretical and methodological approaches to globalization and/in performance. May be taken two times for credit. Prerequisite(s): PERF 600 or permission of instructor.
610. **Graduate Studies in Dance Research. (3-0). Credit 3.** Examines key theoretical and methodological issues in dance studies from a performance studies perspective. Prerequisite: PERF 602 or approval of instructor.
611. **Contemporary Religions and Performance. (3-0). Credit 3.** Examines the intricate relationship between religious traditions and performance. Focus on contemporary religious movements. Prerequisite: Graduate classification.
612. **Music Capitalism. (3-0). Credit 3.** Explores the production, distribution, and consumption of music genres as a performance of capitalism. Prerequisite: Graduate classification.
613. **Performing Texas. (3-0). Credit 3.** Explores “Texas” as a set of complex performances that construct specific identities and communities. Prerequisite: Graduate classification.
614. **Soundscapes. (3-0). Credit 3.** Explores sound in social life; sound as performative of identity; sound performance. Prerequisite: Graduate classification.
615. **Spectacle, Performance, and Politics. (3-0). Credit 3.** Interdisciplinary and international exploration of spectacle as political performance. Prerequisite: Graduate classification.
616. **Sport as Performance. (3-0). Credit 3.** Explores sport as manifold modes of cultural performance; focus on embodiment, gender, race, nationalism, spectacle, politics, warfare, and media. Prerequisite: Graduate classification.
620. **Critical Ethnographic Methods in Performance Studies. (3-0). Credit 3.** Critical methods in performance ethnography; emphasis on political dimensions of field encounter. May be taken two times for credit. Prerequisites: PERF 600, PERF 602.
621. **Topics in Popular Music Studies. (3-0). Credit 3.** Examination of context, politics, and political economy of specific popular music forms. May be repeated for a total of 9 credits. Prerequisite(s): PERF 600, PERF 601, PERF 602, or permission of instructor.
622. **Performance and the Construction of American Identity. (3-0). Credit 3.** Role of performance in construction of national identity; special emphasis on post-Civil War US. Prerequisite(s): PERF 600, PERF 601, PERF 602, or permission of instructor.

- 623. Phenomenology and Music. (3-0). Credit 3.** Theoretical and methodological potentials of phenomenology in analyses of music; special emphasis on use of phenomenology to examine multiple aspects of music production, including embodiment. Prerequisite(s): PERF 600, PERF 601, PERF 602, or permission of instructor.
- 682. American Theatre: Gender on the U.S. Stage. (3-0). Credit 3.** Focuses on 18th-21st century texts and performers in order to account for transformations in representations as well as lived experiences of gender. Prerequisite: Enrollment in the MA in Performance Studies or approval of instructor.
- 685. Directed Studies. Credit 1 to 3.** Directed studies in specific areas of performance studies. Student may take up to two sections of directed studies in the same semester, with a maximum of 6 credits. Prerequisite(s): PERF 600, PERF 601, PERF 602, or permission of instructor.
- 689. Special Topics in Performance Studies. (3-0). Credit 3.** Selected topics in an identified area of performance studies. May be repeated for a total of 9 credits. Prerequisite(s): PERF 600, PERF 601, PERF 602, or permission of instructor.
- 691. Research. Credit 1 to 3.** Research for thesis. Prerequisite(s): Permission of department head.

Harold Vance Department of Petroleum Engineering

W. B. Ayers, M. A. Barrufet, F. E. Beck, T. A. Blasingame, C. H. Bowman, D. B. Burnett, J. C. Calhoun, Jr., A. Datta-Gupta*, C. Ehlig-Economides, G. Falcone, A. Ghassemi, E. Gildin, A. Gupta, A. R. Hasan, Z. Heidari, A. D. Hill (Interim Head), S. A. Holditch, H. C. Juvkam-Wold, J. Killough, M. J. King, R. H. Lane, W. J. Lee, D. D. Mamora, M. S. Mannan, W. D. McCain, D. A. McVay, H. A. Nasr-El-Din, D. S. Schechter, J. J. Schubert, R. A. Startzman, P. P. Valko, R. A. Wattenbarger, D. Zhu

* Graduate Advisor

The Department of Petroleum Engineering offers graduate degree programs and coursework at both the master's and doctoral levels. The graduate program in Petroleum Engineering at Texas A&M University is recognized for excellence in teaching and research both nationally and internationally, and this program is consistently rated as one of the best graduate programs in Petroleum Engineering by U.S. News and World Report. Details concerning the faculty, current research projects and technology specialties can be found at our website www.pe.tamu.edu.

Degree Programs

The Department offers traditional MS and PhD degrees that emphasize technical skills and research capabilities and MEng and DEng degrees that emphasize practical engineering skills along with business and management practices. In all degree programs, students who enter with undergraduate degrees (BS or equivalent) in other fields of engineering or closely related study (including physics and geosciences) will be required to take at least three courses from a core curriculum that represents each of the major areas of study in the industry; these courses will count as part of the degree requirement.

Students who enter the program with degrees other than engineering, physics, or geosciences will be required to complete preparatory study at the undergraduate level before beginning graduate coursework. These prerequisite courses will not count toward degree requirements.

These are the minimum requirements for each degree after prerequisites have been completed:

MS Degree Program. Minimum 32 semester hours and a thesis.

MEng Degree Program.

- **Distance Learning or Residence.** Minimum 36 semester hours with an engineering report.
- **International Petroleum Management.** Minimum 36 semester hours, 18 from the Mays Business School.
- **Institut-Francais du Petrole (IFP).** Minimum 36 semester hours. Acceptance at both IFP and Texas A&M University. Minimum 2 semesters at Texas A&M University, 2 semesters at IFP. Emphasis on business or reservoir geoscience at IFP.

PhD Degree Program. Typically a Master of Science (MS) degree is required prior to pursuing a PhD degree. Minimum of 64 semester hours beyond the Master of Science (MS) degree, qualifying exam, preliminary exam, proposal, and dissertation.

Petroleum Engineering (PETE)

- 602. Well Stimulation. (3-0). Credit 3.** Design and analysis of well stimulation methods, including acidizing and hydraulic fracturing; causes and solutions to low well productivity.
- 603. Advanced Reservoir Engineering I. (3-0). Credit 3.** Petroleum reservoir simulation basics including solution techniques for explicit problems.
- 604. Advanced Reservoir Engineering II. (3-0). Credit 3.** Advanced petroleum reservoir simulation with generalized methods of solution for implicit problems. Prerequisites: PETE 603.
- 605. Phase Behavior of Petroleum Reservoir Fluids. (3-0). Credit 3.** Pressure, volume, temperature, composition relationships of petroleum reservoir fluids.
- 606. EOR Methods—Thermal. (3-0). Credit 3.** Fundamentals of enhanced oil recovery (EOR) methods and applications of thermal recovery methods. Prerequisites: PETE 323.
- 608. Well Logging Methods. (3-0). Credit 3.** Well logging methods for determining nature and fluid content of formations penetrated by drilling. Development of computer models for log analysis.
- 609. Enhanced Oil Recovery Processes. (3-0). Credit 3.** Fundamentals and theory of enhanced oil recovery; polymer flooding, surfactant flooding, miscible gas flooding and steam flooding; application of fractional flow theory; strategies and displacement performance calculations. Prerequisites: PETE 323.
- 610. Numerical Simulation of Heat and Fluid Flow in Porous Media. (3-0). Credit 3.** Various schemes available for the numerical simulation of heat and fluid flow in porous media. Application to hot water and steam flooding of heavy oil reservoirs and to various geothermal problems. Prerequisites: PETE 604; approval of instructor.
- 611. Application of Petroleum Reservoir Simulation. (3-0). Credit 3.** Use of simulators to solve reservoir engineering problems too complex for classical analytical techniques. Prerequisites: PETE 400 and PETE 401.
- 612. Unconventional Oil and Gas Reservoirs. (3-0). Credit 3.** As conventional oil and gas resources are depleted, unconventional resources, including heavy oil and gas from low-permeability sandstones, fractured shales, coal bed, and hydrates, will assume greater roles in meeting USA and world energy demands; this course emphasizes resources, geologic and geographic occurrences, recovery technology and economics of unconventional hydrocarbon resources. Prerequisite: Graduate classification in petroleum engineering, geology or geophysics.
- 613. Natural Gas Engineering. (3-0). Credit 3.** Flow of natural gas in reservoirs and in wellbores and gathering systems; deliverability testing; production forecasting and decline curves; flow measurement and compressor sizing. Prerequisites: PETE 323 and PETE 324.
- 616. Engineering Near-Critical Reservoirs. (3-0). Credit 3.** Identification of reservoir fluid type; calculation of original gas in place, original oil in place, reserves and future performance of retrograde gas and volatile oil reservoirs. Prerequisites: PETE 323, PETE 400, PETE 401.
- 617. Petroleum Reservoir Management. (3-0). Credit 3.** The principles of reservoir management and application to specific reservoirs based on case studies presented in the petroleum literature.
- 618. Modern Petroleum Production. (3-0). Credit 3.** An advanced treatment of modern petroleum production engineering encompassing well deliverability from vertical, horizontal and multilateral/multi-branch wells; diagnosis of well performance includes elements of well testing and production logging; in this course the function of the production engineer is envisioned in the context of well design, stimulation and artificial lift.
- 619. Naturally Fractured Reservoirs. (3-0). Credit 3.** This course is intended to explore all relevant subject matter in naturally fractured reservoirs; naturally fractured reservoirs are commonplace throughout the world, however there is a general lack of understanding of such reservoirs. This course provides the background for all relevant topics such as characterization, fluid flow, simulation and enhanced oil recovery. Prerequisite: Approval of instructor.
- 620. Fluid Flow in Petroleum Reservoirs. (3-0). Credit 3.** Analysis of fluid flow in bounded and unbounded reservoirs, wellbore storage, phase redistribution, finite and infinite conductivity fractures; dual-porosity systems. Prerequisites: PETE 323.

- 621. Petroleum Development Strategy. (2-3). Credit 3.** Applications of the variables, models and decision criteria used in modern petroleum development; case approach used to study major projects such as offshore development and assisted recovery. Both commercial and student-prepared computer software used during the lab sessions to practice methods.
- 622. Exploration and Production Evaluation. (2-3). Credit 3.** Selected topics in oil industry economic evaluation including offshore bidding, project ranking and selection, capital budgeting, long-term oil and gas field development projects and incremental analysis for assisted recovery and acceleration.
- 623. Waterflooding. (3-0). Credit 3.** Design, surveillance and project management of waterfloods in reservoirs. Prerequisite: PETE 323.
- 624. Rock Mechanic Aspects of Petroleum Reservoir Response. (3-0). Credit 3.** Reservoir rocks and their physical behavior; porous media and fracture flow models; influence of rock deformability, stress, fluid pressure and temperature. Prerequisites: PETE 604.
- 625. Well Control. (3-0). Credit 3.** Theory of pressure control in drilling operations and during well kicks; abnormal pressure detection and fracture gradient determination; casing setting depth selection and advanced casing design; theory supplemented on well control simulators. Prerequisites: PETE 411.
- 626. Offshore Drilling. (3-0). Credit 3.** Offshore drilling from fixed and floating drilling structures; directional drilling including horizontal drilling; theory of deviation monitoring and control. Prerequisites: PETE 411.
- 627. Well Completion and Workover. (3-0). Credit 3.** Development of design options, systems and procedures to meet deliverability, safety and integrity requirements for completions and workover equipment; overview of methods in the oil and gas industry; function and design criteria of well components. Prerequisite: Graduate classification.
- 628. Horizontal Drilling. (3-0). Credit 3.** Changing a wellbore from vertical to horizontal; long- and short-radius horizontal wells; bottomhole assemblies for achieving and maintaining control of inclination and direction; drilling fluids; torque and drag calculations; transport of drilled solids. Prerequisites: PETE 411.
- 629. Advanced Hydraulic Fracturing. (3-0). Credit 3.** Physical principles and engineering methods involved in hydraulic fracturing; an advanced treatise integrating the necessary fundamentals from elasticity theory, fracture mechanics and fluid mechanics to understand designs, optimization and evaluate hydraulic fracturing treatments including special topics such as high permeability fracturing and deviated well fracturing.
- 630. Geostatistics. (3-0). Credit 3.** Introductory and advanced concepts in geostatistics for petroleum reservoir characterization by integrating static (cores/logs/seismic traces) and dynamic (flow/transport) data; variograms and spatial correlations; regionalized variables; intrinsic random functions; kriging/cokriging; conditional simulation; non-Gaussian approaches. Prerequisite: Introductory course in statistics or PETE 322.
- 631. Petroleum Reservoir Description. (3-0). Credit 3.** Engineering and geological evaluation techniques to define the extent and internal character of a petroleum reservoir; estimate depositional environment(s) during the formation of the sedimentary section and resulting effects on reservoir character. Prerequisites: PETE 324 and PETE 620.
- 632. Physical and Engineering Properties of Rock. (3-3). Credit 4.** Physical and engineering properties of rock and rock masses including strength, deformation, fluid flow, thermal and electrical properties as a function of the subsurface temperature, in-situ stress, pore fluid pressure and chemical environment; relationship of rock properties to logging, siting and design of wells and structures in rock.
- 633. Data Integration for Petroleum Reservoirs. (3-0). Credit 3.** Introduction and application of techniques that can be used to incorporate dynamic reservoir behavior into stochastic reservoir characterizations; dynamic data in the form of pressure transient tests, tracer tests, multiphase production histories or interpreted 4-D seismic information. Prerequisites: PETE 620; STAT 601.
- 634. Petroleum Reservoir Modeling and Data Analysis. (3-0). Credit 3.** Introduces methods for modeling and integration of reservoir data required to apply these methods; emphasizes the integration of geological information into these models.
- 635. Underbalanced and Managed Pressure Drilling. (3-0). Credit 3.** This course provides an introduction and application of techniques utilized in underbalanced and managed pressure drilling; includes equipment, types of drilling fluids used (air, mist foam, etc.), flow drilling, mud cap drilling and hydraulics calculations. Prerequisite: Graduate Classification.

- 636. Horizontal, Multilateral and Intelligent Wells. (3-0). Credit 3.** Advanced well architectures, primarily horizontal, multilateral and intelligent wells, all aspects of these types of wells, including well completions, reservoir flow, and wellbore flow conditions, and well deliverability; optimization of well design and field applications will be demonstrated with field cases. Prerequisites: PETE 662, graduate classification.
- 637. Streamline Simulation. (3-0). Credit 3.** Introductory and advanced concepts in streamline simulation and its applications; theory of streamlines/streamtubes in multidimensions; topics include: streamline, streamtubes, streamfunctions, transport along streamlines, spatial discretization and material balance, time stepping and transverse fluxes, impact of cell geometry, history matching and production data integration, comparison with finite difference. Prerequisite: Graduate classification.
- 638. Production Logging. (3-0). Credit 3.** Well logging methods concerned with problem well diagnosis and reservoir surveillance; includes fluid flow in pipes, understanding fluid dynamics in a wellbore, theoretical basis of production logging techniques, production log interpretation techniques, and operational considerations. Prerequisite: Graduate classification.
- 640. Models for Simulation of Flow and Transport of Fluids and Heat in Porous Media. (3-3). Credit 4.** Design and develop numerical simulators that describe flow of reservoir fluids and transport of heat through porous media; develop multi-dimensional models capable of handling single mass components (gas, oil or water) in single phases (liquid or vapor). Prerequisites: PETE 603 or approval of instructor; experience in FORTRAN or another programming language; solid understanding of physical processes of flow and transport through porous media, numerical analysis and linear algebra; graduate classification.
- 641. Models for Simulation of Advanced Coupled Processes in Geologic Media. (3-3). Credit 4.** Design and develop advanced multi-phase flow processes and complex geologic media (porous and fractured, with matrix-fracture interactions); structured and unstructured grids, multiple mass components (gas, oil and water) in multi-phase states (liquid, vapor and/or liquid-vapor), and phase changes. Prerequisites: PETE 640 and graduate classification; experience in FORTRAN95, C, C++ or another programming language; solid understanding of physical processes of flow and transport through porous media, numerical analysis and linear algebra.
- 642. Formation Damage: Mechanisms and Remediation. (3-0). Credit 3.** Identification and development of solutions for mechanisms of formation damage that can occur during drilling, completion, and following chemical treatments; includes interaction of cleaning fluids with the formation brines, rock and oil. Prerequisite(s): Graduate classification.
- 643. Oil Field Chemistry. (3-0). Credit 3.** The role of chemistry in well stimulation, water shut-off treatments, scale removal, mitigation, downhole corrosion issues, organic deposition, cementing, drilling fluids and various aspects of formation damage; includes problem identification as the first step in designing chemical treatment to remove formation damage. Prerequisite(s): Graduate classification.
- 644. CO₂ Capture and Uses: Sequestration, Enhanced Oil Recovery (EOR). (3-0). Credit 3.** Understanding the need and potential of CO₂ captures and uses, including sequestration and Enhanced Oil Recovery (CCS-EOR), the scientific, technological and economic aspects of identifying and implementing a CCS-EOR; overview of safety, environmental and legal aspects. Prerequisite(s): Graduate classification.
- 645. Upscaling of Geologic Models for Flow Simulation. (3-0). Credit 3.** In-depth understanding of current approaches to upscaling of 3D geologic models for reservoir flow simulation; includes development of upscaling solvers. Prerequisite(s): Graduate classification.
- 646. Reservoir Characterization and Forecasting. (3-0). Credit 3.** Emphasis on geostatistical estimation/simulation and advanced mathematical inversion methods; integration of three important aspects of reservoir development and management: i) stochastic reservoir description, ii) reservoir model updating; and iii) model-predictive reservoir control and management. Prerequisites: Graduate classification; basic familiarity with linear algebra, probability, statistics, differential and integral calculus and general reservoir engineering.
- 648. Pressure Transient Testing. (3-0). Credit 3.** Diffusivity equation and solutions for slightly compressible liquids; dimensionless variables; type curves; applications of solutions to buildup, drawdown, multirate, interference, pulse and deliverability tests; extensions to multiphase flow; analysis of hydraulically fractured wells. Prerequisites: PETE 324 and PETE 620.

- 650. Advanced Drilling Engineering. (3-0). Credit 3.** Underbalanced drilling techniques, offshore drilling; horizontal, extended reach and multilateral drilling and fishing operations; geothermal drilling and high pressure, high temperature drilling. Prerequisite: Graduate classification; PETE 405 or equivalent basic drilling engineering.
- 656. Advanced Numerical Methods for Reservoir Simulation. (3-0). Credit 3.** Numerical simulation of flow in porous media based on numerical methods for partial differential equations; supplemented by published papers and research topics; development of a reservoir simulator. Prerequisites: Graduate classification; basic reservoir simulation or equivalent course; linear algebra and matrix computations or equivalent course; advanced calculus or equivalent course; programming experience.
- 661. Drilling Engineering. (3-0). Credit 3.** Introduction to drilling systems: wellbore hydraulics; identification and solution of drilling problems; well cementing; drilling of directional and horizontal wells; wellbore surveying abnormal pore pressure, fracture gradients, well control; offshore drilling, underbalanced drilling.
- 662. Production Engineering. (3-0). Credit 3.** Development of fundamental skills for the design and evaluation of well completions, monitoring and management of the producing well, selection and design of artificial lift methods, modeling and design of surface facilities.
- 663. Formation Evaluation and the Analysis of Reservoir Performance. (3-0). Credit 3.** Current methodologies used in geological description/analysis, formation evaluation (the analysis/interpretation of well log data), and the analysis of well performance data (the design/analysis/interpretation of well test and production data); specifically, the assessment of field performance data and the optimization of hydrocarbon recovery by analysis/interpretation/integration of geologic, well log, and well performance data. Prerequisite: Approval of instructor or graduate classification.
- 664. Petroleum Project Evaluation and Management. (3-0). Credit 3.** Introduction to oil industry economics, including reserves estimation and classification-, building and using reservoir models, developing and using reservoir management processes, managing new and mature fields, and investment ranking and selections.
- 665. Petroleum Reservoir Engineering. (3-0). Credit 3.** Reservoir description techniques using petrophysical and fluid properties; engineering methods to determine fluids in place, identify production-drive mechanisms, and forecast reservoir performance; implementation of pressure-maintenance schemes and secondary recovery. Prerequisite: Approval of instructor or graduate classification.
- 666. Conservation Theory and Applications in Petroleum Engineering. (3-0). Credit 3.** Includes formulation, modeling, and interpretation of drilling fluid systems, production systems, tracer testing, hydraulic fracturing, EOR/water flooding, polymer flooding, compositional simulation, thermal recovery, and coal-bed methane production; Mathematics as the symbolic/numeric computing platform.
- 667. Petroleum Engineering Reserves and Evaluation. (3-0). Credit 3.** Estimation and valuation of hydrocarbon reserves and resources, with emphasis on probabilistic methods, technically challenging reservoirs, and unconventional resources. Prerequisite: PETE 664, approval of instructor.
- 681. Seminar. Credit 1 each semester.** Study and presentation of papers on recent developments in petroleum technology.
- 684. Professional Internship. Credit 1 to 4.** Training under the supervision of practicing professional engineers in settings appropriate to the student's professional objectives. May be taken four times for credit. Prerequisite: Graduate classification and one semester of graduate work completed.
- 685. Directed Studies. Credit 1 to 12 each semester.** Students undertake and complete limited investigations not within their thesis research and not covered in established curricula. Prerequisites: Graduate classification; approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of petroleum engineering. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Advanced work on some special problem within field of petroleum engineering. Thesis course.
- 692. Professional Study. Credit 1 to 12.** Approved professional study or project. May be taken more than once but not to exceed 6 hours of credit towards a degree.

Department of Philosophy and Humanities

S. W. Austin, J. L. Bermúdez, R. W. Burch, D. W. Conway, M. J. Cresswell, T. J. Curry, S. H. Daniel, R. K. Garcia, T. D. George, M. R. Hand, C. E. Harris, Jr., C. E. Katz, M. L. LeBuffe, H. J. McCann, J. J. McDermott, B. McMyler, C. P. Menzel, C. A. Palmer*, G. F. Pappas, L. Radzik, R. Sansom, R. A. Smith, R. W. Stadelmann, K. E. Sweet, G. E. Varner (Head)

* Graduate Advisor

The Department of Philosophy and Humanities at Texas A&M University offers the degrees of Master of Arts in philosophy and Doctor of Philosophy. Students may pursue studies in any area of philosophy under these programs, both of which have distinctive features. Applicants are asked to specify the degree they wish to pursue.

The MA program is conceived as a terminal program aimed at two purposes. First, to enable professionals and advanced students from other disciplines to complement their training with systematic study of the philosophical concepts most relevant to their specialty. Second, to enable students who may have come to the study of philosophy late in their careers, or who are returning to academic pursuits after pursuing other interests, to continue to enjoy the personal enrichment of philosophy and/or to prepare themselves for doctoral studies at Texas A&M or elsewhere.

Two options for obtaining the MA are available: a non-thesis internship option and a thesis option. Students interested in applying their philosophical skills to other environments, such as education, medicine, law, the military or business, may arrange a professional internship in addition to taking 30 semester hours of coursework (9 of which may be in other disciplines). Individuals who choose to write a master's thesis must take at least 24 semester hours (6 of which may be in other disciplines) in addition to their thesis research. Depending on their background, applicants may be required to take particular undergraduate courses in order to enhance their program of study.

The PhD program is unique in requiring students to earn, in addition to the PhD, a master's or higher-level supporting degree in a field other than philosophy. Supporting degrees may come from a host of fields. Students pursuing a PhD in political philosophy may, for example, wish to earn an MA or MS in political science. Those interested in environmental ethics might consider a supporting degree in wildlife or ecology. Supporting degrees must be approved by the Department's Graduate Program Advisory Council. Applicants who already hold a master's or higher-level degree may petition to have it counted as the supporting degree. Such petitions are approved only if the department judges the prior work to fit the overall needs of the student's course of study. Other applicants are expected to secure admission to an approved master's program in another department during their second year of study.

The PhD program requires a minimum of 96 semester hours beyond the baccalaureate. Students may apply for admission to doctoral candidacy after completing the supporting degree and formal coursework in philosophy amounting to 44 hours. Further information on the requirements for doctoral candidacy may be obtained by contacting the Department of Philosophy and Humanities.

Philosophy (PHIL)

- 611. Ancient Philosophy. (3-0). Credit 3.** Greek and Roman philosophy from 600 B.C. to 300 A.D.; emphasis on Plato and Aristotle. Prerequisite: Approval of instructor.
- 614. Medieval Philosophy. (3-0). Credit 3.** Christian, Jewish and Islamic thought from 300 to 1450; emphasis on Augustine and Aquinas. Prerequisite: Approval of instructor.
- 616. Modern Philosophy. (3-0). Credit 3.** Developments in philosophy from the Renaissance through the Enlightenment: Renaissance humanism and natural science, 17th- and 18th-century empiricism and rationalism, idealism; major thinkers including Descartes, Hume, Kant, Hegel. Prerequisite: Approval of instructor.
- 620. Contemporary Philosophy. (3-0). Credit 3.** 19th- and 20th-century philosophical movements: phenomenology, existentialism, positivism, pragmatism, analysis, process thought. May be repeated for credit as content varies. Prerequisite: Approval of instructor.
- 623. American Philosophy. (3-0). Credit 3.** The genesis of American philosophical thought from the seventeenth century until the work of Emerson; subsequent concentration on the philosophies of Pierce, James, Royce, Dewey, Mead, Santayana and Whitehead. Prerequisite: Approval of instructor.

- 630. Aesthetics. (3-0). Credit 3.** Metaphor, the ontology of artworks, art and artifactuality, aesthetic attitudes, concepts of aesthetic appraisal such as beauty and sublimity and theory of tropes. Prerequisite: Approval of instructor.
- 631. Philosophy of Religion. (3-0). Credit 3.** Investigation of metaphysical and epistemological issues concerning religious claims, beliefs and experiences. Prerequisite: Approval of instructor.
- 632. Social and Political Philosophy. (3-0). Credit 3.** Theories of justice, equality, liberty and authority in social and political institutions; individualism and the social contract; political philosophy of writers such as Plato, Aristotle, Machiavelli, Locke, Rousseau, Marx, Dewey and Rawls. Prerequisite: Approval of instructor.
- 633. Philosophy of Law. (3-0). Credit 3.** Key issues in normative and analytical jurisprudence, including the concept of law; the relationship between law and morality; civil disobedience; the moral obligation to obey the law; punishment. Prerequisite: Approval of Instructor.
- 635. Ethical Theory. (3-0). Credit 3.** Theories of moral value and conduct, moral language and argumentation; consequentialist and deontological approaches to ethics; ethical naturalism; theories of virtue. Prerequisite: Approval of instructor.
- 640. Epistemology. (3-0). Credit 3.** Nature and origin of knowledge, skepticism, belief, truth, rationality, justification and reliability and knowledge of necessary truths. Prerequisite: Approval of instructor.
- 641. Mathematical Logic I. (3-0). Credit 3.** The metatheory of propositional and first-order logic. Prerequisite: Graduate classification or approval of instructor.
- 642. Mathematical Logic II. (3-0). Credit 3.** Continuation of PHIL 641: Compactness, The Lowenheim-Skolem Theorems, computability theory and Church's thesis, formal arithmetic, Godel's Incompleteness Theorems, Tarski's Theorem, and Church's Theorem. Other topics covered in the course might include systems of modal logic, intuitionistic logic, and more advanced issues in set theory. Prerequisite: 641 or approval of instructor.
- 643. History and Philosophy of Logic. (3-0). Credit 3.** Selected topics on the historical development of logic; philosophical views of the nature of logical theory; the role of logical metatheory in the development of logic. May be repeated for credit as content varies. Prerequisite: PHIL 341 or PHIL 641 or approval of instructor.
- 645. Philosophy of Science. (3-0). Credit 3.** Philosophy of the natural and social sciences, including the nature of theories and laws, the notion of causation, probability and determinism and the nature of theoretical change. Prerequisite: Approval of instructor.
- 646. Philosophy of a Particular Science. (3-0). Credit 3.** Focus on methodological, epistemological and ontological issues in physics, or one of the special sciences, such as biology, psychology, cognitive science, economics. Application of philosophical methods to theoretical issues in the particular science. Relationships between theories and explanations of the particular science more basic sciences or other special sciences. May be repeated for credit for courses focusing on different sciences. Prerequisite: Approval of instructor.
- 650. Metaphysics. (3-0). Credit 3.** Classical and contemporary treatments of the nature of reality, God, the existence of universals, space, time, causality; realism and antirealism, the existence and nature of abstract entities, the nature of events, the nature and logic of time and modality, freedom and determinism, and personal identity. Prerequisite: Approval of instructor.
- 655. Philosophy of Mind. (3-0). Credit 3.** The mind-body problem, personal identity, thought and intentionality, action and responsibility; materialism, behaviorism, functionalism. May be repeated for credit as content varies. Prerequisite: Approval of instructor.
- 658. Philosophy of Language. (3-0). Credit 3.** The nature of language, the various uses of language and their philosophical import, the nature of meaning, truth, reference and issues surrounding formal representations of natural languages. May be repeated for credit as content varies. Prerequisite: Approval of instructor.
- 661. Seminar in the History of Philosophy. (3-0). Credit 3.** Intensive study of a current issue in the history of philosophy. May be repeated for credit with variation in topic. Prerequisite: Approval of instructor.
- 662. Seminar in Ethics and Value Theory. (3-0). Credit 3.** Intensive study of current issue in ethics, ethical theory, applied ethics, aesthetics, or the work of particular philosophers in one of these areas. May be repeated for credit with variation in topic. Prerequisite: Approval of instructor.

- 663. Seminar in Metaphysics or Epistemology. (3-0). Credit 3.** Intensive study of a current issue in metaphysics, epistemology, or other core areas of philosophy. May be repeated for credit with variation in topic. Prerequisite: Approval of instructor.
- 664. Seminar in Applied Philosophy. (3-0). Credit 3.** Intensive study of a topic involving the application of philosophical concepts and theories to an issue arising in another scientific or academic field. May be repeated for credit with variation to topic. Prerequisite: Approval of instructor.
- 671. Professional Ethics. (3-0). Credit 3.** Basic concepts and theories underlying major contemporary ethical codes with application to ethical problems encountered in professions such as engineering, law, business and teaching. May be repeated for credit as content varies. Prerequisite: Approval of instructor.
- 682. Philosophical Authors. (3-0). Credit 3.** Intensive study of works of an individual important philosopher, their historical context, and criticisms and interpretations of them. May be repeated for credit with different authors. Prerequisites: Appropriate background in history of philosophy plus instructor approval.
- 683. Philosophical Pedagogy. (1-0). Credit 1.** Teaching practicum for PhD students in philosophy; detailed examination of all aspects of teaching philosophy to university- and college-level students. Prerequisite: Enrollment in PhD program in Philosophy or approval of instructor.
- 684. Professional Internship. Credit 1 to 6.** Practical experience in an institutional or organizational setting appropriate to analysis and understanding of issues in some area of applied philosophy. Prerequisite: Approval of committee chair and department head.
- 685. Directed Studies. Credit 1 to 6.** Directed studies in specific problem areas in philosophy.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of philosophy. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 to 15.** Research for thesis. Prerequisites: Approval of department head and committee chair.

Department of Physics and Astronomy

A. G. Abanov, T. W. Adair III, G. Agnolet, R. E. Allen, R. L. Arnowitt, W. H. Bassichis, K. Becker, M. Becker, A. A. Belyanin, R. A. Bryan, S. A. Chin, D. A. Church, D. L. DePoy, N. M. Duller, B. Dutta, R. Eusebi*, A. M. Finkel'stein, A. L. Ford, R. J. Fries, E. S. Fry, S. A. Fulling, C. A. Gagliardi, J. C. Hardy, D. R. Herschbach, C. R. Hu, T. Kamon, G. W. Kattawar, H. G. Katzgraber, L. V. Keldysh, R. A. Kenefick, C. M. Ko, O. Kocharovskaya, V. V. Kocharovsky, A. A. Kolomenski, D. M. Lee, I. F. Lyuksyutov, A. McInturff, P. M. McIntyre, L. M. Macri, R. K. Mahapatra, D. G. Melconian, S. Mioduszewski, D. V. Nanopoulos, D. G. Naugle, C. Papovich, G. G. Paulus, V. L. Pokrovsky, C. N. Pope, R. F. Rapp*, J. F. Reading, I. Roshchin, J. H. Ross*, Y. Rostovtsev, A. N. Safonov, W. M. Saslow, V. A. Sautenkov, H. A. Schuessler, M. O. Scully, E. Sezgin, S. Shlomo, J. Sinova, A. V. Sokolov,* N. B. Suntzeff, W. Teizer, D. Toback, K. Tran*, R. E. Tribble, L. Wang, R. C. Webb, M. B. Weimer, G. R. Welch (Head), J. T. White, W. Wu, D. H. Youngblood, A. M. Zheltikov, M. S. Zubairy

* Graduate Advisor

The physics curriculum provides classroom and research experience that prepares a graduate student for a career of either research and teaching at a university, or research and development at an industrial or government laboratory. The courses are well suited to graduate students in astronomy, astrophysics, chemistry, mathematics, geosciences or engineering, as well as those seeking a graduate degree in physics.

PHYS 601, PHYS 603, PHYS 606, PHYS 607 and PHYS 615 and/or courses in mathematics and research in the field of the thesis will normally comprise the program of a candidate for the degree of Master of Science. A non-thesis option is also offered. The five courses mentioned together with PHYS 611 and PHYS 624, one semester of either nuclear or particle physics, and one semester of either atomic or solid state physics provide a comprehensive, integrated coverage of the fields of classical and modern physics at the graduate level and constitute the basic courses normally required for the degree of Doctor of Philosophy. More advanced courses in a number of specialized fields are available for candidates for the PhD degree. There is no language requirement for the PhD degree.

A PhD in Applied Physics is also offered. The Applied Physics program offers students the opportunity to receive a PhD while focusing on areas of research outside of those covered by the traditional fundamental physics program. The interdisciplinary curriculum for this degree includes a core of foundation physics courses plus a selection of graduate courses in associated science and engineering fields relevant to a particular student's area of research specialization. Furthermore, for students interested in materials research, the

Physics Department also participates in the Materials Science and Engineering (MSEN) degree program, allowing students to obtain interdisciplinary graduate degrees with a specialization in the physics of materials.

As part of the training of the graduate student pursuing the MS or PhD in physics, the Department of Physics recommends that all students serve as teaching assistants for at least two semesters.

The current research areas of members of the department include experimental and theoretical research in atomic, nuclear and low temperature/solid state physics. Other research areas within the department include extragalactic astronomy, cosmology, astronomical instrumentation, the theory of elementary particle interactions, atmospheric physics, quantum optics and experimental high energy physics. Research laboratories supporting the experimental programs are well-equipped with modern research apparatus. Special support facilities include a wide array of departmental and University computers and a variable energy cyclotron.

Physics (PHYS)

- 601. Analytical Mechanics. (3-0). Credit 3.** Hamilton approaches to dynamics; canonical transformation and variational techniques; central force and rigid body motions; the mechanics of small oscillations and continuous systems. Prerequisites: PHYS 302 or equivalent; MATH 311 and MATH 412 or equivalents; concurrent registration in PHYS 615.
- 603. Electromagnetic Theory. (3-0). Credit 3.** Boundary-value problems in electrostatics; basic magnetostatics; multipoles; elementary treatment of ponderable media; Maxwell's equations for time-varying fields; energy and momentum of electromagnetic field; Poynting's theorem; gauge transformations. Prerequisites: PHYS 304 or equivalents; PHYS 615.
- 606. Quantum Mechanics. (4-0). Credit 4.** Schrodinger wave equation, bound states of simple systems, collision theory, representation and expansion theory, matrix formulation, perturbation theory. Prerequisites: PHYS 412 or equivalent; MATH 311 and MATH 412 or equivalents; concurrent registration in PHYS 615.
- 607. Statistical Mechanics. (4-0). Credit 4.** Classical statistical mechanics, Maxwell-Boltzmann distribution, and equipartition theorem; quantum statistical mechanics, Bose-Einstein distribution and Fermi-Dirac distribution; applications such as polyatomic gases, blackbody radiation, free electron model for metals, Debye model of vibrations in solids, ideal quantum mechanical gases and Bose-Einstein condensation; if time permits, phase transitions and nonequilibrium statistical mechanics. Prerequisites: PHYS 408 and PHYS 412 or equivalents; PHYS 615.
- 611. Electromagnetic Theory. (4-0). Credit 4.** Continuation of PHYS 603. Propagation, reflection and refraction of electromagnetic waves; wave guides and cavities; interference and diffraction; simple radiating systems; dynamics of relativistic particles and fields; radiation by moving charges. Prerequisite: PHYS 603.
- 614. Introduction to Methods of Mathematical Physics. (4-0). Credit 4.** A one-semester introduction to mathematical methods routinely encountered in the graduate study of physics: directed at physics students whose background has not adequately prepared them for enrollment in PHYS 615. Prerequisite: Approval of instructor.
- 615. Methods of Theoretical Physics I. (4-0). Credit 4.** Orthogonal eigenfunctions with operator and matrix methods applied to solutions of the differential and integral equations of mathematical physics; contour integration, asymptotic expansions of Fourier transforms, the method of stationary phase and generalized functions applied to problems in quantum mechanics. Prerequisites: MATH 311, MATH 407 and MATH 412 or equivalents.
- 616. Methods of Theoretical Physics II. (3-0). Credit 3.** Green's functions and Sturm-Liouville theory applied to the differential equations of wave theory; special functions of mathematical physics; numerical techniques are introduced; conformal mapping and the Schwarz-Christoffel transformation applied to two-dimensional electrostatics and hydrodynamics. Prerequisites: PHYS 615.
- 617. Physics of the Solid State. (3-0). Credit 3.** Crystalline structure and symmetry operations; electronic properties in the free electron model with band effects included; lattice vibrations and phonons; thermal properties; additional topics selected by the instructor from: scattering of X-rays, electrons, and neutrons, electrical and thermal transport, magnetism, superconductivity, defects, semiconductor devices, dielectrics, optical properties. Prerequisites: PHYS 606 and PHYS 607.

619. **Modern Computational Physics. (3-0). Credit 3.** Modern computational methods with emphasis on simulation such as molecular dynamics and Monte Carlo; applications to condensed matter and nuclear many-body physics and to lattice gauge theories. Prerequisites: PHYS 408 and PHYS 412 or equivalents; knowledge of any programming language.
624. **Quantum Mechanics. (4-0). Credit 4.** Continuation of PHYS 606. Scattering theory, second quantization, angular momentum theory, approximation methods, application to atomic and nuclear systems, semi-classical radiation theory. Prerequisite: PHYS 606.
625. **Nuclear Physics. (3-0). Credit 3.** Nuclear models, nuclear spectroscopy, nuclear reactions, electromagnetic properties of nuclei; topics of current interest. Prerequisite: PHYS 606.
627. **Elementary Particle Physics. (3-0). Credit 3.** Fundamentals of elementary particle physics; particle classification, symmetry principles, relativistic kinematics and quark models; basics of strong, electromagnetic and weak interactions. Prerequisite: PHYS 606.
628. **Particle Physics II. (3-0). Credit 3.** Continuation of PHYS 627; introduction to gauge theories; the Standard Model. Prerequisite: PHYS 627.
631. **Quantum Theory of Solids. (3-0). Credit 3.** Second quantization, and topics such as plasmons; many-body effects for electrons; electron-phonon interaction; magnetism and magnons; other elementary excitations in solids; BCS theory of superconductivity; interactions of radiation with matter; transport theory in solids. Prerequisites: PHYS 617 and PHYS 624.
632. **Condensed Matter Theory. (3-0). Credit 3.** Continuation of PHYS 631. Recent topics in condensed matter theory. Peierl's Instability, Metal-Insulator transition in one-dimensional conductors, solitons, fractionally charged excitations, topological excitations, Normal and Anomalous Quantum Hall Effect, Fractional Statistics, Anyons, Theory of High Temperature Superconductors, Deterministic Chaos. Prerequisites: PHYS 601, PHYS 617 and PHYS 624.
633. **Advanced Quantum Mechanics. (3-0). Credit 3.** Many-body theory; second quantization; Fermi systems; Bose systems; interaction of radiation with matter; quantum theory of radiation; spontaneous emission; relativistic quantum mechanics; Dirac equation; Klein-Gordon equation; covariant perturbation theory. Prerequisite: PHYS 624.
634. **Relativistic Quantum Field Theory. (3-0). Credit 3.** Classical scalar, vector and Dirac fields; second quantization; scattering matrix and perturbation theory; dispersion relations. Renormalization. Prerequisite: PHYS 624.
638. **Quantum Field Theory II. (3-0). Credit 3.** Functional integrals; divergences, regularization and renormalization; non-abelian gauge theories; other topics of current interest. Prerequisite: PHYS 634.
648. **Quantum Optics and Laser Physics. (3-0). Credit 3.** Line widths of spectral lines; laser spectroscopy; optical cooling; trapping of atoms and ions; coherence; pico- and femto-second spectroscopy; spectroscopic instrumentation. Prerequisite: Approval of instructor.
649. **Physics of Optoelectronic Devices. (3-0). Credit 3.** Overview of basic concepts: laser physics, optics of semiconductors, heterostructures with quantum confinement and their interaction with light; physical principles of state of the art optoelectronic devices; emerging concepts and technologies: integrated photonics, nanophotonics, plasmonics, metamaterials, terahertz optoelectronics, quantum information processing, etc. Prerequisites: Quantum mechanics (PHYS 412 and PHYS 414 or PHYS 606 or equivalent).
650. **Kinetics of Electronic Processes. (3-0). Credit 3.** Electronic structure of condensed media: metals, semiconductors, insulators; scattering and relaxation mechanisms; Boltzmann equation and methods of quantum kinetics; elementary excitation concept; transport phenomena; high frequency and optical phenomena; strong fields and nonlinear phenomena; superconductivity and quantum Hall effect; heterostructures and superlattices; quantum phenomena in low dimensional and mesoscopic nanostructures. Prerequisite: PHYS 606 (Quantum Mechanics I).
659. **The Evolution of Physics. (3-0). Credit 3.** Traces the evolution of classical physics from early Greek times through the end of the 19th century; feedback between ideas in physics and the surrounding culture; laboratory techniques for teaching classical physical concepts. For physics teachers. Prerequisite: Approval of instructor.
660. **Evolution of Physics. (3-0). Credit 3.** Continuation of PHYS 659. Evolution of physics in the 20th century; birth and development of quantum physics, relativity and nuclear physics; laboratory techniques for teaching modern physical concepts. For physics teachers. Prerequisite: Approval of instructor.

- 665. Concepts of Modern Physics. (3-0). Credit 3.** Physical phenomena of contemporary interest; physical concepts; cosmology and astrophysics, elementary particles, lasers and their applications, atomic and nuclear phenomena, and the application of physical principles in recent technology; laboratory techniques for presenting the concepts in inquiry-oriented physical science courses. For physics teachers. Prerequisite: Approval of instructor.
- 666. Scientific Instrument Making. (2-2). Credit 3.** Theory and techniques for designing and constructing advanced scientific instruments such as spectrometers, cryostats, vacuum systems, etc.; mechanical and electronic shop procedures utilizing the lathe and mill; welding and soldering; drafting and print reading; circuit design. Prerequisite: Approval of instructor.
- 667. Physics for Advanced Placement Teachers. Credit 1 to 4.** Review of the fundamental concepts and techniques of physics and their use in the solution of physical problems; topics included in Advanced Placement Physics Courses B and C; mechanics, electricity and magnetism, kinetic theory and thermodynamics, waves, optics and modern physics. Prerequisite: Approval of instructor.
- 674. Introduction to Quantum Computing. (3-0). Credit 3.** Introduces the quantum mechanics, quantum gates, quantum circuits and quantum hardware of potential quantum computers; algorithms, potential uses, complexity classes, and evaluation of coherence of these devices. Prerequisites: MATH 304, PHYS 208. Cross-listed with ECEN 674.
- 681. Seminar. (1-0). Credit 1.** Subjects of current importance; normally required of all graduate students in physics.
- 685. Directed Studies. Credit 1 to 9.** Individual problems not related to thesis. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of physics. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research toward thesis or dissertation. Prerequisite: Baccalaureate degree in physics or equivalent.
- 697. Seminar in the Teaching of Physics. (1-0). Credit 1.** Methods and mechanics of teaching introductory physics and physics laboratories. Required of all TAs during their first semester of teaching. Graded satisfactory/unsatisfactory. May not be repeated for credit. Prerequisite: Teaching assistant in the Physics Department.

Department of Plant Pathology and Microbiology

D. N. Appel, M. C. Black, P. J. de Figueiredo, M. B. Dickman, D. J. Ebbola, C. F. Gonzalez, D. C. Gross, T. S. Isakeit, Y. Jo, C. M. Kenerley, M. V. Kolomiets, C. W. Magill, T. E. Mirkov, G. N. Odvody, K. L. Ong, E. Pierson, L. L. Pierson (Head), C. M. Rush, H. B. Scholthof, K. B. Scholthof, L. Shan, B. D. Shaw, W. Shim, J. L. Starr, T. A. Wheeler, H. H. Wilkinson, S. Yuan

* Graduate Advisor

Members of the Department of Plant Pathology and Microbiology direct the Master of Science and Doctor of Philosophy degrees in genetics, plant breeding, plant pathology and plant physiology. Students carry out their thesis and dissertation research using facilities located on campus and/or at one of the research centers.

A competent command of the English language is required. For complete information on the options available, prospective students should contact the Department of Plant Pathology and Microbiology.

The department offers a Master of Agriculture (MAgr) degree program in plant protection. The MAgr is a non-research professional degree which requires more formal coursework in lieu of the thesis.

Plant Pathology

Plant pathology is the science of plant diseases, their nature, causal agents and interrelated phenomena. The major objectives concern the scientific training of professional phytopathologists. Emphasis is placed on the fundamental and practical concepts associated with pathology and the conceptual schemes of fungal, bacterial, viral, nematological, mycoplasmal and physiogenic diseases. In addition, facilities are available for research in most phases including physiology of parasitism, host-parasite relationships, genetics of host resistance, genetics of pathogen variation and variability, genetics of host-pathogen-hyperparasite populations, ecology of soil-borne pathogens, etiology and epidemiology of plant diseases, nematology, virology, phytotherapeutics and clinical phytopathology.

(PLPA)

- 601. Fundamentals of Plant Pathology. (3-0). Credit 3.** Increase the understanding of the underlying mechanisms in the disease process; apply that understanding to reduce losses caused by disease; nature of disease causing agents; the outcomes of the interaction between plants and pathogens. Prerequisite: Graduate Classification.
- 603. Plant Disease Management. (3-0). Credit 3.** On-line course designed to provide a strong foundation in the principles and practices of management of plant diseases; analysis of disease cycles and epidemiological parameters to develop and evaluate efficient control strategies and forecasting models. Prerequisites: PLPA 301 or equivalent, permission from instructor.
- 610. Host Plant Resistance. (3-0). Credit 3.** Host plant resistance programs from the standpoint of the plant breeder, plant pathologist and entomologist; team taught with each discipline represented; round-table discussions of assigned readings and lectures. Prerequisite: Approval of instructor. Cross-listed with SCSC 610 and ENTO 610.
- 611. Advanced Plant Pathology. (3-0). Credit 3.** Principles and concepts of plant pathogenesis, plant disease epidemiology, and plant disease management at the level of the whole plant and in plant populations; impact and control of significant plant diseases. Prerequisites: PLPA 301 or equivalent; approval of instructor.
- 613. Advanced Plant Pathology Laboratory. (0-3). Credit 1.** A laboratory course designed to demonstrate key components of the host-pathogen interaction and modern diagnostic and research techniques. Concurrent enrollment in PLPA 611 recommended. Prerequisite: PLPA 301 or approval of instructor.
- 614. Pathogens, the Environment, and Society. (3-0). Credit 3.** Survey the impact of microorganisms on development of modern culture and society; emphasize role pathogens have played in history of mankind; influence of changing environment on emerging diseases. Prerequisite: Graduate Classification.
- 616. Methods in Molecular Biology of Plant-Microbe Interactions. (2-0). Credit 2.** Concepts and techniques used in molecular plant pathology to study the interactions between hosts and pathogens; focus on understanding the rationale for implementing certain procedures and the theoretical concepts underlying the methodology. Prerequisite: Graduate classification.
- 617. Molecular Plant Pathogen Interactions. (3-3). Credit 4.** Critical review of the current literature on molecular and biochemical mechanisms of plant responses to pathogen invasion; overview of disease resistance genes, major classes of defense-related proteins, antimicrobial compounds and signal-transduction pathways. Prerequisite: Graduate classification in any life sciences departments.
- 618. Bacterial Plant Diseases. (2-3). Credit 3.** Bacterial diseases of fruit and vegetable crops, field crops and ornamental plants; nature of the disease, dissemination of the pathogen and methods of control. Prerequisite: Approval of instructor.
- 620. Plant Virology. (2-3). Credit 3.** Overview of plant virology with emphasis on molecular biology of host-virus interactions; topics will include virus replication, gene expression, movement, symptoms, transmission and control; current literature and techniques important to virology presented. Prerequisite: Approval of instructor.
- 623. Diseases of Field Crops. (2-3). Credit 3.** Fundamental and practical aspects of more important and representative diseases of field crops; plant disease problems peculiar to extensive cultivation methods. Prerequisites: PLPA 301 and PLPA 303.*
- 626. Diagnosis of Plant Diseases. (1-3). Credit 2.** Techniques employed in field diagnosis of plant diseases; histological and microbiological studies to verify initial diagnosis. Prerequisite: Approval of instructor.*
- 627. Theory of Plant Disease Epidemics. (2-3). Credit 3.** Nature, scope, techniques and theoretical basis of quantitative plant disease epidemiology. Prerequisite: Approval of instructor.
- 630. Fungi: Physiology and Genetics. (2-0). Credit 2.** Exploration of genetic networks, and genome evolution; physiology of fungal development and plant pathogenesis. Prerequisites: Graduate classification or approval of instructor and concurrent enrollment in PLPA 631.
- 631. Fungi Laboratory. (0-3). Credit 1.** Demonstration of key modern concepts in the Kingdom Fungi; experiments with current research methodologies using fungi. Prerequisites: Graduate classification or approval of instructor and concurrent enrollment in PLPA 630 and/or PLPA 632.

- 632. Fungi: Cell Biology and Taxonomy. (2-0). Credit 2.** Morphological and molecular phylogenetic survey of the Kingdom Fungi; cell biology of fungal form and function. Prerequisites: Graduate classification or approval of instructor and concurrent enrollment in PLPA 631.
- 657. Biotechnology for Biofuels and Bioproducts. (3-0). Credit 3.** Biotechnology issues in developing bioenergy as a renewable energy source; emphasis on the three generations of bioenergy and enabling technologies; special topics include recent advances in bioenergy research, government policy, and industrial development. Prerequisite: Graduate classification.
- 665. Viral Vectors and Gene Therapy. (3-0). Credit 3.** This course will describe various viral vector systems, their development, their use as research tools, and their use in biotechnology and gene therapy; the course will consist of a mixture of short lectures and discussion of papers from the literature. Prerequisites: VTMI 663, VTMI 647, PLPA 616, or PLPA 620 or permission of instructor. Cross-listed with MMPA 665 and VTMI 665.
- 681. Seminar. Credit 1 each semester.** Reports and discussions of topics of current interest in plant pathology; review of literature on selected subjects.
- 684. Professional Internship. Credit 1 to 4.** Work-study program for on-the-job training. The student's major professor and job training supervisor will grade the individual. Prerequisite: Graduate classification in Department of Plant Pathology and Microbiology.
- 685. Directed Studies. Credit 1 to 4 each semester.** Individual problems or research not pertaining to thesis or dissertation. Prerequisites: PLPA 301 and PLPA 303; approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of plant pathology. May be repeated for credit. Prerequisite: Approval of instructor.
- 690. Theory of Research. (1-0). Credit 1.** Design and development of research theory, inquiry and methodology in various subfields of plant pathology and microbiology; includes examination of modern trends and advances, the analysis of research approaches, and the evaluation and interpretation of data using examples from current research literature. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Original investigations in support of thesis or dissertation.

* Field trip required for which departmental fee may be assessed to cover costs.

Department of Political Science

J. E. Anderson, J. A. Baer, J. R. Bond, K. Y. Dionne, W. A. Dixon, J. A. Dyer, G. C. Edwards, III, E. H. Ellis, M. C. Escobar-Lemmon, R. B. Flemming, M. Fuhrmann, S. A. Fulton, N. Geva, E. K. Godwin, G. M. Halter, R. E. Harmel, C. F. Hermann, K. Q. Hill, M. Huang, P. A. Hurley, H. Jo, C. A. Johnson, M. A. Kellam, P. M. Kellstedt, S. Kirkpatrick, M. T. Koch, S. Kurizaki, J. E. Leighley, Q. Li, C. S. Lipsmeyer, N. R. Luttbeg, E. V. McLean, K. J. Meier, A. Mintz, C. J. Nederman, E. L. Owen, A. C. Pacek, E. Parker-Stephen, F. I. Pedraza, D. A. M. Peterson, E. B. Portis, M. F. Rice, J. D. Robertson, J. R. Rogers (Head), C. M. Sprecher, A. Tarar, M. M. Taylor-Robinson*, H. J. Tucker, J. D. Ura, P. P. Van Riper, A. Vedlitz, D. A. von Vacano, W. F. West, T. Whang, G. D. Whitten, C. W. Wiggins, B. D. Wood

* Graduate Advisor

The Department of Political Science offers graduate study leading to the degrees of the Doctor of Philosophy and Master of Arts. The Doctor of Philosophy degree is appropriate for those who wish to pursue careers as research scholars in institutions of higher education. The Master of Arts curriculum is appropriate as preparation for more advanced work in political science.

Students in the PhD program choose a major and minor field from five areas of specialization: American politics, comparative politics, international relations, political theory and public administration/public policy. Minors in Advanced Research Methodology and Race and Ethnic Politics are also available. Students also select a topical field that may be either interdisciplinary in nature or related to their major field of interest. All students are required to complete a common core of methodological courses.

Requirements for an MA in political science may be satisfied by completing one of two options. Option I—the thesis plan—requires a minimum of 30 semester hours of credit, no more than 6 of which may be for thesis research (POLS 691); a final oral examination is required unless the student has a 3.5 average or better. Option II—the non-thesis plan—requires at least 36 semester hours of coursework, 24 of which must be in political science plus a minimum of 6 hours in a supporting field; a comprehensive examination is mandatory.

For both degrees, specific program formulation is the responsibility of the student, his or her graduate committee and the graduate advisor. Required methods courses for the PhD and MA in political science

include POLS 601 and POLS 602. This sequence presumes familiarity with quantitative research methods in social science. Students without such preparation may be required to take prerequisite work in quantitative methods during their first semester of study in the program.

Organizations Affiliated with the Political Science Program

Six academic areas within the Department of Political Science provide opportunities for graduate students to do research in political theory, public policy and administration, American politics, cross-national politics, international relations and methods.

Political Theory Convocation. The Convocation provides a forum for critical discussion among faculty and graduate students with research interests in political theory. Convocation frequently hosts visiting scholars from other universities and sponsors an annual conference focused upon the field of political theory within the discipline of political science.

The Project for Equity, Representation, and Governance (PERG). The program supports scholarship in both public administration and public policy as well as race and ethnic politics. PERG sponsors conferences, visiting speakers, national competitions for undergraduate research, and the dissemination of scholarship to policymakers.

The Program in American Politics. The program supports the intellectual community of scholars and students interested in American politics. It sponsors state-of-the-art conferences on current debates in American politics and faculty and graduate student research presentations.

The Program in the Cross-National Study of Politics. The program supports and promotes cross-national research and activities of the comparative politics faculty and students by providing support for conferences and workshops; acquiring and archiving relevant data sets; and inviting scholars to conferences and workshops.

The Program on International Conflict and Cooperation (PICC). The program seeks to produce theoretical and methodological innovations that contribute to the social scientific knowledge on international relations. The PICC organizes and sponsors internal and external speakers, workshops and theme conferences. It also provides research support for faculty and graduate student members.

The Program in Scientific Political Methodology. The program advances the department's commitment to discovery and explanation about political life through the development and testing of scientific theory. The program sponsors the annual Winter Institute in Social Science Methods, which educates faculty and students about new and especially notable methodological developments. The program also offers a lecture series entitled "Discovery and Verification in Social and Political Science" that brings prominent members of our profession to the department to discuss especially pressing concerns about the use of the scientific method in the discipline.

Prospective students uncertain as to prerequisites or opportunities are encouraged to correspond with the graduate advisor before starting the admissions process.

Political Science (POLS)

- 601. Components of Political Inquiry. (3-0). Credit 3.** Elements of empirical research design, techniques of data collection and data analysis. The evolution of political science as a scientific discipline. Required for political science majors. Prerequisite: Completion of or concurrent enrollment in STAT 303 or equivalent.
- 602. Quantitative Political Analysis. (3-0). Credit 3.** Theory, techniques and applications of quantitative analysis in political science. Required for political science majors. Prerequisite: POLS 601 or equivalent.
- 603. Quantitative Political Analysis II. (2-2). Credit 3.** Introduction to advanced applications of quantitative analysis in political science; critical evaluation of the use of several advanced statistical techniques in political analysis. Prerequisite: POLS 602 or equivalent.
- 604. Conceptualization and Theory in Political Analysis. (3-0). Credit 3.** Exploration of the function of general theoretical assumptions in social scientific research and a critical analysis of some of the most influential general conceptualizations of political phenomena. Prerequisite: POLS 601 or equivalent.

- 606. Advanced Research Methods for Political Scientists. (3-0). Credit 3.** Advanced techniques for specialized problems in empirical political analysis, including voter choice models, longitudinal data, elite interviewing, problems of formal theory and others. May be taken three times. Prerequisites: POLS 601 and POLS 602 or equivalents.
- 607. Advanced Research Methods for Political Scientists II. (3-0). Credit 3.** Advanced techniques for specialized problems in empirical political analysis, including voter choice models, longitudinal data, elite interviewing, problems of formal theory and others. May be taken up to three times as content varies. Prerequisites: POLS 601, POLS 602.
- 620. Comparative Political Systems. (3-0). Credit 3.** Comparative study of national political systems; cross-national relationships and comparative analysis.
- 621. Theory and Method in Comparative Politics. (3-0). Credit 3.** Introduction to methods for conducting research in comparative politics, including approaches to theory development and overcoming obstacles to comparative politics research. Prerequisites: Graduate classification or permission of the instructor.
- 623. Seminar in Cross-National Topics. (3-0). Credit 3.** Cross-cultural investigation of the manner in which selected political processes manifest themselves in various political systems. May be taken for credit up to three times as content varies.
- 624. Seminar in Regional Studies. (3-0). Credit 3.** Political behavior or institutions within a specified country, region or cultural area. May be taken for credit up to three times as content varies.
- 625. Seminar in Comparative Race and Ethnic Politics. (3-0). Credit 3.** Significant themes in comparative study of race and ethnic politics; includes racial and ethnic identities, government and diversity, racial and ethnic violence, managing conflict. May be taken three times for credit. Prerequisite: Graduate classification.
- 630. International Politics. (3-0). Credit 3.** Survey of international politics; security politics, the development of nations, international law, organization and integration.
- 631. Conflict Studies. (3-0). Credit 3.** The study of international conflict, especially factors pertaining to the causes of war. Prerequisite: Graduate classification or approval of instructor.
- 632. Theory and Method in International Relations. (3-0). Credit 3.** Theory, techniques and applications of quantitative analysis in international relations. Prerequisites: POLS 602 and POLS 630 or approval of instructor.
- 633. Seminar in Foreign and Security Policy. (3-0). Credit 3.** Selected aspects of the formation and conduct of foreign and defense policy. May be taken for credit up to three times as content varies.
- 634. International Institutions. (3-0). Credit 3.** Current theoretical and empirical debates in the field of international institutions; includes the value and limitations for understanding the creation, design, behavior, change and impact of international institutions in world politics. Prerequisite: POLS 630.
- 635. International Political Economy. (3-0). Credit 3.** The study of international political economy, focusing on the economic and political causes and consequences of international trade, foreign direct investment, capital mobility, exchange rate, monetary policy, migration, and development. Prerequisite: Graduate classification or approval of instructor.
- 641. Seminar in Public Administration. (3-0). Credit 3.** Literature and research problems of a selected aspect of public administration. May be taken three times.
- 642. Seminar in Public Policy. (3-0). Credit 3.** Literature and research problems of a selected aspect of public policy. May be taken three times.
- 643. Theory and Practice of Public Administration. (3-0). Credit 3.** Theory, process and structure of management in the public sector. Internal management and behavior in federal, state or local agencies in a political setting.
- 644. Seminar in Politics of Race, Ethnicity and Public Policy. (3-0). Credit 3.** Examines race, ethnicity, and public policy; emphasizes how policy process considers race and ethnicity, and differential impact of policy on racial groups. May be taken three times for credit. Prerequisite: Graduate classification.
- 645. Politics, Policy and Administration. (3-0). Credit 3.** Relationship of politics and administration with reference to the influence of administration and bureaucracy, legislative bodies, parties, interest groups and other forces in the formation and execution of public policy in various levels of, primarily, American government.

- 646. Public Policy Theory. (3-0). Credit 3.** Major theories and classifications of public policies, and general explanations of policy formation and impact; recent research testing major theories.
- 650. Normative Political Theory. (3-0). Credit 3.** Examination of the most influential approaches, concepts and political arguments of classical and contemporary political theory. May be taken for credit up to three times as content varies.
- 654. Seminar in Theories of Political Legitimacy, Order and Obligation. (3-0). Credit 3.** Intensive examination of contending theories of political authority, obligation and justice. May be taken up to three times for credit as content varies. Prerequisites: Graduate classification and approval of instructor.
- 660. Gateway Seminar in the Politics of Race and Ethnicity. (3-0). Credit 3.** Overview of the race and ethnicity literature in four different subfields: comparative politics, international relations, American politics, and public administration/policy; emphasis on four themes across the subfields: identity participation (including non traditional participation such as violence), representation, and institutions/structure.
- 670. American Political Institutions. (3-0). Credit 3.** Explores the major issues and controversies in the study of American political institutions; topics include executive, legislative and judicial branches of government, as well as formal organizations such as parties and interest groups. May be taken for credit up to three times as content varies.
- 671. American Political Behavior. (3-0). Credit 3.** An introduction to core theories and controversies about American mass political behavior; topics include public opinion, political culture, political socialization, party identification and political participation. May be taken for credit up to three times as content varies.
- 672. Seminar in American Political Institutions. (3-0). Credit 3.** Relevant literature and research problems of selected aspects of American political institutions at the national level; emphasis on original student research. May be taken for credit up to three times as content varies. Prerequisite: Approval of instructor.
- 674. Seminar in Race, Ethnicity and American Politics. (3-0). Credit 3.** This seminar examines social science theories of race, ethnicity and politics in the United States. The course highlights the political behavior of Latinos, African-Americans, and Asian Americans. May be taken three times for credit. Prerequisite: Graduate classification.
- 675. Seminar in American Political Processes and Behavior. (3-0). Credit 3.** Relevant literature and research problems of selected aspects of mass political behavior in the United States; emphasis on original student research. May be taken for credit up to three times as content varies. Prerequisites: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Topics of interest to political scientists with emphasis on professional norms, opportunities and teaching strategies. Prerequisite: Approval of graduate advisor.
- 685. Directed Studies. Credit 1 to 6 each semester.** Individual instruction in selected fields of political science. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of political science or public policy. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Thesis research. Credit will be given only upon acceptance of completed thesis. Prerequisite: Approval of graduate advisor.

Department of Poultry Science

C. Alvarado, C. A. Bailey, L. R. Berghman, D. J. Caldwell*, J. B. Carey (Head), C. D. Coufal, C. R. Creger, T. Duong, M. B. Farnell, J. T. Lee, B. Lupiani, S. D. Pillai, S. M. Reddy, C. A. Ruiz-Feria, A. R. Sams, R. L. Walzem

* Graduate Advisor

Continual growth in the poultry industry increases the need for technical knowledge in the various fields of science needed for a successful poultry business. In no field of agriculture is an understanding of the fundamental and applied sciences more marketable or more rewarding than in the modern intensive production of poultry meat and eggs. Because the bird is the basis for the department's graduate program, additional areas of interest include exotic and wildlife species as well as cellular and molecular studies using avian models. A major objective of the department is to offer training for work in research, teaching, extension or industrial

operations. We also strive to bridge the gap in both directions between courses in fundamental biochemistry, genetics, physiology and economics and their practical application to the production of poultry and the care of all avian species.

The department offers graduate studies leading to the Master of Agriculture, Master of Science and Doctor of Philosophy degrees including an online degree. In addition to a major in poultry science, students may pursue majors through many intercollegiate faculties including nutrition, food science and technology, and genetics. Faculty expertise exists for study in genetics, reproduction, nutrition, biochemistry, physiology, environment, management, microbiology, processing and marketing for all commercially-important species. The faculty are also actively involved in many of these disciplines for other avian species and in the pursuit of basic cellular and molecular knowledge.

Poultry Science (POSC)

- 603. Avian Incubation and Embryology. (3-3). Credit 4.** Embryonic development of bird eggs under both commercial and experimental incubation conditions; developmental processes are evaluated relative to various environmental and genetic parameters. Prerequisite: Approval of instructor.
- 609. Avian Physiology. (3-3). Credit 4.** Basic physiological principles pertaining specifically to avian species; cardiovascular, neural, respiratory, digestive, endocrine and reproductive systems; physiological experiments use various avian species as laboratory animals. Prerequisite: Approval of instructor.
- 611. Poultry Processing and Distribution Technology. (3-2). Credit 4.** Poultry and egg composition, mechanisms of poultry and egg quality preservation, effects of storage environments, time and product treatment; evaluation of commercial methods of product assembly, processing, distribution and quality control; evaluation of physical, microbiological, functional and chemical methods of quality determination. Cross-listed with FSTC 611.
- 614. Fermentation and Gastrointestinal Microbiology. (3-0). Credit 3.** Fermentation and gastrointestinal ecosystems in terms of microorganisms present, their activities and requirements and their interactions in a dynamic system. Prerequisite: Beginning microbiology and/or biochemistry or approval of instructor. Cross-listed with NUTR 614 and VTMI 614.
- 615. Avian Nutrition. (3-0). Credit 3.** Metabolism and nutritional requirements of domestic fowl including proteins, carbohydrates, fats, minerals, vitamins and related feed additives. Prerequisites: POSC 411 and CHEM 228 or approval of instructor.
- 619. Molecular Methods for Microbial Characterization. (2-2). Credit 3.** Underlying principles of molecular methods for microbial detection and characterization in natural and man-made ecosystems; emphasis on method application and data interpretation; emphasis on microbial pathogens and indicator organisms in foods and environment; laboratory covers select protocols. Prerequisites: POSC 429; SCSC 405; FSTC 326; approval of instructor. Cross-listed with SCSC 619, FSTC 619 and VTMI 619.
- 625. Precision Diet Formula. (2-2). Credit 3.** Theoretical and applied principles associated with precision feeding and diet formulation to optimize nutrient requirements; optimization using least-cost formulation, ingredient inventory, farm and feed mill management, and nutrient management of non-ruminants (poultry, swine, horse, and fish) and ruminant animals (beef and dairy). Prerequisite: POSC 411 or ANSC 318. Cross-listed with ANSC 623.
- 628. Advanced Poultry Meat Processing. (3-0). Credit 3.** Farm-to-table review of quality and safety effects of processing steps converting chicken broilers into poultry meat and derived products; discussion of current research and events influencing the poultry processing industry; preparation of research proposals addressing needs in the field. Prerequisite: Graduate classification.
- 629. Microbiology of Food Irradiation. (2-2). Credit 3.** The course provides a lecture plus laboratory overview of electron beam and x-ray based food irradiation principles. The objective is to provide students with a working knowledge of using electronic pasteurization as a means of destroying microbial pathogens or retarding microbial spoilage in foods. Cross-listed with FSTC 629.
- 630. Applied Animal Genomics. (3-0). Credit 3.** Theory and application of genomics by livestock industries; consideration of genetic markers, gene mapping methods, genome analysis and emerging technologies such as microarrays, transgenesis, cloning and marker assisted selection; exposure to bio-informatic tools for genomics. Prerequisite: GENE 603 or by approval of instructor. Cross-listed with ANSC 629 and GENE 629.

- 634. Diseases of Poultry. (3-0). Credit 3.** Introduction to Poultry Biosecurity and Diseases. Basic understanding of infectious diseases of poultry; control and prevention of infectious diseases. Prerequisites: BIOL 113/BIOL 123.
- 645. Nutrition and Metabolism of Vitamins. (3-0). Credit 3.** Chemistry and metabolism of the fat soluble and water soluble vitamins and their roles in animals; integrates cellular biochemistry and metabolism of the vitamins in the vertebrate animals. Prerequisites: POSC 411 or ANSC 303; BICH 410 or BICH 603. Cross-listed with NUTR 645.
- 649. Immunology. (3-0). Credit 3.** Cellular basis of the immune response; relationships between inflammation and acquired immunity, MHC and cell activation; the role of cytokines in immunoregulation and hypersensitivity, vaccines, and the mechanism of immunity to viruses, bacteria and parasites. Prerequisite: VTPB 409 or equivalent. Cross-listed with VTMI 649.
- 650. Nutrition and Metabolism of Minerals. (3-0). Credit 3.** Nutritional significance of minerals in animal metabolism; chemical, biochemical and physiological role of minerals and homeostatic control in animal metabolism. Prerequisites: POSC 411 or ANSC 303; BICH 410 or BICH 603. Cross-listed with NUTR 650.
- 660. Experimental Immunology. (3-3). Credit 4.** Familiarization, development and integration of techniques into experimental design of immunologic investigation; antibody production, protein purification, immunofluorescence, agar-gel diffusion, immunoelectrophoresis and specialized serologic tests. Prerequisites: BICH 410 or equivalent; 8 hours of microbiology. Cross-listed with VTMI 650.
- 681. Seminar. Credit 1 each semester.** Intensive review of literature on feeding, breeding, incubation, marketing, and management; development of familiarity with journals, organizations, agencies and personnel working on poultry problems. May be repeated as many semesters as desired. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 6 each semester.** Individual problems involving application of theory and practice in the various disciplines of poultry science. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of poultry science. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research methods and techniques in breeding, nutrition, physiology, marketing, management and products technology. Students must conduct experiments in one of these fields. Design of experiments, collection, analysis and presentation of experimental data. Designed for thesis or dissertation credit.

Department of Psychology

G. M. Alexander, W. E. Arthur, Jr., S. Balsis, L. T. Benjamin, Jr., M. Bergman, C. M. Berry, J. L. Bizon, C. H. Blakely, H. Bortfeld, A. E. Bourgeois, A. Carter-Sowell, A. Cepeda-Benito, E. S. Davidson, J. W. Ditre, A. J. Doss, B. D. Doss, P. W. Eastwick, J. F. Edens, S. Eitan, S. Fields, L. Geraci, D. H. Gleaves, J. W. Grau, E. Harmon-Jones, R. W. Heffer, J. A. Hicks, M. A. Hook, C. D. Johnson, A. Kim, H. C. Lench, A. D. LeUnes, M. W. Meagher, K. N. Miner-Rubino, L. C. Morey, M. G. Packard, S. C. Payne, M. Perez, F. B. Rattoni, W. S. Rhoads, D. H. Rosen, P. S. Salter, C. D. Samuelson, R. Schlegel, B. J. Schmeichel, B. Setlow, J. A. Simpson, R. Smallman, S. M. Smith, D. K. Snyder, B. H. Stagner, L. G. Tassinary, A. B. Taylor, J. Vaid, P. J. Wellman (Interim Head), T. G. Wilcox, D. A. Worthy, T. Yamauchi

* Graduate Advisor

The Department of Psychology offers graduate study leading to a PhD degree in psychology. Students in the doctoral program may enter the general psychology, clinical, or industrial/organizational option. Students in the general psychology track will take a broad range of courses before focusing research efforts in one of the many areas of expertise offered by the faculty. The general psychology track offers both a basic and applied science focus and allows students a great deal of flexibility in designing a course of study to fit their needs. Research concentrations exist in behavioral and cellular neuroscience, cognitive psychology, developmental psychology and social psychology. This option allows students the opportunity to prepare for careers in academics or in applied settings. The clinical option offers students specialized training in the area of clinical psychology. In addition to coursework and research, students in this option will have at least three semesters of practicum experience in which they have supervised training in a mental health setting. This course of study also involves a one-year internship. Students in the industrial/organizational option will receive specialized training to prepare them to work in business, consulting, governmental or academic settings. In

addition to research and coursework, students in this option will be encouraged to take practicums where they receive supervised training in an organizational setting. The graduate program in psychology is strongly research oriented, and all students are expected to become involved with research beginning in their first year.

Psychology (PSYC)

- 603. Motivation and Cognitive Processes. (3-0). Credit 3.** Selected topics in areas of motivation and higher mental processes; symbolic processes in perceptual organization; learning and remembering, reasoning and creativity.
- 606. Learning. (3-0). Credit 3.** Procedural and theoretical issues in study of basic learning mechanisms in animals and humans, including Pavlovian and instrumental conditioning. Application of this work to other domains and relevant biological mechanisms also discussed. Prerequisite: PSYC 340 or approval of instructor. Cross-listed with NRSC 606.
- 607. Experimental Psychology. (2-3). Credit 3.** Experimental methods; developing a general frame of reference for approaching experimental research problems.
- 608. Introduction to Clinical Ethics and Techniques. (3-0). Credit 3.** Ethical and legal issues in clinical practice; development of listening and interpretation skills; supervised practicum in interviewing non-clinical subjects; structured role-play of clinical situations. Prerequisite: Approval of instructor.
- 609. Physiological Psychology. (2-3). Credit 3.** Current research and methodological procedures on physiological bases of sensation-perception, memory and learning, arousal-sleep-attention, emotions and motivation. Prerequisite: PSYC 335. Cross-listed with NRSC 609.
- 610. Organizational Psychology. (3-0). Credit 3.** Current literature and research in employee motivation, satisfaction, leadership, communication, group conflict and other group processes.
- 611. Personnel Psychology. (3-0). Credit 3.** Application of psychological principles and research methods to the areas of selection, placement, job analysis, performance appraisal and training. Prerequisites: PSYC 351 or equivalent and graduate classification or approval of instructor.
- 613. Practicum in Psychological Assessment. (3-0). Credit 1 to 4.** Application of psychological assessment across the life-span; assessment of cognitive, intellectual, academic, and memory abilities and adaptive behavior; assessment of personality, behavioral style, and systems/environment; integration of assessment measures in comprehensive psychological evaluations; attendance required at Practicum Seminar designed to integrate research, coursework, and applied training and supervisory instruction from a faculty supervisor; at least 3 credits and no more than 18 credits applied to degree plan. Prerequisites: PSYC 623 and PSYC 624, or approval of instructor.
- 614. Practicum in Psychology. Credit 1 to 4 each semester.** Practical on-the-job experience for graduate students. Activities will be guided by psychologists in the following areas: behavior modification, social, clinical, experimental and industrial. Supervision will be provided by members of University staff. May be taken more than once but not to exceed 18 hours of credit toward a graduate degree. Prerequisite: Approval of instructor.
- 615. Perceptual Processes. (3-0). Credit 3.** Complex sensory and perceptual phenomena with emphasis on the relationship between perception and motivation, cognition, creativity and instinctive/ethical; learning/experiential factors in higher level perceptual processes. Cross-listed with NRSC 615.
- 616. Treatment of Problem Behavior in Children and Families. (3-0). Credit 3.** Current methods of treating families with children displaying aggressive, hyperactive, underachieving and other problem behaviors in natural settings; behavior of children and adolescents at home, school and at play. Prerequisite: Approval of instructor.
- 617. Analytical Psychology. (3-0). Credit 3.** Survey emphasizing Jungian psychology but including coverage of Freudian psychology; application of analytical principles and concepts to a variety of clinical issues and situations. Prerequisite: Approval of instructor.
- 618. Psychology of Persuasion. (3-0). Credit 3.** Theory and scientific evidence regarding strategies and tactics of persuasion; explores theoretical controversies and presents potential integrations.
- 619. History and Systems of Psychology. (3-0). Credit 3.** Historical examination of scientific psychology's antecedents in philosophy and physiology; early systems of psychology including structuralism, functionalism, behaviorism, Gestalt psychology and psychoanalysis. Prerequisite: Graduate classification.

- 620. Theories of Social Psychology. (3-0). Credit 3.** Current theories of social psychology and a review of related studies to these theories; theories of attitude change, prosocial behavior, aggression, equity, coalition formation, social learning and S-R theory applied to social behavior. Prerequisite: PSYC 315 or SOCI 411.
- 621. Seminar in Social Psychology. (3-0). Credit 3.** Attitudes and persuasion; small group interaction and performance; prosocial behavior; aggression; self concept; applied social problems; gender differences in social interaction; and social cognition. May be repeated up to three times for credit. Prerequisite: Approval of instructor.
- 622. Emotions: Neuroscience, Cognitive, & Social Approaches. (3-0). Credit 3.** Overview of the issues in the scientific study of emotions; focus on neuroscience, cognitive, and social approaches; introduction to theory and research in major areas of emotions research. Prerequisite: Graduate classification.
- 623. Psychological Assessment I. (3-0). Credit 3.** Principles of psychological testing; uses and critical evaluation of tests of achievement, intelligence, aptitude and personality.
- 624. Psychological Assessment II. (3-0). Credit 3.** Theory and application of psychological assessment of children, adolescents, and adults; assessment of cognitive, intellectual, academic, and memory abilities and adaptive behavior; integration of assessment measures in comprehensive psychological evaluations. Prerequisite: PSYC 623 or approval of instructor.
- 626. Psychopathology. (3-0). Credit 3.** Various symptom categories in psychopathology including differing theoretical conceptualizations of these symptom categories, and theories and research concerning etiology and treatment.
- 627. Psychological Assessment of Children and Adolescents. (3-0). Credit 3.** Theory and application of psychological assessment of toddlers, children, and adolescents; assessment of cognitive, intellectual, academic, and memory abilities and adaptive behavior; assessment of personality, behavioral style, family functioning, and child-focused systems; integration of assessment measures in comprehensive psychological evaluations. Prerequisite: PSYC 624 or approval of instructor.
- 628. Behavior Disorders in Children. (3-0). Credit 3.** Different systems of classification including research and theory about the origins and anticipated outcomes of various emotional disorders; families of disturbed children; major treatment approaches and community resources for intervention. Prerequisites: PSYC 407 or equivalent and graduate classification or approval of instructor.
- 629. Seminar in Clinical/Community Psychology. (3-0). Credit 3.** Assessment and treatment of specific clinical disorders such as depression, sexual dysfunctions and deviations, anxiety-based disorders, autism, marital distress and psychophysiological disorders. May be repeated up to three times for credit. Prerequisites: PSYC 608 and PSYC 626; PSYC 623 or equivalent.
- 630. Health Psychology and Behavioral Medicine. (3-0). Credit 3.** Theory, research and practice of health psychology emphasizing the prevention and modification of health compromising behaviors; psychological management of stress, pain and chronic/terminal illness; effective interventions for specific health behaviors/disorders. Prerequisite: Graduate classification.
- 633. Gender and Minority Issues in Clinical Psychology. (3-0). Credit 3.** Human behavior and mental health as a function of culture, gender and sexual orientation; discussion of absolutist, relativist and universalist perspectives in cross-cultural psychology; psychology of stereotype and prejudice; adjustment through acculturation and biculturalism; learning about our own and other cultures.
- 634. Principles of Human Development. (3-0). Credit 3.** Biological, psychological and cultural inter-relationships in human development; principles and methods as illustrated in research and theoretical contributions; experiences in procedures of child study. Prerequisite: Graduate classification.
- 635. Behavioral and Cellular Research Seminar. (2-0). Credit 2.** Expose graduate students to neuroscience research, theory, and proposal development; research presentations by guest speakers, faculty, and graduate students; Discussions, readings and presentations on issues related to research design, statistics, methodology, ethics, IACUC, grant writing, presentation skills, job talks, and other relevant topics. May be taken four times for credit. Prerequisite: Graduate classification.
- 636. Seminar in Developmental Psychology. (3-0). Credit 3.** Cognitive development; social and emotional development; developmental abnormalities in connection with social/emotional and cognitive development; language acquisition; family processes; and development during infancy; recent developments in these fields. Topics will vary from semester to semester; may be repeated for credit up to three times as topics change. Prerequisite: Graduate classification.

- 637. Clinical Interventions I. (3-0). Credit 3.** Theory, research and techniques related to evidence-based behavioral and cognitive-behavioral approaches to clinical interventions; ethical, professional, multicultural and history/systems issues in therapeutic psychological interventions. Prerequisite: Enrollment in Clinical Psychology Graduate Program or approval of instructor.
- 638. Clinical Interventions II. (3-0). Credit 3.** Theory, research, and techniques related to evidence-based interpersonal, psychodynamic, group therapy, and family therapy approaches to clinical interventions; ethical, professional, multicultural, and history/systems issues in therapeutic psychological interventions. Prerequisite: Enrollment in Clinical Psychology Graduate Program or approval of instructor.
- 639. Pediatric Psychology. (3-0). Credit 3.** Application of clinical/counseling/school psychology to children and adolescents with chronic illnesses or disabilities and their families; theoretical foundations and models for consultation, assessment and intervention strategies; unique ethical and professional issues associated with research and service delivery in child health psychology/pediatric behavioral medicine. Prerequisite: Approval of instructor.
- 641. Principles of Neuropsychology. (3-0). Credit 3.** Review of major areas of cognitive functioning including concentration, memory, language, visuospatial/construction skills and executive functions; review of neurobehavioral syndromes including dementia, epilepsy, head injury, stroke, drug toxicity, etc.; assessment of deficits associated with disorders. Prerequisite: PSYC 624 or PSYC 627 or equivalent as approved by instructor. Cross-listed with NRSC 641.
- 645. Methods of Human Neuroscience. (3-0). Credit 3.** Provides overview of the principles, theories, and applications of human neuroscience methods, such as electroencephalography, event-related potentials, electromyography, hormones, functional neuroimaging. Prerequisite: Approval of instructor.
- 649. Seminar in Behavioral Neuroscience. (3-0). Credit 3.** Behavioral neuroscience; including behavioral pharmacology, neuropharmacology, methods and techniques, drug reinforcement, behavioral toxicology, pain perception and ingestive behavior. May be repeated up to three times for credit. Prerequisites: PSYC 606 or equivalent; PSYC 609; graduate classification. Cross-listed with NRSC 649.
- 670. Professional Seminar in Social Psychology. (1-2). Credit 2.** Survey of recent theoretical, methodological and empirical developments in social psychology; different topics each semester will include theory and research on attitudes and persuasion, social cognition, interpersonal relationships, group processes, social development, and personality and social behavior. May be taken for credit up to eight times. Prerequisite: Enrollment in the psychology PhD program.
- 671. Experimental Design for Behavioral Scientists. (2-3). Credit 3.** Intensive practical study of designs of special interest to behavioral scientists; repeated measures designs. Prerequisite: STAT 652 or equivalent. Cross-listed with NRSC 671.
- 672. Factor Analysis for Behavioral Scientists. (2-3). Credit 3.** Principles and uses of Factor Analysis in behavioral research; implementation, alternate factor models and interpretation with heavy use of numerical examples. Prerequisite: PSYC 671 or approval of instructor.
- 673. Psychometric Theory and Methods. (2-3). Credit 3.** Overview of methods for the construction and evaluation of psychological measurement instruments including unidimensional scales and multivariate analytical techniques: approaches include classical test theory, factor analysis, unidimensional scaling, latent trait theory, profile and discriminant analysis. Prerequisites: PSYC 607 and PSYC 671 or equivalents.
- 674. Covariance Structure Models and Causal Analysis. (3-0). Credit 3.** Advanced introduction to structural equation models and causal analysis; emphasis on underlying theory and assumptions as well as practical application for the behavioral sciences. Prerequisite: PSYC 671 or STAT 608 or approval of the instructor.
- 676. Web-Based Data Collection. (3-0). Credit 3.** This course covers the conceptual, theoretical, technical and ethical issues associated with collecting data via the internet. It examines the advantages and disadvantages of using the web, the conceptual and ethical issues that arise, the technical aspects of preparing a data collection site, and the range of web resources available. Prerequisite: Graduate standing.
- 677. Clinical Research Seminar. (2-0). Credit 2.** Seminar attended by clinical psychology program students; original research and grant proposals are surveyed via presentations by faculty, students, and speakers outside the clinical program; research design, degree plan development, selection of thesis/doctoral committee, research ethics, IRB process, and preparation for proposal/defense meetings covered via discussion and readings. Prerequisite: Enrollment in the clinical psychology graduate program.

- 678. Couples Therapy. (3-0). Credit 3.** Theory and practice of marital therapy emphasizing systems and communication approaches; effective strategies and techniques; therapy with specific marital problems and obstacles to effective therapy. Prerequisites: CPSY 631; CPSY 639 or equivalent. Cross-listed with CPSY 678.
- 680. Seminar in Organizational Psychology. (3-0). Credit 3.** Areas of organizational psychology: job stress, socialization processes, motivation, leadership, person perception in organizations, conflict management. May be repeated up to five times for credit; content will vary by semester. Prerequisite: PSYC 610 or approval of instructor.
- 681. Industrial/Organizational Psychology. (3-0). Credit 3.** Both research and applied colloquia provided by I/O psychologists and individuals in related disciplines. Prerequisite: Graduate classification.
- 682. Seminar in Personnel Selection and Placement. (3-0). Credit 3.** Personnel selection and placement including job analysis and evaluation, psychological testing, test development, psychometric theory, theories of test fairness, validity generalization, utility theory, performance appraisal and selection/placement decision models. May be repeated up to five times for credit; content will vary by semester. Prerequisite: PSYC 611 or approval of instructor.
- 684. Professional Internship. Credit 1 to 4.** Full-time clinical experience in a departmentally-approved internship training facility. Limited to advanced doctoral students specializing in clinical psychology. Repeatable to 12 hours total.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problem in psychology or special topics to fit small group requirements. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of psychology. May be repeated for credit. Prerequisite: Graduate classification.
- 690. Cognoscenti: Professional Issues in Cognitive Psychology. (2-0). Credit 2.** Introduce students to current themes in research, theory and practice in cognitive psychology; presentations by guest speakers from within and outside the University. Prerequisite: Graduate enrollment in psychology.
- 691. Research. Credit 1 or more each semester.** Research for thesis.
- 697. Seminar in the Teaching of Introductory Psychology. (3-0). Credit 3.** Introductory methods relevant to teaching psychology; for graduate students assisting in the teaching of PSYC 107. Prerequisite: Graduate classification.

Public Service and Administration

(faculty and courses are listed under BUSH, see [page 341](#))

(PSAA)

These master's level courses are intended for individuals preparing for professional careers in public service and administration.

- 601. Foundations of Public Service. (3-0). Credit 3.** Different perspectives on management and leadership in public service; provides overview of how public and nonprofit organizations work; discusses ethical dilemmas that occur in public service careers. Prerequisite: PSAA majors only.
- 602. Tools for Advancement and Leadership in Public Service. (3-0). Credit 3.** Focuses on techniques and practices that executives employ to accomplish their work through politicians, bureaucrats, the media, lobbyists, governing boards, and their supervisors and staff; explores issues that arise from conflict with policy makers, moral and ethical concerns, and professionalism in public service. Prerequisite: Graduate classification.
- 603. International Non-Governmental Organizations. (3-0). Credit 3.** Explores how philanthropy, nonprofit, and NGO sectors operate, with special attention to their niche alongside private and public sectors, revenue sources, impact on society, and converse effects of society and its institutions. Prerequisite: Graduate classification.

- 604. Emergency Management and Homeland Security. (3-0). Credit 3.** Course provides an overview of emergency management and its connection with homeland security. Topics include emergency management cycles, activities that fall into mitigation, preparedness, response, recovery phases of emergency management. Other topics may include emergency management of terrorism, disaster communication, media relations, and performance assessment for emergency management organizations. Prerequisite: Graduate classification.
- 605. Homeland Security Policies, Strategies, and Operations. (3-0). Credit 3.** In-depth examination of past, current, and emerging national and international homeland security policies, strategies, and selected strategic operations. Emphasis on national and global risks, the national security management system, risk and crisis management, longer-term community recovery, and the strategies of other countries applicable to the United States. Prerequisite: Graduate classification.
- 606. Environmental Policy and Management. (3-0). Credit 3.** Covers environmental policy areas, including air and water pollution, toxic waste disposal, public land use, sustainable development, and resource conservation. Explores actions of governmental institutions and actors at all levels in their efforts to implement and manage environmental policy. Prerequisite(s): Graduate Classification.
- 607. Research Methods for Homeland Security Studies. (3-0). Credit 3.** Course introduces students to fundamental social science research principles, concepts, and methods applied in designing and conducting research and communicating research findings and recommendations. Students will conduct research and write a paper on a homeland security topic and will develop expertise in assessing the validity of research done by others. Prerequisite: Graduate classification.
- 608. Cyber Security for Managers. (3-0). Credit 3.** Course introduces students to the operations and security issues involving attacking, exploiting, and defending digitized data, knowledge, and communications and the security challenges arising from the globalization of the Internet, the sharing of networks, and the flow of strategic communications. Does not require significant skills or experience in information technology. Prerequisite: Graduate classification.
- 609. Introduction to Homeland Security. (3-0). Credit 3.** Broad, multidisciplinary overview of homeland security as a contemporary subject and an evolving discipline; fundamental issues, strategies, challenges, and interdependencies related to preventing, mitigating, preparing for, responding to, recovering from, and building in resiliency to counter intentional and non-intentional threats to homeland security. Prerequisite: Graduate classification.
- 611. Public Policy Formation. (3-0). Credit 3.** Examination of public policy formation processes in the United States, with an emphasis on national government. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 612. Public Policy Administration. (3-0). Credit 3.** Analysis of bureaucracy's role in the American political system: bureaucratic power and the relationship between agencies and their environments; analysis of effective policy implementation and program design. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 615. Policy Analysis. (3-0). Credit 3.** Provides students with a solid working knowledge of the techniques involved in public policy analysis; gives students both the theoretical frame work and practical experience necessary for a public manager to analyze public policy effectively. Prerequisite: ECON 322 or equivalent or approval of instructor.
- 616. Public Organization in a Pluralistic Society. (3-0). Credit 3.** Examination of how public policy issues are contested and shaped by the major cleavages in American society, such as race and ethnicity, economic and social class, and gender; strategies for building consensus across these divisions. Prerequisites: Graduate classification.
- 617. State and Local Government: Institutions and Policy. (3-0). Credit 3.** Professional masters students gain a practical, working knowledge of the institutions and processes through which state and local policy is made and implemented. Students also learn about and apply the theoretical and empirical tools used to evaluate policy at the state and local levels. Prerequisite: Graduate classification.
- 618. Education Policy. (3-0). Credit 3.** Course examines the role of government in education and education policy issues, including equity, adequacy and accountability. The final section of the class will focus on current policy topics, emphasizing two strategies favored by the Obama administration — charter schools and pay for performance. Prerequisite: Graduate classification.
- 621. Economic Analysis. (3-0). Credit 3.** Microeconomic analysis of consumers, firms and markets; macroeconomic analysis of growth and stabilization policies; the government's role in the economy. Prerequisites: Graduate classification and approval of MPSA or MPIA director.

- 622. Public Finance. (3-0). Credit 3.** Framework for positive and normative economic analysis of public sector spending and taxation; application of fundamental analytical principles of public finance to current issues in public policy. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 623. Budgeting in Public Service. (3-0). Credit 3.** Course designed to introduce students to selected topics in public administration and political science literature on the politics of public finance and budgeting. Course will introduce students to the practice of budgeting by learning language and issues common to budgeting in government. Prerequisite: Graduate classification.
- 630. Program Evaluation in Public and Nonprofit Organizations. (3-0). Credit 3.** Organizations today are responding to increasing demands for accountability. These demands come from an increasingly sophisticated public, clientele, and from funding sources including government, foundations, and corporations. This course is designed to introduce theories, research, and practice for program evaluation and systems that support the organization's information needs. Prerequisite: Graduate classification.
- 631. Marketing for Nonprofit Organizations. (3-0). Credit 3.** Provides overviews and examines the underlying fundamental principles, concepts, and methods of strategic marketing as it is associated with the nonprofit sector. Prerequisite: Graduate classification.
- 632. Strategic Planning and Financial Management for Nonprofits. (3-0). Credit 3.** Introduces students to underlying fundamental principles, concepts, and methods of strategic planning and financial management applicable to the nonprofit sector and how they are related. Prerequisite: Graduate classification.
- 633. Philanthropy: Fundraising in Nonprofit Organizations. (3-0). Credit 3.** This course examines the theory and practice of fundraising in nonprofit organizations. It provides students with an overview of fundraising strategies and techniques, and of how they relate to the achievement of organizational goals. It also focuses on ways of integrating various fundraising activities into an effective fundraising program. Prerequisite: Graduate classification.
- 634. Public Management. (3-0). Credit 3.** Addresses three critical aspects of public management; the role of management in the public sector, validity of the argument that government should be run like a business and the tools public managers need to be effective. Application of organizational theory concepts applied to case studies. Prerequisite: Graduate classification.
- 635. Social Welfare and Health Policy. (3-0). Credit 3.** Course explores the historical development and impact of US public welfare, child welfare, employment, and health social service programs. Course analyzes values and assumptions that formed the foundations of social welfare policy and explores the social, economic, political, and cultural context in which these policies developed and their potential future. Prerequisite: Graduate Classification.
- 636. Contract and Grant Management in the Public and Nonprofit Sectors. (3-0). Credit 3.** Course examines the use of contracts and grants in providing social services. Explores the theoretical background of government contracts and grants; the management of third-party services from the perspectives of government agencies, private sector contractors, and nonprofit organizations; and the skills needed to write effective grant and contract proposals. Prerequisite: Graduate classification.
- 637. Decision Making in Government and Public Service. (3-0). Credit 3.** Course will introduce students to the study and practice of judgment and decision making processes in government and administrative settings. Course content is firmly grounded in empirically-based theory and research with a practical slant - the course is designed to help students to develop and improve their own decision making skills. Prerequisite: Graduate classification.
- 638. Health Economics and Policy. (3-0). Credit 3.** Course examines health care and health care markets in U.S. and abroad. Topics include production of and demand for health, moral hazard and adverse selection in insurance markets, information asymmetries in physician-patient relationships, regulation and payment systems for providers, Medicare, Medicaid and other programs, and comparisons to other countries. Prerequisite: Graduate classification.
- 640. Energy Policy and Security. (3-0). Credit 3.** Policy and economic issues related to increasing global reliance on fossil fuels, including the resulting impact on security concerns and global warming; utilizes competitive and non-competitive market theories, non-renewable resource analysis, and cost-benefit analysis. Prerequisites: Graduate classification; BUSH 621; course experience in microeconomics and quantitative modeling.

- 641. Organization Theory for the Public Sector. (3-0). Credit 3.** Theories of bureaucracy and control, management, human relations, decision making and organizations and their environments; effects of organizations on individuals, the government and the policy formation process. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 642. Ethics and Public Policy. (3-0). Credit 3.** Theory and practice for analyzing and responding to the ethical responsibilities and dilemmas for professional conduct; ethical dimensions of analysis and decision making for policy makers and public administrators. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 643. Foundations of the Nonprofit Sector. (3-0). Credit 3.** Overview of the origins, size, scope and composition of the nonprofit and voluntary sector in American society today; introduction to the historical, political and religious foundations of the nonprofit sector; examines theoretical and conceptual framework in this course. Prerequisite: Graduate classification.
- 644. Management and Leadership of Nonprofit Organizations. (3-0). Credit 3.** Introduction and overview of nonprofit organizations and the environment they operate in; examination of the distinctiveness of these organizations and the special skills required for effective management of them; empirical and normative issues surrounding nonprofit management and leadership. Prerequisite: Graduate classification.
- 645. Networks and Inter-organizational Collaboration. (3-0). Credit 3.** Introduction to the knowledge base pertaining to inter-organizational relationship and the management environment of network based organizations. Prerequisite: Graduate classification.
- 646. Bureaucracy in a Democracy. (3-0). Credit 3.** Examines the issues surrounding the role of bureaucracy in American government; readings and ideas from the fields of political science, public administration, and administrative law. Although the course emphasizes broad theory-based knowledge, it has applied value for students intent on careers in public service. Prerequisite: Graduate classification.
- 647. Risk and Public Policy. (3-0). Credit 3.** Course focuses on how concepts of risk are used to shape public policies and introduces primary methods for analyzing and managing potentially risky policies. Course explores cases involving environmental, energy, and security concerns, including nuclear energy and waste disposal elimination of chemical weapons; global climate change; and the threat of terrorism in the United States. Prerequisite: Graduate classification.
- 648. Performance Management in the Public and Nonprofit Sectors. (3-0). Credit 3.** Drawing on readings, practical exercises and guest lectures, students will examine public sector performance management and measurement as tools for improving strategic planning, resource allocation, organizational learning, internal operational processes, and internal and external accountability. Students will apply their learning to the development of a particular organization's performance measurement system. Prerequisite: Graduate classification.
- 649. Volunteer and Human Resources in Nonprofit Organizations. (3-0). Credit 3.** Course introduces theories, research and practice for managing personnel and human resources for paid and volunteer staff in nonprofit settings. Course explores the behaviors and cognitions of participants in nonprofit organizations, the motivational and personnel programs required by the organization, and the managerial strategies for effective human resources management. Prerequisite: Graduate classification.
- 650. Social Innovation and Entrepreneurship in Nonprofit Management. (3-0). Credit 3.** Nonprofit management practices and principles related to social entrepreneurship and innovation; research, theories, and practice examples utilized to teach principles of designing and implementing a social innovation which can be applied to domestic and international social problems. Prerequisites: Graduate classification, PSAA 634 or PSAA 644 or approval of instructor.
- 661. Public Personnel Administration. (3-0). Credit 3.** Organization and operation of civil service personnel systems in American governments. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 663. Natural Resource Economics. (3-0). Credit 3.** Critical evaluation of policies and procedures in natural resource development and use; identification of problems in resource development, the political-economic decision-making process and analytical tools which can contribute to economic decisions. Prerequisite: ECON 323. Cross-listed with AGEC 604.

- 664. Business and Public Policy. (3-0). Credit 3.** Role of business organization in the United States and other countries; topics pertaining to the external political and social environment of business and the implications for business managers including market failures and political failures as well as equity and ethical issues; case studies with business/government problems. Prerequisite: Graduate classification. Cross-listed with MGMT 610.
- 666. Advanced Public Management. (3-0). Credit 3.** Examination of the primary challenge facing public managers today from the managerial, political, legal and market/entrepreneurial perspectives. Prerequisite: Graduate classification.
- 669. Legal Environment of Nonprofit Management. (3-0). Credit 3.** Laws, policies, and ideals affecting the creation and governance of nonprofit organizations; includes medical, education, cultural, social, religious, and advocacy organizations; considers these organizations' contributions to society, how they cooperate with or rival for-profit entities, and how they should be governed. Prerequisite: Graduate classification.
- 670. Public Information Systems Management. (3-0). Credit 3.** Introduction to information systems for future public managers, management and public policy issues regarding information systems, and current policy issues related to information and communications technology. Prerequisite: Graduate classification.
- 671. Science and Technology Policy. (3-0). Credit 3.** An overview of the role of science and technology in the public policy process; explores the impact of public policy on science and technology. These two perspectives are radically distinct, yet intertwined in the broader process of public policy making in the United States. Prerequisite: Graduate classification.
- 673. Conflict Resolution in Public Management. (3-0). Credit 3.** In policy domains driven by high salience, dominated by moral value, or where scientific data are sparse, conflict often arises. This course is designed to broadly address the topic of conflict resolution within the public sector with the intent to enhance leadership in the policy process. Prerequisite: Graduate classification.
- 674. Political Economy of International Development. (3-0). Credit 3.** Course examines aspects of international development and underdevelopment, including lack of sustained economic growth and the prevalence of income inequality. Course designed to provide leaders in public service areas with basic knowledge of development and development assistance in cross-national and regional perspectives and the tools to analyze information in the future. Prerequisite: Graduate classification.
- 675. Public Service and Administration Capstone Seminar. (3-0). Credit 3.** Course provides a capstone experience for students as they operate in teams to address an important policy and administrative issue. Students draw on the coursework and experiences of their Bush School education to develop specific recommendations for design, implementation and evaluation of this project task. For MPSA majors only. Prerequisites: For MPSA majors only; graduate classification; approval of MPSA director.
- 676. Public Service and Administration Capstone Seminar II. (3-0). Credit 3.** Course provides a capstone experience for students as they operate in teams to address an important policy and administrative issue. Students draw on the coursework and experiences of their Bush School education to develop specific recommendations for design, implementation and evaluation of this project task. Continuation of BUSH 675. Prerequisites: BUSH 675; approval of MPSA director.
- 684. Professional Internship. Credit 1 to 6.** Directed internship in a public or private organization to provide on-the-job training with professionals in organizational settings appropriate to the student's professional objectives. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 685. Directed Studies. Credit 1 to 4.** Directed individual instruction in selected problems in government and public service. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of government and public service. May be repeated for credit. Prerequisites: Graduate classification and approval of MPSA or MPIA director.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Reading

(faculty, see [page 383](#))

(RDNG)

- 604. Reading Diagnosis. (2-3). Credit 3.** Appraisal and diagnosis of reading problems; practicum in administration and interpretation of individual reading inventories. Prerequisite: RDNG 649 or RDNG 674 recommended.
- 612. Children's Literature and Literacy. (3-0). Credit 3.** Critical selection and evaluation of various children's literature genres; comparative studies of children's literature; development, implementation and evaluation of research in children's literature and literacy; integration of reading and response theory into the study of literature. Prerequisite: Graduate classification.
- 613. Multicultural Children's Literature and Literacy. (3-0). Credit 3.** Analysis and evaluation of Native American, Black and Hispanic children's literature; development, implementation and evaluation of research in multicultural literature and literacy; analysis of issues influencing multicultural literature and literacy. Prerequisites: RDNG 612; graduate classification.
- 614. Reading Research and Trends. (3-0). Credit 3.** Exploration of recent research in reading; identification of trends and patterns in issues attached, research designs employed and consistent findings; generation of new research hypotheses and guidelines for improving current practice. Doctoral level only. Prerequisites: Doctoral classification or approval of instructor.
- 615. Theories of the Reading Process. (3-0). Credit 3.** Seminar for doctoral students and advanced master's students to study and critique major theories of the reading process that have been influential in the fields of reading, language arts, educational psychology, and related fields. Prerequisite: Doctoral status or approval of instructor.
- 616. Organization and Supervision of Reading Programs. (3-0). Credit 3.** Organization of school reading programs; role of reading supervisor in program implementation, staff development, program evaluation. Coordination of reading services with total curriculum. Prerequisites: Doctoral classification; approval of instructor.
- 620. Literacy and Language. (3-0). Credit 3.** Orthography of different languages and its relation to literacy acquisition and failure to acquire basic literacy skills. This is a seminar course in reading, language arts, bilingual education, psychology, linguistics, and related fields. Prerequisite: Graduate status.
- 642. Clinic Teaching in Reading. (1-6). Credit 3.** Practicum in recognition, diagnosis, remediation and corrective procedures of reading-study problems; demonstration and laboratory analysis of physiological and psychological factors related to reading disabilities. Prerequisite: RDNG 649 or RDNG 674.
- 649. Reading Instruction in High School and College. (3-0). Credit 3.** Basic principles of reading instruction; nature and scope of total reading program; methods, materials and organization of developmental, corrective and speed-reading programs in high school and college.
- 650. Foundations of Reading Instruction. (3-0). Credit 3.** Psychological, linguistic and physical factors related to reading performance; implications for content and teaching methods; appraisal of current research and related reading for teachers, supervisors and reading specialists. Prerequisites: RDNG 649 and RDNG 674 or approval of instructor.
- 674. Developmental Reading in the Elementary School. (3-0). Credit 3.** Methods and materials of reading instruction in the elementary grades; past, present and emerging programs; organization and administration of programs and classroom management; teaching reading to special groups; issues in reading.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of reading. May be repeated for credit.

Department of Recreation, Park and Tourism Sciences

J. L. Crompton, M. Duerden, J. R. Dunlap, M. B. Edwards, G. D. Ellis (Head), J. H. Gramann, U. Gretzel, L. Hodges, T. B. Jamal, R. A. Kaiser, G. T. Kyle, W. A. McIntosh, D. Matarrita-Cascante, S. K. Nepal, C. D. Outley, J. F. Petrick*, M. A. Schuett, D. Scott, C. S. Shafer, A. Stronza, J. K. Thomas, C. Torres, J. R. Walker, P. A. Witt, K. Woosnam

* Graduate Advisor

Graduate course offerings in the Department of Recreation, Park and Tourism Sciences are designed to generate and disseminate knowledge concerning the development, management and sustainable use of recreation, park, community, and tourism resources and opportunities. The focus of the program is on the relationships between people, recreational, community and tourism developments, and the natural resource base. The curriculum has five main areas of emphasis: recreation and park administration; recreation and natural resources management; tourism; community development; and youth development. The first emphasis deals primarily with the public sector, while the third deals primarily with the private sector. Recreation and natural resource management, community development, and youth development involves both sectors.

Graduate study in these areas is interdisciplinary. Cooperative relationships exist with a wide range of outstanding graduate-level programs in the University. This provides students with an opportunity to structure an individualized program of study in the field of their choice. Courses selected within the department and in supporting fields are designed to serve the individual needs of students interested in teaching, public service, research, and administration of recreation, park, community and tourism developments.

The Department of Recreation, Park and Tourism Sciences offers courses of study leading to the Master of Recreation and Resources Development; Master of Natural Resources Development; Master of Science (thesis and non-thesis) and Doctor of Philosophy degrees in recreation, park and tourism sciences. The MRRD is a professional degree with a major in Recreation and Resources Development for those who are already working in or anticipate a career in professional service. The MNRD with a major in Natural Resources Development is identical in intent and general requirements to those for the MRRD; however, more emphasis is placed on undertaking an interdisciplinary mix of coursework from other natural resources programs at Texas A&M University. The MS thesis degree prepares students for advanced graduate study at the PhD level, which often leads to a career in university research and teaching. The MS non-thesis degree emphasizes professional development. It includes additional courses in the student's selected field instead of a thesis. Non-thesis MRRD, MNRD and MS students may elect a professional internship.

Recreation, Park and Tourism Sciences (RPTS)

- 601. Interrelationships of Recreation and Leisure Concepts. (3-0). Credit 3.** History and philosophy of the field of recreation and parks; fundamentals of planning, development and management of resources allocated for recreation, parks and tourism purposes; development of the recreation movement with broad treatment of the role of recreation and parks in contemporary society.
- 602. Social Science Foundations of Recreation, Parks and Tourism. (3-0). Credit 3.** Sociological and social psychological dimensions of leisure, recreation and related behavior; nature and function of leisure for individuals and for society; implications for development and management of recreation resources. Prerequisite: RPTS 601 or previous academic background in recreation and parks.
- 603. Financing and Marketing Park and Recreation Resources. (3-0). Credit 3.** Positioning park and recreation services; traditional and non-traditional sources of financing for developing services and facilities; philosophy and techniques of marketing services and facilities.
- 604. Principles of Community and Community Development. (3-0). Credit 3.** Examines different theories about community development as well as the concept of community; explores measurement and other methodological issues in the conduct of basic and applied community research. Prerequisite: Graduate classification.
- 605. Community Organization. (3-0). Credit 3.** Examines how community organization and institutions differ and result from diverse social, cultural and demographic factors; explores how these factors restructure communities over time and community responses to restructuring. Prerequisite: Graduate classification.

- 606. Overview of Tourism. (3-0). Credit 3.** Theoretical introduction to the field of tourism sciences; the cooperative and dynamic nature of decision-making in tourism; the contributions made by various disciplines towards understanding the consequences of tourism trade and activity; and identification of critical issues in the study of travel and tourism.
- 609. Social, Economic and Cultural Issues in Outdoor Recreation and Natural Resources. (3-0). Credit 3.** Survey of socio-economic and cultural characteristics impinging on provision of outdoor recreation opportunities in urban and non-urban settings; implications of social and cultural factors on recreation resource use patterns, resource development and policy issues.
- 615. Analytic Techniques in Recreation, Parks and Tourism. (3-0). Credit 3.** Analysis of current research; instruments and analytic techniques used in the selection and formulation of research problems.
- 616. Tourism Economics. (2-3). Credit 3.** Introduction to tourism economics including: tourism consumption and demand analysis; operating and capital budgeting; measurement of economic impacts through input/output analysis; forecasting; project management through PERT/CPM; decision making under uncertainty; benefit/cost analysis. Prerequisites: RPTS 606 and STAT 651 or approval of instructor.
- 620. Interdisciplinary Seminar in Prevention Science. (1-0). Credit 1.** Contemporary research programs that represent the interdisciplinary field of prevention science; strengths and limitations of diverse theoretical and conceptual bases of research in prevention science; application of research findings to issues related to the prevention of mental, emotional, and physical health problems and the promotion of well-being. May be taken 3 times for credit. Prerequisite: Graduate standing and either admission to the interdisciplinary graduate certificate in prevention science program or approval of instructor. Cross-listed with COMM 671, HLTH 671 and SPSY 620.
- 626. Social Impacts of Tourism. (2-3). Credit 3.** Analysis of social, cultural and political impacts associated with travel behavior and tourism development, emphasizing a case study approach; theories and methods for assessing individual, community and organization impacts at local and regional levels; host/guest interactions; evaluation of processes of tourism planning and decision-making; and qualitative and quantitative measures for assessing social impacts. Prerequisite: RPTS 606 or approval of instructor.
- 636. Philosophy of Social Research. (3-0). Credit 3.** Overview of the history and development of the philosophy of social science; Relationships science; issues in social research; Sociology of Knowledge; related debates in various disciplines and fields of study. May be taken 3 times for credit. Prerequisite: Doctoral candidate.
- 641. Tourism Experience. (3-0). Credit 3.** Discusses the theoretical foundations of tourism experiences from an interdisciplinary perspective, including the role of humans, nature/landscapes, built environments and technologies in staging tourism-experiences; draws implications for the design/planning, management and marketing of tourism venues such as events, festivals, museums, hotels/resorts, cruise ships, cities, theme parks as well as websites.
- 646. Heritage Tourism. (3-0). Credit 3.** Comprises a transdisciplinary examination of contemporary research and practice in heritage tourism and public culture; students encouraged to deploy a variety of disciplinary outlooks to explore the representation of peoples, places and pasts in a range of settings from the indigenous/sacred to the postindustrial/post colonial.
- 666. Tourism and the Natural Environment. (3-0). Credit 3.** Environmental and natural resource issues in tourism development and travel activity; philosophical issues in nature based- and eco-tourism; sustainable development and tourism; assessment of environmental impacts at macro and micro scales; integrating values into allocation, planning and management of tourism use of natural resources; the role of tourism in the stewardship of ecosystems. Prerequisite: RPTS 606 or approval of instructor.
- 670. Youth Development Programs and Services. (3-0). Credit 3.** Principles and practices of youth development supports, opportunities, programs and services; emphasis on the role of out-of-school time settings in youth development; programming considerations related to gender, disability and culture; introduction to evaluation and financing of youth development programs.
- 678. Latent Variable Model Applications in the Leisure Sciences. (3-0). Credit 3.** Introduction to structural equation modeling (SEM); background on conceptual issues, application of the method, and insight on SEM software; measurement theory, missing data analysis, non-normal data, confirmatory factor analysis, path analysis, multi-group models. Prerequisites: STAT 636 or approval of instructor.

- 681. Seminar. (1-0). Credit 1.** Preparation and discussion by students of special reports, topics and research data in recreation and parks; presentation of subjects of professional significance by staff members and invited speakers.
- 684. Professional Internship. Credit 1 to 4.** Survey and application of principles of recreation and resources development; selected aspects of park and recreation management in professional setting within an approved recreation/park agency under the supervision of a member of the graduate faculty.
- 685. Directed Studies. Credit 1 to 4 each semester.** Investigations not included in student's research for thesis or dissertation; problems selected in administration or management, recreation or planning.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of recreation and resources development. May be repeated for credit. Prerequisite: Approval of department head.
- 691. Research. Credit 1 or more each semester.** Research in recreation and resources development for thesis or dissertation.
- 693. Professional Study. Credit 1 to 9.** Approved research or professional paper undertaken as the terminal requirement for the Master of Science Non-Thesis or Natural Resources Development. May be taken more than once, but not to exceed 3 hours credit towards a degree. Prerequisite: Approval of instructor.

Renewable Natural Resources

Graduate courses in renewable natural resources are designed for outstanding graduate students who desire interdisciplinary coursework in natural resources. All instructors for these courses are regular faculty in the departments of Ecosystem Science and Management; Recreation, Park and Tourism Sciences; and Wildlife and Fisheries Sciences. Renewable natural resources courses stress a comprehensive understanding of the nature, use and management of renewable natural resources. Students in a variety of disciplines including agricultural economics, forest science, geography, geology, oceanography, range science, recreation, park and tourism sciences, and wildlife and fisheries sciences may find these courses applicable to their degree plans, subject to Office of Graduate Studies regulations and the approval of their graduate committees.

(RENRR)

- 650. Leadership Development and Management of Environmental NGOs. (3-0). Credit 3.** Trends and increasing power of NGOs in environment and sustainable development; understanding of the organizational structures, functions, planning and management processes of environmental NGOs; technical skills and leadership qualities for careers with environmental NGOs. Prerequisite: Graduate classification. Cross-listed with ESSM 676.
- 659. Ecological Economics. (3-0). Credit 3.** Study of the relationships between ecosystems and economic systems; understanding the effects of human economic endeavors on ecological systems and how the ecological benefits and costs of such activities can be quantified and internalized. Prerequisite: Graduate classification. Cross-listed with AGECE 659 and ESSM 671.
- 660. Environmental Impact Analysis for Renewable Natural Resources. (3-0). Credit 3.** Analysis and critique of contemporary environmental analysis methods in current use; environmental impact statements; national policies; political, social and legal ramifications as related to development and use of renewable natural resources. Cross-listed with ESSM 672.
- 662. Environmental Law and Policy. (3-0). Credit 3.** Analysis of the legal theories used to allocate and protect environmental resources; common law, federal and state statutes, and international treaties dealing with the environment; policies and laws for controlling air, water, solid waste, toxic waste and water pollution; species protection and natural resource use.
- 664. Coastal Zone Management. (3-0). Credit 3.** Major issues of coastal management in the United States; relationships between natural environments of the coastal zone and public policies affecting the development, use and conservation of natural resources. Prerequisite: Graduate classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of renewable natural resources. May be repeated for credit.

Russian

(faculty, see [page 413](#))

(RUSS)

- 692. Readings. (3-0). Credit 3.** Readings in Russian literary texts in the original language. Prerequisite: Graduate classification.

Safety Engineering

The Master of Science in Safety Engineering is administered by the Mary Kay O'Connor Process Safety Center (MKOPSC) at Texas A&M University. The objective of this program with thesis is to teach the principles and practices of safety engineering for leadership careers in industry. The prerequisite for the M.S. in Safety Engineering program is a Bachelor Degree in Engineering.

As with all Master of Science degrees requiring a thesis, a minimum of 32 semester credit hours of approved courses and research is required. This program consists of 15 hours of required coursework. The remaining 17 hours will consist of the allowed combination of 691-Research, electives and internship hours as applicable. This MS in Safety Engineering is also offered via distance education with either the thesis and non-thesis option. This program includes extensive engineering applications with integration of safety principles, safety practices and case studies.

Admission is offered based on meeting admission requirements and the agreement of a faculty advisor, which can be from any engineering department. A degree plan is then approved in joint consultation between the faculty advisor and the Director of the Center.

(SENG)

- 611. Occupational and Environmental Epidemiology. (3-0). Credit 3.** The epidemiologic evaluation of human health hazards in the workplace and the environment; issues in the design and critical review of epidemiologic studies in the determination of effects of chemicals, heavy metals and radiation on human health resulting from occupational and environmental exposures. Prerequisites: SENG 680 and VIBS 607 or approval of instructor.
- 636. Biological Control System Analysis. (3-0). Credit 3.** Current advances in practical biomechanics and ergonomics in industry in combating musculoskeletal injury and illness, demonstrations of the positive effects of redesign of job requirements, hand tools, chairs, manual material handling tasks, machine controls and workspace arrangements. Prerequisite: ISEN 430 or ISEN 630.
- 644. Worker Response to Physiological and Environmental Stress in Manufacturing. (3-0). Credit 3.** Function of the human body in a work environment in response to physical exertion and environmental stress in manufacturing; anatomy, anthropometry, strength, respiration, neurophysiology, electrophysiology, cardiovascular muscle physiology, and worker capacity evaluation (back and carpal tunnel syndrome). Prerequisite: ISEN 430 or ISEN 630.
- 645. Occupational Biomechanics. (3-0). Credit 3.** Fundamental topics upon which models are constructed; variety of models appropriate in occupational settings; bioinstrumentation theory and practice for model evaluation; experience in applying the models and associated tools in the occupational setting. Prerequisite: SENG 644 or ISEN 644 or equivalent.
- 655. Process Safety Engineering. (3-0). Credit 3.** Applications of engineering principles to process hazards analysis including source and dispersion modeling, emergency relief systems, fire and explosion prevention and mitigation, hazard identification, risk assessment, process safety management, etc. Prerequisite: Approval of instructor. Cross-listed with CHEN 655.
- 660. Quantitative Risk Analysis. (3-0). Credit 3.** Fundamental concepts, techniques, and applications of quantitative risk analysis and risk-informed decision making for students in all engineering fields. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas. Prerequisite: Graduate or Senior status. Cross-listed with CHEN 660 and ISEN 660.
- 670. Industrial Safety Engineering. (3-0). Credit 3.** General concepts and techniques of safety engineering upon which more detailed and advanced applications may be based; applications of safety engineering principles to industrial and commercial systems; the concept of designing optimally safe systems.
- 671. Product Safety Engineering. (3-0). Credit 3.** Provides specialized emphasis required to develop within a student the ability to function in the product design as a specialist in product safety engineering; safety engineering and human factors principles are focused on specific problems in product safety and liability considerations; application of system safety principles.

- 674. System Safety Engineering. (3-0). Credit 3.** Current system safety engineering analysis techniques; failure mode and effect and fault tree analysis. Engineering economic analysis is reviewed to develop skills for the safety engineer in presenting alternate solutions to management.
- 677. Fire Protection Engineering. (2-3). Credit 3.** Theory of combustion, characteristics of flammables, fire resistance, fire spread, fire protection principles, public and private fire service organization and equipment; automatic extinguishing systems. Fire protection analysis and design projects.
- 680. Industrial Hygiene. (3-0). Credit 3.** Recognition of environmental stresses present in man-machine-environment systems and the effect of these stresses on human performance, safety and health; chemical, physical, ergonomic and biological exposures, manufacturing systems, materials and operations.
- 681. Seminar. (1-0). Credit 1.** Formal presentations in industrial hygiene and safety engineering by students and professional industrial representatives.
- 682. Instrumentation for Industrial Hygiene. (3-3). Credit 4.** Evaluation of environmental stress factors present in man-machine-environment systems. Introduction to quantitative and qualitative instrumentation used in industrial hygiene. Development of in-depth evaluation techniques as a precursor to the design of engineering controls. Prerequisite: SENG 680 or approval of instructor.
- 683. Evaluation and Control of the Occupational Environment. (3-3). Credit 4.** Detection, evaluation and control of chemical, physical and biological agents prevalent in manufacturing, construction and mercantile operations. Evaluation procedures and control technology emphasized. Guest speakers and field trips to local industry. Prerequisites: SENG 680 and SENG 682 or approval of instructor.
- 684. Professional Internship. Credit 1 to 6.** Training under the supervision of practicing engineers in settings appropriate to the student's professional objectives. Prerequisites: Approval of chair of student's advisory committee and department head.
- 685. Directed Studies. Credit 1 to 12 each semester.** Investigation of topics not within the scope of thesis or dissertation research and not covered by other formal courses.
- 686. Acoustics and Noise Control. (2-3). Credit 3.** Physical, physiological and psychological aspects of noise; evaluation and control of the noise problem in the work environment and community. Source, path and level of noise; acoustical properties of materials; damage-risk criteria for hearing; and criteria for noise and vibration in communities, buildings and vehicles.
- 687. Industrial Ventilation. (2-3). Credit 3.** Development of design principles and application of natural, dilution and local exhaust ventilation to control occupational exposures to conditions conducive to the development of occupational disease.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of safety engineering and industrial hygiene. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research in industrial hygiene, safety engineering or related topics for thesis or dissertation.

School Psychology

(faculty, see [page 392](#))

(SPSY)

- 610. Child Psychopathology. (3-0). Credit 3.** Major forms of psychopathology and behavioral disorders in children and adolescents; concepts of child psychological disorders; application of multiple theoretical models; understanding of the development context in which these orders exist. Prerequisites: Graduate standing; approval of department head.
- 611. Introduction to School Psychology: Legal, Ethical and Credentialing Issues in School Psychology. (1-0). Credit 1.** History of professional psychology with emphasis on school psychology; legal, ethical and credentialing issues in psychology; scholarly writing; models of providing clinical child and special educational services. May be taken up to three times for credit. Prerequisite: Graduate classification and approval of department head.
- 612. Individual Assessment of Children's Intelligence. (3-2). Credit 4.** Educational and clinical applications of individual assessment; diagnostic measures of intelligence, language abilities, perception and achievement; videotaping of student test administration is required for purposes of supervision and self-evaluation. Limited to 12 students per semester. Prerequisites: EPSY 622; approval of department head.

- 613. Crisis Intervention in the Schools. (3-0). Credit 3.** Fundamentals of school-based crisis intervention; emphasis on personal and situational crises, and the development and implementation of crisis intervention and prevention plans within the school setting; differing models of crisis intervention, models of coping with crisis and critical incidents, and the efficacy of crisis intervention. Prerequisite: Graduate classification.
- 614. Integrated Assessment Practicum. (1-6). Credit 3.** Student test administration competencies and a minimum of 150 hours of supervised experience in administration, analysis and reporting of individual diagnostic instruments. May be taken twice for credit. Prerequisites: SPSY 612; approval of department head.
- 615. Preschool Assessment. (3-0). Credit 3.** Assessment of infants and young children (birth to 5 years of age); requires extension of the diagnostic skills gained in other coursework to applications for early intervention and child find with younger children; measures/methods will include norm-referenced, criterion referenced, and play-based/observational methods used in the assessment of infants and young children. Prerequisites: SPSY 612 and approval of instructor.
- 617. Emotional Disturbance in Children. (3-0). Credit 3.** Diagnostic procedures and techniques in personality assessment and identification of emotionally disturbed children and youth. Prerequisite: Graduate classification and approval of department head.
- 620. Interdisciplinary Seminar in Prevention Science. (1-0). Credit 1.** Contemporary research programs that represent the interdisciplinary field of prevention science; strengths and limitations of diverse theoretical and conceptual bases of research in prevention science; application of research findings to issues related to the prevention of mental, emotional, and physical health problems and the promotion of well-being. May be taken 3 times for credit. Prerequisite: Graduate standing and enrollment in the interdisciplinary graduate certificate in prevention science or approval of instructor. Cross-listed with COMM 671, HLTH 671 and RPTS 620.
- 628. Consultation: Theory and Techniques. (3-0). Credit 3.** History and theory of various models of consultation including mental health, behavioral and organizational development; skills and techniques necessary for effective consultation; relevant research issues. Prerequisites: SPSY 612 and SPSY 614 or approval of instructor; approval of department head.
- 629. Psychosocial Variables in the Education of Minority Children. (3-0). Credit 3.** Issues in education of ethnic minority children including determinants of minority children's achievement, bias in assessment and placement of minority children, value conflicts between home and school, and impact of social, economic and educational inequality; ethnically sensitive institutional and counseling practices. Prerequisite: Approval of department head.
- 638. Systems Consultation and Prevention Science. (3-0). Credit 3.** Theory, research and practice in prevention science with an emphasis on individuals from birth to age 21; understanding and application of theories and methods of prevention science. Prerequisites: Graduate classification, SPSY 628, approval of department head.
- 641. Child Therapy for School Behavior Problems. (3-0). Credit 3.** Selected therapy approaches for treating childhood behavior disorders that interfere with children's interpersonal and intrapersonal adjustment and school learning; play therapy, behavior therapy, cognitive therapies; case studies; observation of therapy cases in public and/or mental health settings. Prerequisites: PSYC 628; approval of department head.
- 642. Behavioral Assessment and Intervention. (3-0). Credit 3.** This course provides overview of contemporary behavior theory and applied behavior analysis; overview of behavioral assessment strategies with an emphasis on the systematic observations of behavior and interviews; and contemporary behavior therapy approaches for use with educators, children, and their families. Prerequisite: Graduate classification and approval of department head.
- 643. Academic Assessment and Intervention. (3-0). Credit 3.** Developing effective and appropriate interventions for school-based academic concerns; collecting and interpreting data from informal academic assessments and observations for intervention development and evaluation; using curriculum-based assessments for monitoring student's academic programs and teacher decision making; understanding effective instructional strategies and their application to academic interventions. Prerequisite: Graduate classification and approval of department head.

- 644. Child Therapy: Advanced Theory and Techniques. (3-0). Credit 3.** Supervised experiences in public and mental health settings in the application of psychotherapy techniques with children, adolescents and families; interviewing techniques; process of therapy; advanced theoretical foundations; case management. Prerequisites: SPSY 641 and approval of department head.
- 645. Social and Emotional Development and Intervention. (3-0). Credit 3.** Theories of how children develop in the areas of social and emotional learning, recent empirical findings in the area of social and emotional development; preventive and remedial interventions for social and emotional difficulties. Prerequisites: Graduate classification; approval of department head.
- 657. Bilingual Psychoeducational Assessment. (3-2). Credit 4.** Theory of second language acquisition; discrete point and descriptive approach to language assessment; achievement assessment; cognitive assessment and practical and cultural factors when assessing bilingual children. Prerequisites: EPSY 622; approval of department head.
- 683. Field Practicum in... Credit 1 to 15.** Faculty supervised experience in professional employment public and mental settings in school psychology. Repeatable to 15 hours. Prerequisite: Approval of department head.
- 684. Professional Internship. Credit 1 to 4 each semester.** Limited to advanced doctoral students; faculty supervised experience in approved professional employment settings. Applications for September assignments must be approved the previous October. May be repeated up to 9 hours. Prerequisites: Completion of required substantive coursework; approval of department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problems. Prerequisite: Approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of school psychology. May be repeated for credit. Prerequisite: Approval of department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation. Prerequisite: Approval of department head.

College of Science (SCEN)

- 600. Science Graduate Study Abroad. Credit 1 to 18.** Approved study abroad student participation; reciprocal educational exchange programs. May be taken two times for credit. Prerequisite: Admission to approved program.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of science. May be repeated for credit. Prerequisites: Graduate classification and approval of instructor.
- 698. Writing for Publication. (3-0). Credit 3.** Writing in academic disciplines and settings. Writing for different audiences and purposes. Style; planning and development of journal articles; grant proposals; correspondence; oral presentations; technical reports. Permission of departmental/college graduate advisor. Prerequisite: Advanced standing in master's/doctoral programs.

Department of Sociology

J. M. Ackerman, J. S. Burk, S. R. Cohn, B. M. Crouch, A. Currier, J. R. Feagin, B. A. Finlay, N. Y. Flores, M. A. Fossett, H. Foster, J. C. Gaston, S. N. Gatson, P. R. Goldsmith, K. Henderson, J. O. Jewell, V. M. Keith, D. Liu, R. S. Mackin, R. A. May, W. A. McIntosh, S. G. Mestrovic, W. L. Moore, E. Murguia, H. Ono, N. Plankey Videla, D. L. Poston, Jr., H. N. Prechel*, R. Saenz, A. Schaffer, J. A. Sell (Head), K. Suzuki, J. K. Thomas, Z. Valdez, W. Zhang, L. Zheng

* Graduate Advisor

The Department of Sociology offers graduate study leading to a Doctor of Philosophy. The Doctor of Philosophy degree prepares students for careers of teaching and research in higher education and for careers of research in the private and public sector.

The graduate program is designed to facilitate rapid completion of the Ph.D. within five years of full-time study. If students enter the program with a Bachelor's Degree, they must take 96 hours to complete the Ph.D. Students entering the graduate program with a Masters' Degree must take 64 hours. In addition, Ph.D. students must pass a written and oral preliminary examination focusing on their competence in one major area concentration and one minor area concentration in sociology and write a dissertation.

Research and teaching in the department cover all major areas in sociology. The curriculum is constructed especially to support specialized training in the areas of culture; political and economic sociology; demography, crime, law and deviance; race, class and gender; and social psychology. The department helps students participate actively in these areas of scholarship by providing excellent research facilities and access to data, opportunities to collaborate in faculty research projects, and aid in seeking grants and fellowships to support their own work.

Sociology (SOCI)

601. **Urban Sociology. (3-0). Credit 3.** Patterns of organization and the dynamics of change in the contemporary city; internal and external structure of the city; processes of growth and decline. Prerequisite: SOCI 321 or approval of instructor.
602. **Rural Sociology. (3-0). Credit 3.** Application of sociological concepts to the rural environment; social change and its effect on rural social structures. Prerequisite: Approval of instructor.
603. **The Contemporary Family. (3-0). Credit 3.** Review and criticism of theories developed for study of the family; family formation, dynamics, conflicts, power, dissolution; subcultural family forms and responses to social change. Cross-listed with WGST 603.
604. **Comparative Historical Methods. (3-0). Credit 3.** Surveys key methodological issues, including the logic of comparative design and analysis of primary and secondary sources. Exemplars of important comparative historical research-both classics and more recent publications-will be reviewed. Prerequisite: Graduate classification.
605. **Social Movements. (3-0). Credit 3.** Surveys the literature on social movements including the topics of movement emergence, movement outcomes, state repression, and revolutions; reviews contemporary debates in the theories of social movement and new developments in research. Prerequisite: Graduate classification.
606. **War and Democracy. (3-0). Credit 3.** Sociological approaches to the study of war's effects on democracy and democratic control of the military and the use of force, in comparative-historical context.
607. **Seminar in Social Organizations. (3-0). Credit 3.** Relevant conceptual and empirical approaches to the study of selected aspects of social organization. May be taken up to two times for credit as content varies. Prerequisite: Graduate classification.
608. **Social Organization. (3-0). Credit 3.** Theoretical and conceptual bases of patterned human behavior; structural, processual and functional aspects of human groups from simplest informal to the most complex formal types: small groups, associations, institutions, complex organizations, bureaucracies, societies.
609. **Social Change. (3-0). Credit 3.** Concepts, theories and methodological approaches to studying social change; evolutionary, conflict, equilibrium and modernization approaches. Prerequisite: Approval of instructor.
611. **Classical Sociological Theory. (3-0). Credit 3.** Critical analysis of the writings of the principal founders of modern sociology; Marx, Durkheim and Weber and their influence on current theoretical issues. Prerequisite: SOCI 430 or equivalent or approval of instructor.
615. **Contemporary Sociological Theory. (3-0). Credit 3.** Critical analysis of current sociological perspectives, their logic of inquiry, substantive claims and application to empirical research. Prerequisite: SOCI 611.
616. **Political Sociology. (3-0). Credit 3.** Survey of the principal social and organizational bases of politics; the institutionalization of political power; explanation of political change and movements of social protest. Prerequisite: Graduate classification or approval of instructor.
617. **Comparative Racial-Ethnic Relations. (3-0). Credit 3.** Cross-cultural variations in racial-ethnic relations and structures of inequality; assessment of systems and power-conflict frameworks in diverse settings such as South America, Mexico, South Africa, Caribbean Regions and United States. Prerequisite: Approval of instructor.
618. **Sociology of Education. (3-0). Credit 3.** The school system and the democratic way of life; relationship of education to social organization, social change and social control. Role of education in society. Prerequisite: SOCI 205.

- 620. Human Ecology. (3-0). Credit 3.** Interrelationships between humans and their social and natural environments; human aggregations and their forms of settlement and organization. Prerequisites: SOCI 205 and SOCI 206; 6 additional hours of social science.
- 621. Social Psychology. (3-0). Credit 3.** Personality, social and cultural systems; development and interrelationships; cognitive activities, motivational determinants and selectivity; goals, structures, coordination and related factors influencing complex social groupings. Prerequisites: SOCI 205; 12 additional hours of social science.
- 622. Social Demography. (3-0). Credit 3.** Survey of methods, theories and problems of contemporary demographic phenomena. Prerequisite: Approval of department head.
- 623. Measurement of Sociological Parameters. (3-0). Credit 3.** Sociological research including scaling, scale analysis and experimental design. Prerequisites: Graduate classification; three hours of statistics.
- 624. Qualitative Methodology. (3-0). Credit 3.** Course provides exposure to and critical assessment of qualitative approaches to data gathering in social science; topics include naturalistic observation, field research skills, unobtrusive measures and grounded theory construction.
- 625. Seminar in Comparative and Historical Methods. (3-0). Credit 3.** This course familiarizes students with methodological debates and strategies of analysis pertinent to the examination of social structures and events across societies and historical time. Prerequisite: Graduate Classification.
- 627. Seminar in Law, Deviance and Social Control. (3-0). Credit 3.** Relevant literature and research in selected aspects of law, deviance and social control. May be taken up to three times for credit as content varies. Prerequisite: Graduate classification.
- 628. Deviant Behavior. (3-0). Credit 3.** Contemporary sociological approaches to deviance; theoretical and empirical studies of major types of deviant behavior.
- 629. Sociology of Law. (3-0). Credit 3.** Critical survey of the social sources of law, the role of law in social organizations and problems of law enforcement. Prerequisite: Graduate classification.
- 631. Seminar in Sociological Research. (3-0). Credit 3.** Critical analysis of research procedures used by sociologists. Prerequisite: SOCI 623.
- 633. Demographic Methods. (3-0). Credit 3.** Procedures and techniques for the collection, evaluation and analysis of demographic data; measures of population growth, composition, fertility, mortality and migration. Prerequisite: SOCI 622.
- 635. Sociology of Complex Organizations. (3-0). Credit 3.** Comparative structures; contingency models; micro- and macro-theoretical perspectives.
- 647. Seminar in Demography and Human Ecology. (3-0). Credit 3.** Relevant literature and research problems of a selected aspect of demography and human ecology, such as fertility and mortality, migration, international demography. May be taken up to three times for credit as content varies. Prerequisite: Graduate classification.
- 651. Sociology of Culture. (3-0). Credit 3.** Theoretical developments and methodological issues relevant to studying culture through classical, modern and postmodern sociological perspectives; includes background concerning the conditions under which theories develop and discussion of controversies in the definition of and research agendas within the sociology of culture. Prerequisite: Graduate classification.
- 657. Seminar in Culture. (3-0). Credit 3.** Relevant literature and research in selected aspects of culture and cultural processes. May be taken up to three times for credit as content varies. Prerequisite: Approval of instructor.
- 660. Theories of Race and Ethnic Group Relations. (3-0). Credit 3.** Sociological theories of intergroup assimilation, conflict and adaptation; includes examination and analysis of three major contemporary perspectives; assimilation and social fusion theory, conflict models and models of ethnic pluralism; theories of melioration of social discrimination also examined. Prerequisite: Graduate classification.
- 661. Sociology of Gender. (3-0). Credit 3.** Overview of the Sociology of Gender; historical development, primary concepts, contemporary issues, theory, methods, and applications. Prerequisite: Graduate Classification. Cross-listed with WGST 661.
- 662. Racism and Anti-Racism. (3-0). Credit 3.** This seminar focuses on racism and anti-racism issues, including social science research on slavery, anti-Black discrimination and Black resistance, anti-Asian discrimination and Asian American resistance, anti-Latino discrimination and Latino resistance, and white anti-racist groups. We assess empirical research on these topics and explore important theoretical frameworks. Prerequisite: Graduate classification.

- 663. Black and Latino Americans. (3-0). Credit 3.** This seminar focuses social science theory and research about African Americans and Latinos. We will emphasize historical backgrounds, social science theories applied to these groups, patterns of immigration, cognitive framing, patterns of racial-ethnic discrimination, and racial/class/gender intersections. We will review critically important research books dealing with these and related U.S. racial-ethnic issues. Prerequisite: Graduate classification.
- 667. Seminar in Race and Ethnic Relations. (3-0). Credit 3.** Origins, extent, consequences of racial and ethnic differences on key demographic variables such as fertility, mortality, migration and population size, growth, distribution and composition; how demographic variables affect and are affected by racial and ethnic differences in family structure, social mobility and socioeconomic stratification. May be taken up to three times for credit as content varies. Prerequisite: Graduate classification.
- 676. Theory Construction. (3-0). Credit 3.** Examination of issues on the philosophy of science and their relationship to the development of social science theory, particularly in sociology. Students will develop and apply theory construction principles to their own research agendas. Prerequisite: Graduate classification.
- 677. Seminar in Social Psychology. (3-0). Credit 3.** Relevant literature and research problems of a selected aspect of social psychology. May be taken for credit up to three times as content varies. Prerequisite: Graduate classification.
- 681. Professional Seminar in Sociology. (1-0). Credit 1.** Provides socialization to the profession of sociology; focuses on the role of the graduate student in sociology departments and other areas of professionalization; systematically introduces students to faculty members and their work; and provides instruction on how to write and publish research. Repeatable to 6 hours total.
- 685. Directed Studies. Credit 1 to 4 each semester.** Directed individual study of selected problem in field of sociology. Prerequisite: Approval of instructor.
- 687. Seminar in Rural Sociology. (3-0). Credit 3.** Develop sociological understanding of agriculture and natural resources; includes people involved in production, rural communities and agribusiness; focus on causes of social change and social organizations in agriculture and consequences. May be taken up to three times for credit as content varies. Prerequisite: Graduate classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of sociology. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Initiation and completion of research project of approved scope for an advanced degree. Prerequisite: Approval of instructor.

Department of Soil and Crop Sciences

J. Aitkenhead-Peterson, D. H. Bade, D. D. Baltensperger (Head), T. A. Baughman, P. A. Baumann, B. Bean, F. J. Betran, J. M. Blumenthal, K. F. Bronson, K. W. Brown, M. D. Burrow, D. R. Chalmers, J. M. Chandler, A. Chandra, Z. J. Chen, J. T. Cothren, H. T. Cralle, Y. Deng, J. B. Dixon, P. A. Dotray, M. C. Dozier, R. Duncan, R. L. Dubble, M. C. Engelke, G. W. Evers, S. E. Feagley, C. J. Fernandez, S. A. Finlayson, J. Foster, G. Ganjegunte, J. R. Gannaway, T. J. Gentry, T. J. Gerik, V. A. Haby, S. Hague, C. T. Hallmark, B. L. Harris, G. E. Hart, D. B. Hays, J. L. Heilman, T. J. Herrmann, F. M. Hons, L. R. Hossner, M. A. Hussey, A. M. Ibrahim, R. W. Jessup, C. A. Jones, W. R. Jordan, R. J. Kohel, R. J. Lascano, R. H. Loepfert, Jr., J. E. Matocha, G. N. McCauley, M. L. McFarland, K. J. McInnes, M. Menz, M. H. Milford, S. Miyamoto, G. W. Moore, J. Moore, C. L. Morgan, G. D. Morgan, P. W. Morgan, S. C. Murray, L. R. Nelson, W. R. Ocumpaugh, G. C. Peterson, T. L. Provin, K. S. Rathore, J. C. Read, L. A. Redmon, L. W. Rooney, W. L. Rooney, F. M. Rouquette, Jr., D. L. Rowland, J. Rudd, E. C. A. Runge, A. M. Schubert, S. A. Senseman, J. W. Sij, Jr., C. E. Simpson, J. J. Sloan, C. W. Smith*, D. T. Smith, G. R. Smith, J. W. Stansel, K. Steinke, D. M. Stelly, R. E. Tabien, L. Tarpley, C. L. Trostle, F. T. Turner, D. M. Vietor, R. W. Weaver, B. Wherley, R. H. White, R. P. Wiedenfeld, L. P. Wilding, H. Zhang, D. A. Zuberer

* Graduate Advisor

The graduate programs of the Department of Soil and Crop Sciences are designed to prepare individuals for careers in research, teaching, extension and industry, and management of agronomic enterprises. Agronomy, food science and technology, genetics, molecular and environmental plant sciences, plant breeding and soil science are majors available to students.

Research-oriented programs in agronomy, food science and technology, genetics, plant breeding, molecular and environmental plant sciences and soil science lead to the MS or PhD degree in these fields. There is

no language requirement at the MS or PhD level. Members of the faculty have expertise in cereal chemistry, crop breeding, crop physiology, environmental agronomy, cytogenetics, plant physiology, protein chemistry, environmental soil science, soil chemistry, soil fertility, soil genesis and classification, soil microbiology, soil mineralogy, soil physics, soil-plant-water relations, turfgrass science and weed science. Recipients of the MS and PhD degrees may obtain a research-, teaching-, industry- or extension-oriented position upon graduation.

Multidisciplinary programs can be arranged with other academic departments in the University. The facilities of the Electron Microscopy and Real Estate Research Centers are accessible, as are those of the Texas Water Resources Institute and the Department of Statistics.

Soil and Crop Sciences (SCSC)

- 603. Cytological and Histological Principles in Plant Breeding. (2-3). Credit 3.** Modern concepts and recent developments for advanced students in plant and soil sciences and related fields employing microscopic evaluation; specimen preparation, stain technology, theory and use of microscopes, micro-manipulators, microtomes, the microtome cryostat, use of equipment in modern cytological research. Prerequisite: Graduate classification.
- 605. Pedology. (3-0). Credit 3.** Soil genesis, morphology and classification; development of a working knowledge of soil taxonomy and diagnostic horizons used in placement of soils. Prerequisites: SCSC 301 or equivalent; or approval of instructor. Two 2-day field trips for which departmental fees may be assessed to cover costs.
- 606. Soil Microfabric and Reconstruction Analysis. (2-6). Credit 4.** Mineralogical methods suitable for soil genesis, micromorphology and reconstruction analysis; application of thin section analysis and x-ray spectroscopy to soil reconstruction; soil variability, sample collection, fractionation and pretreatment of samples for soil matrices. Offered in alternate years. Prerequisites: SCSC 301 and SCSC 310.
- 607. Crop Physiology. (3-0). Credit 3.** Growth and productivity of major agronomic crops as related to plant physiological processes and environmental parameters, including manipulation of crop growth for enhanced production. Prerequisites: SCSC 303; MEPS 313.
- 608. International Agronomic Development. (2-0). Credit 2.** Overview of world food situation; role of assistance programs and international and national research centers in the development of viable agronomic research and outreach programs for the Third World; roles and importance in training programs for institutional development and service.
- 609. Integrated Farming Systems. (3-0). Credit 3.** System-oriented course that stimulates critical thinking and debate regarding the strength and weakness of modern crop and livestock production systems within the context of ecological and economic sustainability; evaluates conservation tillage, integrated nutrient and pest management and multiple cropping systems. Prerequisite: Approval of instructor.
- 610. Host Plant Resistance. (3-0). Credit 3.** Host plant resistance programs from the standpoint of the plant breeder, plant pathologist and entomologist; team taught with each discipline represented; round-table discussion of assigned readings and lectures. Prerequisite: Approval of instructor. Cross-listed with ENTO 610 and PLPA 610.
- 611. Introduction to Environmental Biophysics. (3-2). Credit 4.** Theoretical and experimental analysis of interactions between living organisms and their environments; measurement and modeling of the physical environment; measurement and modeling of energy and mass transfer between organisms and their environments, and of organism response to fluxes of mass and energy. Prerequisites: Graduate classification and approval of instructor.
- 612. Forage Crops Management. (3-0). Credit 3.** Forage plant development, population dynamics and growth behavior patterns; applications of ecological and physiological principles to forage management; principles and practices of forage crops investigations; current literature and concepts. Prerequisite: SCSC 308 or approval of instructor.
- 613. Ethical Aspects of International Agricultural Systems. (3-0). Credit 3.** Diverse theories of morality; ethical dimensions of population growth, high yielding crop production systems, genetic engineering, and use of land, soil, and water. Prerequisites: Approval of Instructor.
- 614. Biodegradation and Bioremediation. (3-0). Credit 3.** Processes affecting the biodegradation of organic chemicals in the environment; assessment of the utility of various remedial procedures, including biodegradation and bioremediation; in site specific situations. Prerequisite: Organic chemistry. Cross-listed with VIBS 614.

- 615. Reclamation of Drastically Disturbed Lands. (3-0). Credit 3.** Theoretical and practical aspects of reclamation of lands disturbed during mining of lignite, uranium, phosphorous, oil shale and other minerals and disturbances due to industrial activities; emphasis on physical and chemical characteristics of disturbed materials and their impact on establishment of permanent vegetation. Prerequisite: SCSC 301 or approval of instructor.
- 616. Land Disposal of Waste. (3-0). Credit 3.** Theoretical, regulatory and practical aspects of disposal of municipal garbage, sewage effluent, sewage sludge, industrial and hazardous wastes by land treatment and landfilling; clean up of soil resources contaminated by past waste disposal activities will be considered. Prerequisite: Two courses in soils or approval of instructor.
- 617. Advanced Soil Physics. (3-3). Credit 4.** Physical properties of soil; dynamics of soil, water and ion movement, soil aeration and soil thermal relationships. Prerequisites: SCSC 445 or equivalent, a two-semester course in physics, and one semester of calculus. (Offered in alternate years.)
- 618. Advanced Soil Analysis. (2-3). Credit 3.** Fundamental procedures for analysis of soils and sediments including chemical, spectrophotometric, electrometric, chromatographic and sample handling; methods important to the soils researcher and analyst. Prerequisite: SCSC 422 or approval or instructor.
- 619. Molecular Methods for Microbial Characterization. (2-2). Credit 3.** Underlying principles of molecular methods for microbial detection and characterization in natural and man-made ecosystems; emphasis on method application and data interpretation; emphasis on microbial pathogens and indicator organisms in foods and environment; laboratory covers select protocols. Prerequisites: SCSC 405; FSTC 326; POSC 429; approval of instructor. Cross-listed with FSTC 619, POSC 619, VTMI 619.
- 620. Brazilian Agriculture and Food Production Systems. (3-0). Credit 3.** Compare Brazilian and U.S. agriculture and culture related to soil, water, and forest conservation and management in Brazil; tour and learn about Amazon River, rain forest, Brasilia, farm, ranch, and floral production systems, agricultural cooperatives and research, sugar and alcohol production, phosphate mining and production; visit points of interest. Prerequisite: Approval of instructor.
- 621. International Agricultural Research Centers - MX. (3-0). Credit 3.** Introduction to international agricultural research, Consultative Group on International Agriculture activity; modern and underdeveloped tropical agricultural systems; introduction to Mexican culture; critical evaluation of complex and international agricultural issues and research programs. Prerequisites: Approval of instructor; graduate classification.
- 623. Natural Resources and Agricultural Sustainability in UK. (3-0). Credit 3.** Environmental impacts and sustainability of United Kingdom and U.S. agriculture compared; soil, water, crop, and environmental management; conservation of watersheds; production of hydropower; sustainable use of water resources; cultural immersion. Prerequisite: Approval of instructor.
- 624. Physical Chemistry of Soils. (3-3). Credit 4.** Physical chemistry of clay minerals and inorganic and organic soil colloids; specific and non-specific absorption; kinetic processes and chemical equilibria in soils. Prerequisites: SCSC 626; CHEM 324 or approval of instructor.
- 625. Biofuels and the Environment. (2-0). Credit 2.** Biofuel crop use and disposal; production systems; conversion technologies; impacts of bioenergy production on sustainability, environment, and soil and water quality; carbon and energy budgets. Prerequisite: SCSC 301 or approval of instructor.
- 626. Soil Mineralogy. (3-4). Credit 5.** Crystal structures and properties of important minerals in soils and sediments especially clay minerals and oxides combined with identification techniques involving theory and practice with x-ray diffraction, electron microscopy, infrared and chemical methods.
- 627. Soil Chemistry and Fertility. (3-0). Credit 3.** Chemical and biological behavior of nitrogen, phosphorus and potassium in soils; secondary nutrients, micronutrients and soil acidity and liming; interpretation of soil chemical/biochemical research from historical and current literature and relationships with nutrient availability, plant uptake, and environmental quality. Prerequisites: SCSC 422; MEPS 313.
- 629. Laboratory Quality Systems. (3-0). Credit 3.** Quality systems and method development used within a laboratory; ensuring the integrity of procedures used in lab processes, chain of custody, information management, and international laboratory standards; regulatory requirements for laboratory operation; bio-security precautions; laboratory management. Cross-listed with VTMI 629.
- 630. Cereal Grains for Human Food. (3-3). Credit 4.** Fundamental concepts of dry milling, wet milling, oil extraction, baking, malting, brewing, storage, sanitation, and quality evaluation and control interrelated with physical and biochemical properties of cereals and their products; use of instruments and techniques to evaluate cereal quality. Prerequisite: Approval of instructor. Cross-listed with FSTC 630.

- 631. Prerequisite Programs for Feed Industry HACCP. (1-0). Credit 1.** Development of preliminary science-based risk management decision factors in feed industry; understanding and complying with FDA regulatory requirements for animal feed; application of international standards; prerequisite programs for Feed Industry Hazard Analysis and Critical Control Point (HACCP); module one of three. Prerequisite: Graduate classification.
- 632. Feed Industry HACCP - Principles and Plan Development. (1-0). Credit 1.** Principles of Feed Industry Hazard Analysis and Critical Control Point (HACCP) plan development; science-based risk analysis of decision factors; regulatory requirements of HACCP; module two of three. Prerequisite: SCSC 631.
- 633. Feed Industry HACCP - Advanced Plan Development. (1-0). Credit 1.** Principles of Feed Industry Hazard Analysis and Critical Control Point (HACCP) advanced plan development; case studies of HACCP principles; HACCP plan development for feed industry companies; module three of three. Prerequisites: SCSC 631 and SCSC 632.
- 634. Regulatory Science: Principles & Practices in Food Systems. (3-0). Credit 3.** Regulatory tools, standards and approaches in production, processing and distribution of agricultural goods; development and implementation of regulations; interdependence of federal and state agencies, use of risk analysis.
- 635. Comparative Global Standards in Food Systems. (3-0). Credit 3.** Laws, regulations and standards governing the production, distribution, processing and marketing of food across regions of the world; international standard setting bodies and risk assessment committees; regulatory equivalency and harmonization; product approval procedures; cost/benefits of global standards and trade agreements.
- 636. Regulatory Science: Methodology in Food Systems. (3-0). Credit 3.** Risk management methodology including investigation of food and feed firms, conducting internal compliance audits; sample collection, chain-of-custody, trace-back and trace-forward, recalls, label review, data interpretation, risk ranking, resource prioritization, incident command and rapid response. Prerequisite: SCSC 634.
- 637. Environmental Microbiology. (3-0). Credit 3.** Microbial diversity and interactions in various environments with emphasis on soil and freshwater systems. Molecular methods for detection and characterization of indigenous and introduced microorganisms. Environmental sources and fate of pathogens. Biotechnological applications of environmental microorganisms.
- 641. Plant Breeding I. (3-0). Credit 3.** Theoretical and practical aspects of plant breeding including genetic basis; application of breeding methods and interdisciplinary considerations in breeding problems. Prerequisites: SCSC 304 or HORT 404; GENE 301; STAT 651.
- 642. Plant Breeding II. (3-0). Credit 3.** Expectations of genetic improvement for different plant breeding methods; relative efficiency for crops of different reproductive mechanisms; genetic variances, covariances and genotype-environment interaction components of variance used in planning selection procedures. Prerequisites: SCSC 641; GENE 613; STAT 619.
- 643. Molecular Quantitative Genetics and Plant Breeding. (3-0). Credit 3.** Classical, applied and molecular aspects of quantitative genetics in plant breeding; genetic relationships; genetic diversity; genetic phenomena (linkage, heterosis and epistasis); genotype by environment interaction; mapping quantitative trait loci (QTL); genomic and marker-assisted selection; application of statistical software. Prerequisites: STAT 651, SCSC 642 or GENE 613; or approval of instructor. Cross-listed with GENE 643.
- 644. Forage Ecology and Management. (3-0). Credit 3.** Investigation of multidisciplinary approaches toward the development of integrated forage, livestock, and wildlife production systems that are economically feasible and environmentally sustainable. Prerequisites: Approval of instructor and graduate classification.
- 645. World Agriculture and International Plant Breeding. (1-0). Credit 1.** Evolution of world agriculture; plant breeding and improved varieties; international agricultural research centers and green revolution; population growth; environmental challenges; IPR; role of plant breeding and biotechnology in meeting world food needs. Prerequisite: SCSC 304, HORT 404 or approval of instructor. Cross-listed with HORT 645.
- 646. Advanced Studies in Cotton Fiber Quality and Its Measurements. (3-0). Credit 3.** Advanced studies in cotton fiber quality and its measurement will explore the morphology of cotton fiber growth, the instruments used to determine fiber quality, and the interpretation of quality measurements.

- 650. Mode of Action and Environmental Fate of Herbicides. (2-3). Credit 3.** Relationships between physical-chemical characteristics of herbicides and their biological activity, selectivity, environmental fate in soil, water, and plants. Laboratory includes practical applications of gas and liquid chromatography, liquid scintillation counting and plant bioassays. Prerequisite: SCSC 450 or approval of instructor.
- 651. Weed Biology and Ecology. (2-2). Credit 3.** Fundamentals of weed invasion, development, persistence and competition with agronomic crops; consideration of ecological concepts important to weed-crop relationships as influenced by weed control and other cultural practices. Practical consideration of integrated weed management systems and weed identification. Prerequisites: SCSC 303; MEPS 313.
- 654. Genome Analysis. (3-0). Credit 3.** Genome structure, organization and function of model organisms and higher eukaryotes; theory and methodology of genetic and physical mapping, comparative genomics, sequencing, sequence analysis and annotation; emphasis on understanding the function of complex genomes, genome-wide expression analysis, genetic and epigenetic mechanisms; X-inactivation, imprinting, gene silencing, transposons, genome duplication and evaluation. Prerequisite: GENE 603 or GENE 431. Cross-listed with GENE 654 and MEPS 654.
- 655. Analysis of Complex Genomes—Lab. (0-7). Credit 3.** Laboratory methods in molecular genetic techniques for genetic mapping, physical mapping, and map-based cloning of both qualitative and quantitative phenotypes. Prerequisite: GENE 603 or equivalent or approval of instructor. Cross-listed with GENE 655 and MEPS 655.
- 657. Environmental Soil and Water Science. (3-0). Credit 3.** Discussion of physical, chemical, and biological properties of soil and water and the impact on productivity and sustainability of various ecosystems; application of the knowledge of properties and soil processes to develop and evaluate strategies for protecting and/or improving soil and water quality. Prerequisite: SCSC 301. Stacked with SCSC 455.
- 658. Watershed and Water Quality Management. (3-0). Credit 3.** Land use impact on surface and ground water chemistry; legislation impacting water quality; surface and groundwater impairment and restoration; case studies in best management practices. Prerequisite: Graduate classification.
- 660. Experimental Designs in Agriculture. (3-0). Credit 3.** Teaches fundamental principles and procedures of experimental designs in agricultural sciences. Emphasis includes factorial designs, predicting outputs, use of covariance, balanced and unbalanced experimental designs as related to common agricultural research projects under field, greenhouse or growth chamber culture. Students will become familiarized with computer programming of common statistical software. Prerequisite: STAT 651.
- 663. Applied Spatial Statistics. (3-2). Credit 4.** An introduction to the theory and practice of spatial statistics as applied to the natural resources. Spatial analyses focusing primarily on ordinary kriging, point processes, and lattice data. Prerequisites: MATH 141, MATH 142, STAT 651, or equivalents; ESSM 651 preferred. Cross-listed with ESSM 663.
- 671. Plant Growth and Development. (3-0). Credit 3.** The course is a comprehensive analysis of plant development primarily focused on the molecular and cellular processes underlying morphogenesis, vegetative growth and reproduction. The role of the major phytohormones as coordinators of development will be analyzed. Plastic developmental responses to conditioning environmental signals will also be considered. Prerequisites: MEPS 601 or approval of instructor. Cross-listed with MEPS 671.
- 681. Seminar. Credit 1 each semester.** For graduate students and staff members in soils and crops; presentation and discussion of special topics and research data; participation required of all graduate students in agronomy.
- 684. Professional Internship. Credit 1 or more each semester.** Program planned to provide professional training in student's particular field of interest. Faculty and employer will supervise the activity. Prerequisite: Approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Advanced problems in some phase of agronomy not directly related to thesis or dissertation.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of agronomy. May be repeated for credit. Prerequisite: Approval of department head.
- 691. Research. Credit 1 or more each semester.** Investigations leading to thesis or dissertation.

Special Education

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(SPED)

- 609. Educating Individuals with Autism Spectrum Disorders. (3-0). Credit 3.** Study of the incidence, prevalence, and characteristics of individuals with autism spectrum disorders, particularly for teachers, counselors, and related fields; research and best practices in assessment, treatment, and education; includes treatment of social, communication, academic, and behavior deficits with emphasis on behavior analysis. Prerequisite: Graduate classification.
- 610. Special Education and the Family. (3-0). Credit 3.** Overview of issues in special education interpreted within the context of the family; relationships among the school, the families, and the community; impact of relationships on service provisions; field experiences working with families with special needs. Prerequisite: Approval of department head.
- 611. Multicultural Special Education. (3-0). Credit 3.** Multicultural perspectives in special education; foundations of multicultural special education; cultural responsive teaching; methods for teaching culturally and linguistically diverse learners in special education. Prerequisite: Graduate status.
- 612. Special Education Law and Policy. (0-7). Credit 3.** Legal development of the discipline of special education; current requirements for providing free and appropriate education to students with disabilities; assessment and performance of research with legal information. Prerequisites: Graduate classification and approval of department head.
- 613. Issues in Educating Students with Disabilities. (3-0). Credit 3.** Overview of research and issues related to referral, assessment and educational interventions with exceptional children and youth; information on cross-categorical approach to special education; addresses implications for future practices in special education. Prerequisites: Approval of department head; G8 status.
- 614. Issues in Moderate and Severe Disabilities. (3-0). Credit 3.** Psychological, social, physical and cognitive aspects of moderate to severe disabilities; service delivery systems; biomedical issues community programming; transition programming; adult service program; programs for the elderly; all in relation to individuals with moderate to severe disabilities. Prerequisites: Graduate classification and approval of department head.
- 615. Special Education Assessment: Technical and Legal Aspects. (3-0). Credit 3.** Teaches skills to critically examine assessment tools and procedures in special education; technical and legal issues in pre-referral evaluation, eligibility assessment, IEP writing and program evaluation; emphasizes test validity and test sensitivity to growth; mastery of knowledge base and realistic scenarios. Prerequisites: Graduate classification or approval of instructor; approval of department head.
- 617. Adolescent Literacy for Students with Diverse Instructional Needs. (3-0). Credit 3.** Research-based strategies to teach reading and writing to 4th through 12th grade students with disabilities and other diverse instructional needs; emphasis on current issues, assessment, motivation, intervention, and content area issues and strategies. Prerequisite: Graduate classification.
- 618. Induction and Preparation for the Special Education Professoriate. (3-0). Credit 3.** Orientation to full-time doctoral studies; understanding historical and contemporary issues in the field of special education; familiarization with special education literature and systematic reviews of research literature. Prerequisite: Admission into special education doctoral program.
- 619. Critical Research and Practice Issues in Special Education. (3-0). Credit 3.** Examination of the historical, conceptual/theoretical and empirical basis of special education research and practice; understanding special education as a field and specific areas for in-depth knowledge. Prerequisite: Admission into special education doctoral program.
- 620. Bilingual Special Education. (3-0). Credit 3.** Topics concerning bilingual special education will be covered including history of the field; language acquisition and assessment; general assessment, individual education plans (IEPs); curriculum development; mainstreaming; consultation services; and parental involvement. Prerequisite: Approval of department head.
- 621. Overview of Exceptional Students. (3-0). Credit 3.** Overview of historical foundations for special education practice; definitions of disabilities, relevant educational characteristics of students with disabilities; assessment procedures associated with the identification of students' disabilities; intervention procedures related to education of students with disabilities. Prerequisites: Graduate classification and approval of department head.

- 622. Community-Based Integrated Services. (3-1). Credit 3.** Special Education is presented as a component of a community-based integrated delivery system to address the educational needs of disabled and at-risk students; course activities include participation in a collaborative R&D activity with schools and/or health and human service agencies engaged in integrated service projects. Prerequisite: Approval of department head.
- 623. Self-Determination and Advocacy. (3-0). Credit 3.** Conceptualization and theoretical framework of self-determination for students with disabilities; the role of self-determination in improving student outcomes; and best practices in promoting self-determination among students with disabilities. Prerequisites: Graduate status.
- 628. Consultation in Special Education. (3-0). Credit 3.** Rationale, strategies, procedures and resources for providing consultation as systematic problem-solving to school procedures, and resources for improving services for children with disabilities, and those who are at-risk of school failure. Prerequisites: Graduate classification and approval of department head.
- 630. Early Literacy for Students with Diverse Instructional Needs. (3-0). Credit 3.** Research-based strategies to teach beginning reading and writing to pre-K through 4th grade students with disabilities and other diverse instructional needs; emphasis on current issues, assessment, prevention, and intervention. Prerequisite: Graduate classification.
- 632. Transition from School to Work. (3-0). Credit 3.** Current issues and practices related to the transition of students from school to work; partnerships with business and industry; secondary and postsecondary education linkages; work-based training. Prerequisite: Approval of department head.
- 641. Low-Incidence Instruction for Individuals with Significant Support Needs. (3-0). Credit 3.** Examination of how particular types of low-incidence disabilities; including mental retardation, autism, physical disabilities, traumatic brain injury, deafness, blindness, multiple disabilities, and other health impairments, affect academic and job performance. Current methods for teaching individuals with low-incidence disabilities, including an overview of Adaptive/Assistive Technology (AT) solutions. Prerequisites: Graduate status, permission of Department Head.
- 642. Program Development for Students with Behavior Problems. (3-0). Credit 3.** Field-based course relating to effective management of challenging and severe behavior problems in the classroom using proactive strategies; effective instruction and planned behavioral interventions; methods for observing, assessing and analyzing challenging and severe behaviors; includes a 20-hour field based component. Prerequisites: Graduate classification and approval of department head.
- 682. Seminar in Special Education. (1-0). Credit 1.** Knowledge, skills and attitudes in special education. Specific topics are announced for each seminar offered. May be taken more than once, but not to exceed 6 hours of credit. May be taken 6 times. Prerequisites: Graduate classification and approval of department head.
- 683. Field Practicum. Credit 1 to 15 each semester.** Faculty supervised experience in professional practice settings in Special Education. May be repeated for credit. Prerequisite: Approval of instructor and department head.
- 684. Professional Internship. Credit 1 to 6 each semester.** Supervised experience in professional functions appropriate to career goals in special education. Prerequisite: Approval of instructor and department head.
- 685. Directed Studies. Credit 1 to 6 each semester.** Directed individual study of selected problems in special education. Prerequisite: Approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of special education. May be repeated for credit. Prerequisite: Approval of department head.
- 699. Advanced Applied Behavior Analysis. (3-0). Credit 3.** Rigorous repertoire of knowledge and skill in behavior analysis; comprehensive and contemporary description of applied behavior analysis; application of principles and paradigms of theoretical and experimental aspects of behavior. Prerequisites: SEFB 618 and graduate classification.

Special Education Field Based

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(SEFB)

- 618. Applied Behavior Management in the Classroom. (3-0). Credit 3.** Field-based course related to effective management of challenging behavior problems in the classroom using proactive classroom strategies, effective instruction and planned behavior interventions; discussion and applications of methods for observing, assessing and analyzing challenging behaviors. Prerequisites: Graduate classification and approval of department head.
- 625. Student Teaching in Special Education. (0-12). Credit 3.** Observation and participation in settings involving students with disabilities; supervised student teaching in accredited school or supervised field work in settings approved by program. Must be taken satisfactory/unsatisfactory. Prerequisites: Graduate classification and approval of department head.
- 683. Field Practicum for Transition Specialist. (0-3). Credit 1.** Faculty supervised experience in professional employment settings special education. May be repeated for credit. Prerequisite: Approval of instructor and department head.
- 684. Internship in Special Education. Credit 1 to 4.** University-directed experience in a professional employment setting; full-time teaching and responsibility in a classroom with students with disabilities. May be taken 4 times. Prerequisites: Graduate classification and approval of department head.

Sport Management

(faculty, see [page 432](#))

(SPMT)

- 601. Research Methods for Sport Organizations. (3-0). Credit 3.** Methodology and application of social science research in sport organizations; including the research process, research designs, sampling procedures, measurement, survey research, hypothesis testing, application and interpretation of appropriate statistics, and the research presentation.
- 610. Administration of Sport Organizations. (3-0). Credit 3.** Issues related to the administration of sport and fitness organizations; includes interschool athletics and corporate organizations.
- 611. Revenue Generation in Sport. (3-0). Credit 3.** Examine the basic financial, accounting, and revenue generation principles central to the management of sport organizations. Prerequisites: Graduate classification.
- 612. Personnel Management in Sport. (3-0). Credit 3.** Examine the service orientation of sport organizations, individual differences in employees and clients, personnel management practices, and expected outcomes of effective personnel management. Prerequisite: Graduate classification.
- 613. Diversity in Sport Organizations. (3-0). Credit 3.** Examines an encompassing perspective of diversity within North American and international sport organizations; provides students with an analysis and understanding of the various ways that people within sport organizations can differ; treats issues of the non-dominant, historically under-represented elements of U.S. society, with an emphasis placed on racial and gender issues. Prerequisite: Graduate Student.
- 615. Sport Marketing. (3-0). Credit 3.** Explores and examines the elements of planning, organizing and prompting sporting events. Prerequisite: Graduate classification.
- 623. Athletics Administration. (3-0). Credit 3.** Principles and processes of managing intercollegiate athletic organizations and properties. Prerequisite: Graduate classification.
- 655. Sport Law. (3-0). Credit 3.** Legal principles affecting sponsors and users of sports programs; liability concepts in tort, contract, civil rights and property law in program planning, development, marketing and management. Prerequisite: Graduate classification or approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of research and the research process in sport management. May be taken 4 times for credit. Prerequisite: Graduate classification.
- 682. Seminar in... (1-0). Credit 1.** Discussions of current topics and issues impacting sport management and administration. May be taken 8 times for credit. Prerequisite: Graduate classification.

- 683. Practicum in Sport Management. (3-0). Credit 3.** Participation and study in sport management and administration; acquisition and practice of professional and/or clinical skills in sport management. Prerequisites: Graduate classification and approval of instructor.
- 684. Internship in Sport Management. Credit 1 to 6.** Supervised internship with sport management organization; application of formal training to performing professional functions consistent with career goals. Prerequisites: Graduate classification; approval of instructor.
- 685. Directed Studies. Credit 1 to 12.** Directed study of special problems in sport management not related to thesis. May be repeated for credit. Prerequisites: Graduate classification, approval of instructor; approval of department head.
- 689. Special Topics in ... Credit 1 to 4.** Selected topics in an identified area of sport management. May be repeated for credit. Prerequisite: Graduate classification.
- 690. Theory of Research in Sport Management. (3-0). Credit 3.** Theory and design of research problems and experiments in various fields of sport management. May be taken 2 times for credit. Prerequisite: Graduate classification.
- 691. Research. Credit 1 to 18.** Research for thesis or dissertation. Prerequisites: Graduate classification and approval of committee chair.

Department of Statistics

J. A. Calvin, R. J. Carroll, W. Chen, D. B. H. Cline, A. Dabney, D. Dahl, P. F. Dahm*, R. Fan, R. J. Freund, C. E. Gates, M. Genton, J. D. Hart, R. R. Hocking, J. Huang, O. C. Jenkins, E. Jones, M. Jun, S. Lahiri, E. Li, F. Liang, M. T. Longnecker, Y. Ma, B. K. Mallick, J. H. Matis, J. F. McNamara, U. Müller-Harknett, H. J. Newton, E. Parzen, J. Perrett, M. Pourahmadi, S. S. Rao, L. J. Ringer, H. Sang, S. Sheather (Head), M. Sherman, S. Sinha, W. B. Smith, F. M. Speed, C. H. Spiegelman, S. Wang, T. E. Wehrly, W. West, L. Zhou, J. Zinn

* Graduate Advisor

The Department of Statistics offers a graduate program leading to the degrees of Master of Science or Doctor of Philosophy. The department cooperates closely with all subject matter area departments in setting up flexible minor programs in statistics.

The Department of Statistics offers two options in its master's degree programs: (1) the MS (thesis option) which requires the preparation of a thesis and, (2) the MS (non-thesis option) which requires more formal coursework in lieu of the thesis. Both programs provide a balanced training in statistical methods and statistical theory and are intended to prepare the student to adapt statistical methodologies to practical problems.

The aim of the PhD program is to provide comprehensive and balanced training in statistical methods and statistical theory. Particular emphasis will be placed on training students to independently recognize the relevance of statistical methods to the solution of specific problems and to enable them to develop new methods when they are needed. The training will also aim at conveying a sound knowledge of existing statistical theory, including the mathematical facility to develop new results in statistical methodology. At the same time, the program will be kept sufficiently flexible to permit students to develop their specific interests.

The following courses are offered on an irregular basis: STAT 602, STAT 606, STAT 609, STAT 623, STAT 634, STAT 635, STAT 637, STAT 658, STAT 662, STAT 665 and STAT 671. Contact the department for specific offerings for any given term.

Statistics (STAT)

- 601. Statistical Analysis. (3-2). Credit 4.** For students in engineering, physical and mathematical sciences. Introduction to probability, probability distributions and statistical inference; hypotheses testing; introduction to methods of analysis such as tests of independence, regression, analysis of variance with some consideration of planned experimentation. Prerequisite: MATH 152 or MATH 172.
- 602. Statistical Methods of Regression Analysis. (3-0). Credit 3.** Linear, nonlinear, nonparametric and logistic regressions; methodologies and their statistical foundations for detection of collinearity, outliers and correlation in errors or independent variables. Prerequisites: STAT 601 or STAT 641; STAT 610; MATH 423 or equivalent.

- 604. Topics in Statistical Computations. (3-0). Credit 3.** Efficient uses of existing statistical computer programs (SAS, R, etc.); generation of random numbers; using and creating functions and subroutines; statistical graphics; programming of simulation studies; and data management issues. Prerequisite: MATH 221, MATH 251, or MATH 253.
- 605. Advanced Statistical Computations. (3-0). Credit 3.** Programming languages, statistical software and computing environments; development of programming skills using modern methodologies; data extraction and code management; interfacing lower-level languages with data analysis software; simulation; MC integration; MC-MC procedures; permutation tests; bootstrapping. Prerequisite: STAT 612 and STAT 648.
- 606. Design of Experiments. (3-0). Credit 3.** Fundamental concepts in the design of experiments, justification of linear models, randomization, principles of blocking and the use of concomitant observations; construction and analysis of basic designs including confounding, fractional replication, composite designs and incomplete block designs. Prerequisite: STAT 642 or STAT 653 or approval of instructor.
- 607. Sampling. (3-0). Credit 3.** Planning, execution and analysis of sampling from finite populations; simple, stratified, multistage and systematic sampling; ratio estimates. Prerequisite: STAT 601 or STAT 652 or concurrent enrollment in STAT 641.
- 608. Regression Analysis. (3-0). Credit 3.** Multiple, curvilinear, nonlinear, robust, logistic and principal components regression analysis; regression diagnostics, transformations, analysis of covariance. Prerequisite: STAT 601 or STAT 641.
- 609. Order Statistics and Non-Parametric Methods. (3-0). Credit 3.** Application of distribution-free and rank procedures for estimation, confidence intervals construction and hypotheses testing; both exact and approximate methods considered. Prerequisite: STAT 601, STAT 641 or STAT 652.
- 610. Theory of Statistics - Distribution Theory. (3-0). Credit 3.** Brief introduction to probability theory; distributions and expectations of random variables, transformations of random variables and order statistics; generating functions and basic limit concepts. Prerequisite: MATH 409 or concurrent enrollment in MATH 409.
- 611. Theory of Statistics - Inference. (3-0). Credit 3.** Theory of estimation and hypothesis testing; point estimation, interval estimation, sufficient statistics, decision theory, most powerful tests, likelihood ratio tests, chi-square tests. Prerequisite: STAT 610 or equivalent.
- 612. Theory of Linear Models. (3-0). Credit 3.** Matrix algebra for statisticians; Gauss-Markov theorem; estimability; estimation subject to linear restrictions; multivariate normal distribution; distribution of quadratic forms; inferences for linear models; theory of multiple regression and AOV; random and mixed-effects models. Prerequisite: Course in linear algebra.
- 613. Statistical Methodology I. (3-0). Credit 3.** Elements of likelihood inference; exponential family models; group transformation models; survival data; missing data; estimation and hypotheses testing; non-linear regression models; conditional and marginal inferences; complex models-Markov chains, Markov random fields, time series, and point processes. Prerequisite: STAT 612.
- 614. Probability for Statistics. (3-0). Credit 3.** Probability and measures; expectation and integrals, Kolmogorov's extension theorem; Fubini's theorem; inequalities; uniform integrability; conditional expectation; laws of large numbers; central limit theorems Prerequisite: STAT 610 or its equivalent.
- 615. Stochastic Processes. (3-0). Credit 3.** Survey of the theory of Poisson processes, discrete and continuous time Markov chains, renewal processes, birth and death processes, diffusion processes and covariance stationary processes. Prerequisites: STAT 611; MATH 409.
- 616. Multivariate Analysis. (3-0). Credit 3.** Multivariate normal distributions and multivariate generalizations of classical test criteria, Hotelling's T^2 , discriminant analysis and elements of factor and canonical analysis. Prerequisites: STAT 611 and STAT 612.
- 618. Statistical Aspects of Machine Learning and Data Mining. (3-0). Credit 3.** This course will examine the statistical aspects of techniques used to examine data streams which are large scale, dynamic, and heterogeneous. This course will examine the underlying statistical properties of classification; trees; bagging and boosting methods; neural networks; support vector machines; cluster analysis; and independent component analysis. Prerequisites: STAT 610, STAT 611, and STAT 613.
- 620. Asymptotic Statistics. (3-0). Credit 3.** Review of basic concepts and important convergence theorems; elements of decision theory; delta method; Bahadur representation theorem; asymptotic distribution of MLE and the LRT statistics; asymptotic efficiency; limit theory for U-statistics and differential statistical functionals with illustrations from M-,L-,R-estimation; multiple testing. Prerequisite: STAT 614.

- 621. Advanced Stochastic Processes. (3-0). Credit 3.** Conditional expectation; stopping times; discrete Markov processes; birth-death processes; queuing models; discrete semi-Markov processes; Brownian motion; diffusion processes, Ito integrals, theorem and limit distributions; differential statistical functions and their limit distributions; M-,L-,R-estimation. Prerequisite: STAT 614 or STAT 615.
- 623. Statistical Methods for Chemistry. (3-0). Credit 3.** Chemometrics topics of process optimization, precision and accuracy; curve fitting; chi-squared tests; multivariate calibration; errors in calibration standards; statistics of instrumentation. Prerequisite: STAT 601, STAT 641 or STAT 652 or approval of instructor.
- 626. Methods in Time Series Analysis. (3-0). Credit 3.** Introduction to statistical time series analysis; autocorrelation and spectral characteristics of univariate, autoregressive, moving average models; identification, estimation and forecasting. Prerequisite: STAT 601 or 642 or approval of instructor.
- 627. Nonparametric Function Estimation. (3-0). Credit 3.** Nonparametric function estimation; kernel, local polynomials, Fourier series and spline methods; automated smoothing methods including cross-validation; large sample distributional properties of estimators; recent advances in function estimation. Prerequisite: STAT 611.
- 630. Overview of Mathematical Statistics. (3-0). Credit 3.** Basic probability theory including distributions of random variables and expectations. Introduction to the theory of statistical inference from the likelihood point of view including maximum likelihood estimation, confidence intervals, and likelihood ratio tests. Introduction to Bayesian methods. Prerequisites: MATH 221, STAT 251, and STAT 253.
- 631. Statistical Methods in Finance. (3-0). Credit 3.** Regression and the capital asset pricing model, statistics for portfolio analysis, resampling, time series models, volatility models, option pricing and Monte Carlo methods, copulas, extreme value theory, value at risk, spline smoothing of term structure. Prerequisites: STAT 610, STAT 611, STAT 608.
- 632. Statistical Methodology II-Bayesian Modeling and Inference. (3-0). Credit 3.** Decision theory; fundamentals of Bayesian inference; single and multi-parameter models; Gaussian model; linear and generalized linear models; Bayesian computations; asymptotic methods; non-iterative MC; MCMC; hierarchical models; nonlinear models; random effect models; survival analysis; spatial models. Prerequisite: STAT 613.
- 633. Advanced Bayesian Modeling and Computation. (3-0). Credit 3.** Bayesian methods in their research; methodology, and applications of Bayesian methods in bioinformatics, biostatistics, signal processing, machine learning, and related fields. Prerequisite: STAT 608, STAT 613, STAT 632.
- 634. Response Surface Design and Analysis. (3-0). Credit 3.** Definition of response surface and relation to multiple regression; ridge analysis; first, second and third order designs for response surface estimation; optimization of response surface designs for various criteria; the Box-Draper theory and EVOP. Prerequisite: STAT 608.
- 635. Application of Stochastic Processes to the Natural Sciences. (3-0). Credit 3.** Basic concepts, Random walks, Markov chains, branching processes, Markov processes in continuous time, homogeneous and nonhomogeneous processes, multi-dimensional processes, queuing processes, epidemic processes, competition and predation, diffusion and non-Markovian processes. Prerequisite: STAT 610 or approval of instructor.
- 636. Methods in Multivariate Analysis. (3-0). Credit 3.** Multivariate extensions of the chi-square and t-tests, discrimination and classification procedures; applications to diagnostic problems in biological, medical, anthropological and social research; multivariate analysis of variance, principal component and factor analysis, canonical correlations. Prerequisites: MATH 423 and STAT 653 or approval of instructor. Cross-listed with INFO 657.
- 637. Statistical Methods in Ecology. (3-0). Credit 3.** Derivation and application of statistical distributions for sampling models, birth-death processes, time intervals, size models, heterogeneous and clustered models in ecology; stochastic models for population growth, competition and predation and multi-dimensional processes. Prerequisite: STAT 601, STAT 641 or STAT 652 with approval of instructor.
- 638. Introduction to Applied Bayesian Methods. (3-0). Credit 3.** Uncertainty regarding parameters and how they can be explicitly described as a posterior distribution which blends information from a sampling model and prior distribution; emphasis on modeling and computations under the Bayesian paradigm; includes prior distributions, Bayes Theorem, conjugate and non-conjugate models, posterior simulation via the Gibbs sampler and MCMC, hierarchical modeling. Prerequisites: STAT 604, STAT 608, STAT 630.

- 641. The Methods of Statistics I. (3-0). Credit 3.** An application of the various disciplines in statistics to data analysis, introduction to statistical software; demonstration of interplay between probability models and statistical inference. Prerequisite: Concurrent enrollment in STAT 610 or approval of instructor.
- 642. The Methods of Statistics II. (3-0). Credit 3.** Design and analysis of experiments; scientific method; graphical displays; analysis of nonconventional designs and experiments involving categorical data. Prerequisite: STAT 641.
- 643. Biostatistics I. (3-0). Credit 3.** Bio-assay for quantitative and quantal responses: statistical analysis of contingency, including effect estimates, matched samples and misclassification. Prerequisites: STAT 608, STAT 630, and STAT 642 or STAT 610.
- 644. Biostatistics II. (3-0). Credit 3.** Generalized linear models; survival analysis with emphasis on non-parametric models and methods. Prerequisite: STAT 643 or approval of instructor.
- 645. Applied Biostatistics and Data Analysis. (3-0). Credit 3.** Survey of crucial topics in biostatistics; application of regression in biostatistics; analysis of correlated data; logistic and Poisson regression for binary or count data; survival analysis for censored outcomes; design and analysis of clinical trials; sample size calculation by simulation; bootstrap techniques for assessing statistical significance; data analysis using R. Prerequisites: STAT 651, STAT 652, and STAT 659, or equivalent or prior approval of instructor.
- 646. Statistical Bioinformatics. (3-0). Credit 3.** An overview of relevant biological concepts and technologies of genomic/proteomic applications; methods to handle, visualize, analyze, and interpret genomic/proteomic data; exploratory data analysis for genomic/proteomic data; data preprocessing and normalization; hypotheses testing; classification and prediction techniques for using genomic/proteomic data to predict disease status. Prerequisites: STAT 604, STAT 651, STAT 652 or equivalent or prior approval of instructor.
- 647. Spatial Statistics. (3-0). Credit 3.** Spatial correlation and its effects; spatial prediction (kriging); spatial regression; analysis of point patterns (tests for randomness and modelling patterns); subsampling methods for spatial data. Prerequisite: STAT 601 or STAT 611 or equivalent.
- 648. Applied Statistics and Data Analysis. (3-0). Credit 3.** Background to conduct research in the development of new methodology in applied statistics. Topics covered will include: exploratory data analysis; sampling; testing; smoothing; classification; time series; and spatial data analysis. Prerequisite: Approval of instructor.
- 651. Statistics in Research I. (3-0). Credit 3.** For graduate students in other disciplines; non-calculus exposition of the concepts, methods and usage of statistical data analysis; T-tests, analysis of variance and linear regression. Prerequisite: MATH 102 or equivalent.
- 652. Statistics in Research II. (3-0). Credit 3.** Continuation of STAT 651. Concepts of experimental design, individual treatment comparisons, randomized blocks and factorial experiments, multiple regression, Chi-squared tests and a brief introduction to covariance, non-parametric methods and sample surveys. Prerequisite: STAT 651.
- 653. Statistics in Research III. (3-0). Credit 3.** Advanced topics in ANOVA; analysis of covariance; and regression analysis including analysis of messy data; non-linear regression; logistic and weighted regression; diagnostics and model building; emphasis on concepts; computing and interpretation. Prerequisite: STAT 652.
- 655. Forecasting Methods and Applications. (3-0). Credit 3.** Development of statistical models for describing business trends and economic fluctuations, generation of forecasts and error limits, evaluation of forecasts; applications to economic data arising in business. Classification 6 students may not enroll in this course. Prerequisite: STAT 652 or equivalent or approval of instructor. Cross-listed with INFO 655.
- 656. Applied Analytics Using SAS Enterprise Miner. (3-0). Credit 3.** Introduction to data mining and will demonstrate the procedures; Optimal prediction decisions; comparing and deploying predictive models; neural networks; constructing and adjusting tree models; the construction and evaluation of multi-stage models. Prerequisite: STAT 657.
- 657. Advanced Programming Using SAS. (3-0). Credit 3.** Programming with SAS/IML, programming in SAS Data step, advanced use of various SAS procedures. Prerequisites: STAT 604 and STAT 642.
- 658. Transportation Statistics. (3-0). Credit 3.** Design of experiments, estimation, hypothesis testing, modeling, and data mining for transportation specialists. Prerequisite: STAT 211 or STAT 651.

- 659. Applied Categorical Data Analysis. (3-0). Credit 3.** Introduction to analysis and interpretation of categorical data using ANOVA/regression analogs; includes contingency tables, loglinear models, logistic regression; use of computer software such as SAS, GLIM, SPSSX. Prerequisite: STAT 601, STAT 641 or STAT 652 or equivalent.
- 661. Statistical Genetics I. (3-0). Credit 3.** Basic concepts in human genetics, sampling designs, gene frequency estimation, Hardy-Weinberg equilibrium, linkage disequilibrium, association and transmission disequilibrium test studies, linkage and pedigree analysis, segregation analysis, polygenic models, DNA sequence analysis. Prerequisites: STAT 610 and STAT 611.
- 662. Advanced Statistical Genetics. (3-0). Credit 3.** This course is a continuation of the course, STAT 661 Statistical Genetics. A strong background in statistics, genetics, and mathematics is required. Topics include counting methods, EM algorithm, Newton's method, scoring in genetics, genetic identity coefficients, descent graphs, molecular phylogeny, models of recombination, sequence analysis, diffusion processes, and linkage disequilibrium mappings. Prerequisites: STAT 610, STAT 611, STAT 661.
- 665. Statistical Applications of Wavelets. (3-0). Credit 3.** This is a course on the use of wavelet methods in statistics. The course introduces wavelet theory, provides an overview of wavelet-based statistical methods. Topics include smoothing of noisy signals, estimation of function data and representation of stochastic processes. Some emphasis is given to Bayesian procedures. Prerequisite: STAT 611 or approval by the instructor.
- 667. Statistics for Advanced Placement Teachers. (3-0). Credit 3.** Review of the fundamental concepts and techniques of statistics; topics included in Advanced Placement Statistics; exploring data, planning surveys and experiments, exploring models, statistical inference. Prerequisite: Approval of instructor.
- 671. Methods of Statistical Data Modeling I. (3-0). Credit 3.** Introduction to new methods of statistical analysis, especially statistical data modeling, exploratory data analysis, adaptive and robust estimation. Prerequisite: STAT 611 or equivalent.
- 673. Time Series Analysis I. (3-0). Credit 3.** Introduction to diverse modes of analysis now available to solve for univariate time series; basic problems of parameter estimation, spectral analysis, forecasting and model identification. Prerequisite: STAT 611 or equivalent.
- 674. Time Series Analysis II. (3-0). Credit 3.** Continuation of STAT 673. Multiple time series, ARMA models, test of hypotheses, estimation of spectral density matrix, transfer function and forecasting. Prerequisites: STAT 673.
- 681. Seminar. (1-0). Credit 1.** Oral presentations of special topics and current research in statistics. May be repeated for credit. Prerequisite: Graduate classification in statistics.
- 684. Professional Internship. Credit 1 to 3.** Practicum in statistical consulting for students in PhD program. Students will be assigned consulting problems brought to the Department of Statistics by researchers in other disciplines. Prerequisite: STAT 642 or its equivalent.
- 685. Directed Studies. Credit 1 to 6.** Individual instruction in selected fields in statistics; investigation of special topics not within scope of thesis research and not covered by other formal courses. Prerequisites: Graduate classification and approval of department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of statistics. Open to non-majors. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more.** Research for thesis or dissertation. Prerequisite: Graduate classification.

Teacher Education

(faculty, see [page 383](#))

(TEED)

- 602. Contemporary Perspectives on Education. (2-3). Credit 3.** Current issues in American public education concerning sociological, curricular, political and legal perspectives. Prerequisite: Admission to Post-Baccalaureate Teacher Certification Program.
- 649. Instructional Strategies in Academic Specialties in Middle and Senior High School: Principles and Applications. (2-3). Credit 3.** Relation of information processing models to theory and practice of planning, delivering and evaluating instruction in public school settings. Subject matter and generic competencies required for teacher certification in Texas.

- 682. Seminar. (3-0). Credit 3.** Reports of research, discussions and analysis of problems and issues in teaching/learning with first year of teaching in public schools. May be repeated for credit. Prerequisites: TEED 602 and TEED 649.
- 684. Professional Internship. Credit 3 to 9.** Supervised experiences in performing professional functions in classroom settings. Prerequisite: Approval of program coordinator.

**Texas A&M University, Baylor College of Medicine, and
University of Texas System
Study Abroad
(TAMU)**

- 699. Courses at Baylor College of Medicine, Institutions within The University of Texas System and Study Abroad. Credit 1 or more each semester or summer term.** Designed to serve registration needs of graduate students who will engage in graduate work through interinstitutional cooperative agreements with Baylor College of Medicine, The University of Texas System or other institutions with which Memoranda of Agreements have been executed. Specific arrangements for registration in this course must be made through the Office of Graduate Studies at Texas A&M University well in advance of the time that the student expects to enroll in the course. Prerequisites: Written permission of the chair of the student's Advisory Committee, the head of the student's major department, the dean of graduate studies at Texas A&M University and the dean of the Graduate School of Baylor College of Medicine or the proper authority of the institution within The University of Texas System or Study Abroad institutio

Systems Engineering

Systems engineering is an organized, systematic approach for the application of technology to complex engineering problems. Such applications will invariably involve many considerations and constraints which are not purely technological. The human, sociological, economic, business and political factors are combined with the creative design aspects of engineering. Areas of special career interest can be developed by combining graduate courses in an engineering specialty or business with systems engineering to respond to the growing demand of industry and government for systems oriented graduates. Persons interested in this program should contact the Associate Dean for Graduate Programs of the Dwight Look College of Engineering, Zachry 204. No graduate degrees in systems engineering are offered; the courses are in support of other programs.

(SYEN)

- 603. Practices in Systems Engineering. (2-2). Credit 3.** Interdisciplinary course with review of engineering principles; develop processes and techniques to show how engineering practices are used to create systems; study of important fundamental aspects of systems engineering such as need analysis, requirements, interface determination, technology selection, communications and cost analysis. Prerequisite: Graduate classification.

**Theatre Arts
(THAR)**

- 685. Directed Studies. Credit 1 to 3 each semester.** Directed studies in specific problem areas in theatre. Prerequisite: Approval of department head.

Intercollegiate Faculty in Toxicology

L. C. Abbott, C. D. Allred, J. A. Arosh, R. L. Autenrieth, E. M. Bailey, J. M. Ball, S. K. Banu, W. Bissett, G. R. Bratton, R. C. Burghardt, J. A. Calvin, R. J. Carroll, R. S. Chapkin, K. Chu, M. F. Criscitiello, W. L. Dees, R. H. Finnell, A. K. H. Holzenburg, I. Ivanov, A. Jayaraman, L. Johnson, A. B. Kier, G. Y. L. Ko, Q. Li, W. Liu, T. J. McDonald, R. C. Miranda, M. A. Mora, A. R. Parrish, T. D. Phillips, P. V. Pietrantonio, M. Pine, W. W. Porter (Intercollegiate Faculty Chair), S. K. Ramaiah, F. M. Raushel, G. M. Rivera, L. H. Russell, S. H. Safe, F. Schroeder, M. O. Scully, S. A. Senseman, M. Sherman, C. H. Spiegelman, J. N. Stallone, G. Stoica, S. U. Talcott, J. A. Thompson, Y. Tian, E. Tiffany-Castiglioni, N. D. Turner, A. R. Villalobos, C. Walker, J. R. Wild, E. Wilson, U. Winzer-Serhan, T. K. Wood, B. Zhou, W. E. Zimmer

Toxicology research and training at Texas A&M has been recognized as a distinct discipline since 1970 when the Texas Higher Education Coordinating Board approved an MS and PhD program in toxicology. The academic component of the program is administered by the Intercollegiate Faculty of Toxicology, which is composed of faculty and graduate students from 16 departments, four colleges and two associated laboratories, namely, the Texas Veterinary Diagnostic Laboratory and the U.S.D.A. Food Animal Protection Research Laboratory as well as several units from the Texas A&M Health Science Center. Admission to the toxicology program requires approval by both the Faculty of Toxicology and a participating academic department. Graduate Research Assistantships and scholarships are available from the Faculty of Toxicology and from individual departments on a competitive basis.

Admission into the toxicology program requires the successful completion of courses in advanced biology and/or chemistry or their equivalents. The completion of a thesis/dissertation is required for MS or PhD degrees in toxicology. It is strongly recommended that all students in the PhD program complete the following core courses or their equivalents: BICH 603. General Biochemistry I. Credit 3; STAT 651. Statistics in Research I. Credit 3; VIBS 619. Food Toxicology II. Credit 3; VIBS 670. Basic Environmental Toxicology. Credit 3; VMID 686. Scientific Ethics. Credit 1; VTTP 673. Metabolic and Detoxication Mechanisms. Credit 3; VTTP 676. Genetic and Molecular Toxicology. Credit 3; VTTP 681. Toxicology Seminar. Credit 1 (each Fall and Spring Semester); VTTP 685. Directed Studies. Credit 1 to 4; Toxicology electives—selected from advanced courses—variable credit.

The toxicology electives may be selected from a number of courses which will provide additional expertise in specialized areas within the subdisciplines of cellular and molecular toxicology, developmental and reproductive toxicology, behavioral and neurotoxicology, and applied veterinary, environmental and food toxicology.

Urban Planning

Urban planning takes a long term, comprehensive and transdisciplinary view towards enhancing the quality of the places we live in. The planning program is directed towards future professionals and scholars who seek to understand and manage urban and natural environments.

The graduate program in urban planning supports the Master of Urban Planning (MUP), as well as students pursuing degrees in fields related to cities and communities, the environment and natural resources, and public service and leadership. Because of the transdisciplinary nature of the MUP program, candidates for this degree are encouraged to apply from a broad range of disciplines such as anthropology, architecture, civil engineering, education, geography, land development, landscape architecture, political science, public service, public health, social work and sociology.

(PLAN)

(faculty, see [page 461](#))

- 601. Introduction to Planning. (1-0). Credit 1.** Will give an overview of the field of planning, the main areas of concentration/employment within the field, the faculty, their areas of expertise, etc. Prerequisite: All MUP students in their first semester.
- 604. Planning Methods I. (3-0). Credit 3.** Fundamental concepts and methods used in urban and regional research; qualitative and quantitative research designs; measurement and scaling; sampling; data collection; data file construction; introduction to data analysis and statistical inference. Prerequisite: Graduate classification.

- 610. Structure and Function of Urban Settlements. (3-0). Credit 3.** The study of urbanization and how geographic, economic, sociological and political factors give rise to changes in the structure and functions of cities; how the movement of people, products, services and capital create unique urban patterns of land use and infrastructure with implications for long-term livability and sustainability. Prerequisites: Graduate classification.
- 612. Transportation in City Planning. (2-3). Credit 3.** Influence of transportation in shaping urban form; relationships between land use and transportation; conceptual layout of street systems; trends in urban development, site development, circulation and relationships to the street system; guidelines for the redevelopment of existing streets and the adjacent land.
- 613. Planning Methods and Techniques. (3-0). Credit 3.** Methods and techniques of research, data collection and analysis; coordination of planning process with public policy and plan implementation.
- 614. Planning and Technological Changes. (3-0). Credit 3.** Examines the general relationships between technology and social change; examine the historical and technological roots of change; focuses on the social impact of technological change.
- 616. Analyzing Risk/Hazard and Public Policy. (3-0). Credit 3.** Evaluation and development of risk analysis, including risk assessment, perception of risk, risk communication and risk management; the mitigation of risk, involving technology, emergency management, disaster preparedness; emphasizes the relationship with risk analysis in public policy, participation, emergency preparedness, hazard mitigation and the management of risk. Prerequisite: Graduate classification.
- 620. Dispute Resolution and Participation in Planning. (3-0). Credit 3.** Theory and practice of public policy-oriented alternative dispute resolution (ADR) especially in environmental and land planning and regulation; practical skills of facilitation/mediation as aids to conventional public participation; voluntary negotiation as a supplement to regulation; relevant theoretical perspectives from decision and game theory and compensation literatures. Prerequisite: Graduate classification.
- 623. Development Planning in Third World Countries. (3-0). Credit 3.** Examines historical, political, economic, social and cultural dimensions of "Third World" development problems; application of planning methods and techniques toward long-term solutions in the context of unfolding contemporary world events; considers the role of international lending institutions, technical assistance and funding requirements in developing countries.
- 625. Geographical Information Systems in Landscape and Urban Planning. (2-3). Credit 3.** Provides students an understanding of GIS fundamentals; basic concepts, principles and functions; essential skills for applying GIS in various fields such as urban planning, landscape architecture, land development, environment studies, transportation and hazard management; based on learning through class projects. Prerequisite: Graduate classification.
- 626. Advanced GIS in Landscape Architecture and Urban Planning. (2-2). Credit 3.** Continuation of GIS in Landscape Architecture and Urban Planning PLAN 625; topics include advanced spatial analysis technology: emphasis on urban planning, landscape architecture, land development, hazard management and related applications to issues. Prerequisite: PLAN 625.
- 627. Economic Development. (3-0). Credit 3.** Examines the strategies employed in the pursuit of local economic development. Discusses basic principals for critically assessing alternative development policies and programs; reflects on the goals and objectives of economic development efforts; and identifies tools for structure and financing local projects.
- 628. Affordable Housing Development. (3-0). Credit 3.** Affordable Housing Development is designed to teach planning and land development students how the development of affordable housing through public, private and non-profit partnerships can meet the housing needs of low-and-moderate-income households.
- 629. Neighborhood Revitalization. (3-0). Credit 3.** This course addresses the social, political and economic theory of neighborhoods-their growth, function and design. Students will gain an understanding of how neighborhoods experience change, as well as the consequences of this change for residents.
- 630. Survey of Health Planning Processes. (3-0). Credit 3.** Considers evolution and development of the health care system in the U.S. and how hospitals and other health service institutions go about developing strategic planning systems.
- 631. Health Systems Planning and Policy. (3-0). Credit 3.** Specific health planning issues; distribution of manpower and facilities, financial resources, local-federal partnership, system's organization and governance.

- 632. Design for Active Living. (3-0). Credit 3.** Understanding the forms and characteristics of the built environment and the influence on human behaviors, lifestyles and health; theoretical and empirical insights into the issues of physical activity, obesity, and automobile dependency; focus on how changes in the built environment help address these issues. Prerequisite: Graduate classification or approval of instructor. Cross-listed with LAND 632.
- 633. Planning for Healthy Communities. (3-0). Credit 3.** An introduction to issues involved in planning healthy cities/communities; by exploring experiences initiated by the World Health Organization and subsequent international experiences, attention is given to the healthy cities/communities movement in the United States and the case studies of programs at local, state and national levels.
- 634. Environmental Health Policy and Planning. (3-0). Credit 3.** Interdisciplinary perspective of environmental risk analysis methods and policy implications; federal and state agencies and programs involved in developing and implementing environmental health policies and monitoring environmental health hazards; historical and economic context of environmental health legislation; framework for policy making process and criteria to determine effectiveness and outcomes. Prerequisite: Graduate classification.
- 640. Law and Legislation Related to Planning. (3-0). Credit 3.** Legislative process and planning legislation; enabling legislation and legal tools of planner: zoning, subdivision ordinances, eminent domain, extraterritorial jurisdiction and other related planning instruments.
- 641. Problems of Environmental Planning Administration. (3-0). Credit 3.** State and federal legislation pertaining to environmental consumer protective aspects of urban planning; review of administrative procedures; major judicial decisions.
- 642. Planning for Coastal Sustainability and Resiliency. (3-0). Credit 3.** Principles of resiliency and sustainability in coastal areas; examination of issues from ecological, social, economic, organizational, planning and built-environment perspectives; application of principles to realistic problems, settings and solutions. Prerequisite: Graduate classification.
- 643. Preservation Law. (3-0). Credit 3.** Theory and practice of historic preservation in the legal context; the constitutional and statutory foundations of historic resources planning and plan implementation; review of case studies and municipal ordinances.
- 647. Disaster Recovery and Hazard Mitigation. (3-0). Credit 3.** Interdisciplinary study of the impacts of environmental disasters; describes process of disaster recovery and examines methods of reducing future vulnerability; analyzes regulation, market mechanisms, and public education as methods for implementing mitigation measures. Prerequisite: Graduate classification.
- 649. Organizational and Community Response to Crises and Disasters. (3-0). Credit 3.** Introduction to the study of organized and community planning and response to natural and technological disasters and social crisis; focus upon emergency preparedness and response; practical issues, planning for emergency management and existing research literature of basic disaster at the organization and community levels. Prerequisite: Graduate classification.
- 650. Disaster Response Planning. (3-0). Credit 3.** Mitigation, preparedness, response and recovery strategies; roles of the Federal Emergency Management Agency, the Governor's Division of Emergency Management, the National Weather Service and the American Red Cross.
- 651. Planning for Coastal and Marine Protected Areas. (3-0). Credit 3.** The science, policy and politics of establishing coastal and marine protected areas (CMPAs); an interdisciplinary graduate-level seminar; the theory and practice of using protected areas to manage complex problems related to the coastal and marine environment. Prerequisite: Graduate classification.
- 654. Planning Administration and Management. (1-0). Credit 1.** Issues of professional practice in public and private sectors.
- 656. Housing and Community. (3-0). Credit 3.** Housing, its development, planning, marketing, designing, financing, and production; social and design history and contemporary issues of American housing development, urban renewal, neighborhood structure and community facilities.
- 658. Plan Implementation. (3-0). Credit 3.** Techniques of implementing major urban development programs and plans; capital improvements programming and budgeting; overview of regulatory measures including zoning and subdivision regulations; public involvement process; and fiscal planning.

- 661. Information and Communication in Planning. (2-2). Credit 3.** Types and sources of planning related information; use of verbal, printed and electronic media in communicating planning information and formulating alternative solutions to community development problems.
- 662. Applied Planning I. (1-6). Credit 3.** Acquisition, analysis, and management of information pertaining to urban and regional planning in a case specific scenario; issue analysis; formulation of goals and objectives, and policies; consensus building; includes all tasks leading up to the preparation of an urban, regional or strategic plan.
- 663. Applied Planning II. (1-6). Credit 3.** Preparation of a major plan or planning document for a specific subject associated with the field of urban and regional planning including the environment; land use; urban design; transportation systems; housing and community facilities; infrastructure systems; growth management systems; urban image; and other topics. Prerequisite: PLAN 662 or approval of instructor.
- 664. Planning Theory and History. (3-0). Credit 3.** A critical examination of the justifications for and major alternative approaches to planning in the public domain, beginning with the fundamental historical intentions of and projects in city planning within industrial societies and tracing the subsequent development of planning as political reform, political analysis, social mobilization and other modern variants.
- 665. Plan Making. (3-0). Credit 3.** Introduction to a wide variety of styles and methodologies employed by the urban and regional planner; planning styles reviewed include: comprehensive land use planning; policies planning; strategic planning; regional planning; and private sector corporate planning. Emphasis is given to the actual review and content analysis of plans.
- 669. Urban Infrastructure Planning. (2-2). Credit 3.** Identification of urban infrastructure requirements; criteria for utility location and design; projection of the conversion of land to urban uses; estimating demand for urban services; anticipating the effect of urbanization on storm runoff; and municipal practice in financing infrastructure extensions.
- 670. Urban Public Transportation Planning. (2-3). Credit 3.** Planning, operations, fiscal, management and legal aspects of urban, rural and regional public transportation modes; preparation of transportation systems program elements.
- 673. Design for Sustainable Transportation. (3-0). Credit 3.** Introduce planning and design principles, techniques, and examples for achieving sustainable transportation; transit-oriented development, neo-traditional design, traffic calming, non-motorized travel, and smart growth; car sharing, parking pricing, location efficient mortgage, and alternative vehicles and fuel technologies. Prerequisite: Graduate classification.
- 674. Transportation System Analysis. (3-0). Credit 3.** Introduces basic concepts and techniques of modeling, analyzing and solving problems in transportation systems planning, operations, management and design within a unified framework for transportation systems analysis; includes: disaggregate demand theory and application, activity analysis and land use forecasting, network optimization stochastic processes, queuing models and simulation. Prerequisite: CVEN 672 or approval of instructor.
- 675. Theory of Planning and Urbanism. (3-0). Credit 3.** Theories of planning and urbanization in world literature; physical community design as expression of ideology and cultural value systems.
- 676. Transportation Investment Decisions. (3-0). Credit 3.** The course provides the graduate-level student with an overview of the elements of transportation investment decisions including transportation supply, demand, finance, and economic impact.
- 678. Applied Transportation Studio: Site Planning and Traffic Impact. (3-0). Credit 3.** This course provides a practical overview of urban planning and transportation topics including transportation-land use, functional classification, thoroughfare and land use planning, site planning, traffic impact analysis, access management and site design. Prerequisite: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Reports and discussions of current research and selected topics in urban and regional planning. Prerequisite: Approval of instructor.
- 684. Professional Internship. Credit 1 to 8.** Professional practice under approved arrangement with public or private agencies.
- 685. Directed Studies. Credit 1 to 6 each semester.** Individual and group problems dealing with application of planning theory and practice. Opportunities to select foreign and domestic planning project of special interest.

- 689. Special Topics in...** **Credit 1 to 4.** Selected topics in an identified area of urban and regional planning. May be repeated for credit.
- 691. Research.** **Credit 1 or more each semester.** Research for thesis or dissertation.
- 693. Professional Study.** **Credit 1 to 6.** Approved professional study project undertaken as the terminal requirement for the Master of Urban Planning degree; preparation of a record of study summarizing rationale, procedure and results of the completed activity. Prerequisite: Approval of committee chair.

Urban Science

(faculty, see [page 461](#))

(URSC)

- 631. Foundations of Planning Thought. (3-0). Credit 3.** This PhD level course examines a series of foundational issues in planning and design theory. These include the definition of planning problems, rationality, modernism and post modernism, the validation of value judgments, relations with future generations, multiculturalism and gender justice in liberal democratic societies. Prerequisite: Doctoral classification or approval of instructor.
- 632. Structure and Functions of Cities and Regions. (3-0). Credit 3.** Surveys the design, financial, natural, physical, political and social parameters that influence the development of cities and regions, including presentation of theories about cities and regions, organization of, planning to shape them, and public and private sector plans for structure and function of cities and regions. Prerequisite: Doctoral classification or approval of instructor.
- 641. Analytic Methods in Landscape and Urban Research I. (3-0). Credit 3.** Explicitly address linking theory, measurement, data set development and data analysis issues critical for conducting research in urban and regional planning and landscape architecture. Prerequisites: Doctoral classification or approval of instructor.
- 642. Analytic Methods in Landscape and Urban Research II. (3-0). Credit 3.** Provides students in urban and regional science with a survey of hands on experiences with advanced techniques and procedures related to conceptual measurement and operational issues, data set development and manipulation and data analysis issues critical for conducting academic research. Prerequisites: STAT 651, CARC 601, URSC 641, or approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Oral communication of current research and selected topics in urban and regional science to include lectures, presentations, interviews and discussions. Prerequisite: Approval of instructor.
- 682. Seminar. (1-0). Credit 1.** Written communication of current research and selected topics in urban and regional science to include posters, articles, reports and books. Prerequisite: Approval of instructor.
- 685. Directed Studies. Credit 1 to 6.** Directed study of selected problems within urban and regional science. Prerequisite: Approval of instructor.
- 689. Special Topic in...** **Credit 1 to 4.** Selected topics in an identified area of urban and regional science. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for dissertation. Prerequisite: Approval of instructor.

Department of Veterinary Integrative Biosciences

L. C. Abbott, J. A. Arosh, S. K. Banu, F. W. Bazer, G. R. Bratton, C. M. Budke, R. C. Burghardt, J. Cai, B. P. Chowdhary, E. G. Cothran, E. M. Crouch, K. J. Cummings, W. L. Dees, R. H. Finnell, G. T. Fosgate, B. J. Gastel, S. C. Geller, S. A. Hamer, P. G. Harms, A. G. Hoffman, M. A. O. Höök, N. H. Ing, R. Ivanek Miojevic, L. A. Jaeger, G. A. Johnson, L. Johnson, W. R. Klemm, G. Y. Ko, F. H. Landis, J. Li, Q. Li, J. R. Lupton, D. N. McMurray, R. B. Mouneimne, W. J. Murphy, B. Norby, T. D. Phillips, M. Pine, W. W. Porter, T. Raudsepp, J. C. Reagor, L. H. Russell, Jr., P. B. Samollow, H. M. Scott, L. C. Skow, M. R. Slater, J. R. Snell, J. M. Steiner, E. Tiffany-Castiglioni (Head), A. R. Villalobos, M. P. Ward, C. J. Welsh*, T. H. Welsh, Jr.

* Graduate Advisor

The departmental graduate programs are aimed at educating students to be able to advance biomedical science through original research and to disseminate that knowledge for the protection and promotion of animal and human health. The department offers both MS and PhD degrees in Biomedical Sciences (with major specialty areas of cell/molecular biology, developmental biology/embryology, epidemiology, reproduction and neuroscience). MS degrees are also offered in Veterinary Public Health-Epidemiology and Science and Technology Journalism.

Many of the faculty participate in University-wide graduate training programs in Neuroscience, Reproductive Biology, Food Science and Technology, Genetics, Toxicology and Biotechnology.

In addition to the specialty area research training, students have the opportunity to learn anatomy and public health practices in a variety of domestic species and wild, aquatic and laboratory animals. The training in microscopic anatomy includes histology, histochemistry, cytology and ultrastructure (transmission and scanning electron microscopy). The training in public health emphasizes epidemiology, food safety, food toxicology and control of zoonotic diseases.

The Master of Science in Veterinary Public Health-Epidemiology is designed to serve the needs of veterinarians wishing to go into some aspects of government service, military veterinary personnel seeking advanced training in public health and students with a career goal of academia or research.

The Master of Science in Science and Technology Journalism (MS/STJR) is a distinctive program to prepare students for careers as science and technology writers, reporters and editors in the public media, government, industry, academia and other sectors. It also can serve as a foundation for doctoral study.

Study programs are prepared in consultation with the student and a committee of graduate faculty members and its chairperson. The general procedural rules are those specified in this catalog. More detail on core course requirements, degree plans, and administrative matters is available in the department's "Guidelines and Policies" manual.

Veterinary Integrative Biosciences (VIBS)

601. **Anatomy. (2-6). Credit 4 each semester.** Topographical dissection of one of the following domestic animals: horse, ox, dog or cat. May be taken more than once but not to exceed 12 hours of credit toward a graduate degree. Prerequisite: VIBS 912 or VIBS 305 or equivalent.
602. **Histology. (2-6). Credit 4.** Molecular phenomena placed in context with tissues, organs and organ systems; cell and tissue structures visualized by light microscopy and electron micrographs for functional relationships; clinical correlations reveal relevance of histology in specific disease states; conceptual thinking exercises facilitate problem-solving skills. Prerequisite: Graduate classification.
603. **Neuroanatomy. (2-6). Credit 4.** Gross, developmental and microscopic anatomy of nervous system of selected laboratory and domestic animals. Prerequisite: Approval of instructor. Cross-listed with NRSC 603.
604. **Biomedical Neuroendocrinology and Endocrine Disorders. (3-0). Credit 3.** Gross and functional anatomy and endocrine functions of neuroendocrine systems, hypothalamus and pituitary. Neuroendocrine control of puberty, sexual behavior, menstruation, ovulation, pregnancy, labor, lactation, testis, thyroid, growth, stress, diabetes, obesity, sleep, memory, learning and aging and their disorders. Overview biosynthesis, transport and signaling of neuropeptides, prostaglandins, peptide and steroid hormones. Prerequisite: Approval of instructor. Cross-listed with NRSC 604.
605. **Chemical Hazard Assessment. (3-0). Credit 3.** Chemical and biological methods for testing hazardous chemicals and complex mixtures; chemical analysis; microbial bioassays; developmental toxicity; enzyme induction; mammalian cell culture. Prerequisite: Graduate classification.
606. **Neuroanatomical Systems. (3-0). Credit 3.** Course emphasis is on major neural systems that govern identifiable physiological functions, behavior and neurodegenerative disease. Whole-brain anatomy is approached from a "systems" perspective, wherein components of defined functional systems are described in terms of their location, inputs and outputs, and physiological /behavioral significance in health and disease. Prerequisite: Approval of instructor. Cross-listed with NRSC 605.
607. **Applied Epidemiology. (3-3). Credit 4.** An introductory course of the application of epidemiological concepts to the study of disease occurrence in populations of lower animals and man. The purpose of epidemiology is to identify the host, agent and environmental determinants and dynamics of disease spread that provide the basis for successful preventive medicine and public health programs.

- 608. Epidemiology Methods I. (3-3). Credit 4.** Epidemiology concepts and methods used in the investigation of determinants of health or disease in populations; stressing basic methods for experimental design, conduct and analysis of both observational and experimental studies. Prerequisite: STAT 651 or equivalent.
- 609. Anatomy of Reproductive Systems. (2-6). Credit 4.** Gross and microscopic anatomy of the reproductive systems of domestic animals. Prerequisite: VIBS 601 or VIBS 602 or VIBS 910 or equivalent. (Offered in alternate years.)
- 610. Epidemiologic Methods II and Data Analysis. (3-3). Credit 4.** Principles and methods for the analysis of data from epidemiologic studies including the purpose of data analysis and role of statistics, sampling distributions, probability distributions, analysis of crude, stratified and matched data, and the use of linear and logistic regression methods. Prerequisites: VIBS 608 and STAT 651 or approval of instructor.
- 611. Tumor Cell Biology and Carcinogenesis. (3-0). Credit 3.** Basic principles of tumor biology; role of gene-environment interactions; molecular mechanisms regulating cancer initiation and progression; therapeutic treatment of cancer. Prerequisites: BIMS 320 or equivalent; graduate classification.
- 612. Mammalian Embryology. (3-0). Credit 3.** Embryology of domestic mammals; gametogenesis, fertilization, cell proliferation and differentiation, and organogenesis; selected commonly occurring congenital defects of domestic animals used to emphasize embryologic sequences and processes. Prerequisite: Approval of instructor.
- 614. Biodegradation and Bioremediation. (3-0). Credit 3.** Processes affecting the biodegradation of organic chemicals in the environment; assessment of the utility of various remedial procedures, including biodegradation and bioremediation; in site specific situations. Prerequisite: Organic chemistry. Cross-listed with SCSC 614.
- 615. Food Hygiene. (3-3). Credit 4.** The clinical description, pathogenesis, diagnosis, source, epidemiology and prevention or control of food borne diseases caused by biological, chemical and natural hazards. Prerequisite: Graduate classification.
- 616. Advanced Developmental Neurotoxicology. (3-0). Credit 3.** Study of mechanisms of toxicity of substances potentially devastating to the developing brain and spinal cord including lead, mercury and other heavy metals, alcohol, nicotine (smoking), pesticides, flame retardants, and others. Prerequisite: Approval of instructor.
- 617. Cell Biology. Credit 1 to 5.** Series of five 1-hour credit modules focusing on selected aspects of structure, function, and signal transduction in eukaryotic cells through critical analysis of recent literature in the field. Each module listed as separate course section; students may enroll in up to five 1-hour module sections per semester. Prerequisite: Approval of instructor.
- 618. Food Toxicology. (3-0). Credit 3.** The study of food additives, chemical and microbial contaminants, and naturally occurring toxins associated with foods. Prerequisite: Graduate classification.
- 619. Food Toxicology II. (3-0). Credit 3.** Public health implications of toxic factors in foods, their source, nature, occurrence and distributions; emphasis on mycotoxins including their isolation, detection, identification and toxicology; study of state-of-the-art food safety research techniques. Prerequisite: Graduate classification.
- 620. Cytogenetics. (3-0). Credit 3.** Examination and analysis of variation in chromosome structure, behavior and number; developmental and evolutionary effects of this variation. Prerequisite: GENE 603. Cross-listed with GENE 620.
- 628. Scanning Electron Microscopy. (2-4). Credit 3.** Principles of electron interaction with solids; application of secondary and backscatter electron images. Prerequisite: Approval of instructor one semester prior to registration.
- 633. Animal Diseases in Comparative Medicine. (3-0). Credit 3.** The study of major zoonotic diseases, including frequency of occurrence, clinical signs, diagnosis, epidemiology, bioterrorism concerns and the prevention or control in animals and humans. Prerequisite: Graduate classification.
- 640. Neurobiology. Credit 1 to 5.** Biology of the mammalian central nervous system with emphasis on cellular and molecular interactions; contemporary research topics in areas such as neuron-glia interactions, neuroimmunology, neuroendocrinology, developmental neurobiology and neurogenetics; extensive readings from primary literature. Prerequisites: Undergraduate or graduate cell biology, genetics and biochemistry or approval of instructor. Cross-listed with NRSC 640.

- 650. Education in a Veterinary Medical and Biomedical Environment. Credit 1 to 3.** Philosophical, stylistic and methodological consideration for designing, planning implementing and evaluating effective veterinary medical and biomedical teaching and learning. Orientation for graduate school. Prerequisite: Graduate classification.
- 655. Methods of Specialized Journalism. (3-0). Credit 3.** Writing and placement of magazine and journal articles in specialized areas of media content such as agriculture, ecology, science, business, education, natural resources; individual projects directed to student's field of interest.
- 657. Issues in Science and Technology Journalism. (3-0). Credit 3.** Current issues, fundamental concepts in science and technology journalism, communication theory, science and journalism components, philosophy and literature of the field.
- 658. Research Methods in Science and Technology Journalism. (3-0). Credit 3.** Research methods including theory, hypothesis formulation, design, data collection, data analysis, measurement and report writing. Qualitative and quantitative methods. Research topics.
- 660. Reporting Science and Technology. (3-0). Credit 3.** Gathering, writing and editing complex information, translation techniques, interpretation and analysis, literary and organizational devices and measurement of readability.
- 662. Reporting Science Policy. (3-0). Credit 3.** Analysis and reporting of legal, political, economic and business issues in science and technology, public policy-making processes and procedures, interdependence of science and technology, and public policy.
- 663. Biomedical Reporting. (3-0). Credit 3.** Sources of biomedical information, specialized information-gathering skills, key biomedical vocabulary/concepts, audiences, outlets, translation/interpretation, research, ethical issues.
- 664. Risk and Crisis Reporting. (3-0). Credit 3.** Assessment and analysis of environmental and health risk, analytical procedures, interpretation of risk factors, reporting science crisis events.
- 670. Basic Environmental Toxicology. (3-0). Credit 3.** Introduction to general principles of toxicology; test methods, target organs, toxicity of major classes of toxins/toxicants, and risk assessment for engineers and other non-toxicologists; risk assessment methodology. Prerequisite: VIBS 602 or approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Review and discussion of current scientific work in one of the department's areas of specialization (anatomy, cellular and molecular biology, epidemiology, food safety, genetics, informatics, neuroscience, public health concepts, reproduction/developmental biology, toxicology, zoonoses).
- 684. Professional Internship. Credit 1 to 4.** A directed internship in an organization to provide students with on-the-job training with professionals in settings appropriate to the student's professional objectives. Prerequisite: Approval by committee chair.
- 685. Directed Studies. Credit 1 to 4 each semester.** Research problem in one of the department's areas of specialization (anatomy, cellular and molecular biology, epidemiology, food safety, genetics, informatics, neuroscience, public health concepts, reproduction/developmental biology, toxicology, zoonoses, science and technology journalism).
- 689. Special Topics in... Credit 1 to 4.** Selected topics in one of the department's areas of specialization (anatomy, cellular and molecular biology, epidemiology, food safety, genetics, informatics, neuroscience, public health concepts, reproduction/developmental biology, toxicology, zoonoses, science and technology journalism).
- 690. Theory of Research. (3-0). Credit 3.** Theory and design of research related to current biomedical problems especially those involving study of animal disease; philosophical perspectives underlying historical advances in research pertaining to the study, prevention and treatment of disease. Prerequisite: Graduate classification. Cross-listed with VTPP 690 and VPAT 690.
- 691. Research. Credit 1 or more each semester.** Research reported by writing of thesis or dissertation as partial requirement for MS or PhD degree. Prerequisite: Approval of department head.

Department of Veterinary Large Animal Clinical Sciences

W. T. Bissett, T. L. Blanchard, S. P. Brinsko, G. K. Carter, M. K. Chaffin, N. D. Cohen*, E. M. Green, C. C. Love, W. A. Moyer, R. D. Posey, J. Romano, A. J. Roussel (Head), D. G. Schmitz, J. A. Thompson, D. D. Varner, M. A. Walker, K. E. Washburn, J. P. Watkins

* Graduate Advisor

Veterinary Large Animal Clinical Sciences (VLCS)

- 622. Equine Disease and Epidemiology. (3-0). Credit 3.** Principles and methods of epidemiology applied to equine health and prevention and control of selected equine infectious diseases. Prerequisites: Enrollment in equine certificate and graduate classification, or approval of instructor.
- 685. Directed Studies. Credit 1 to 8 each semester.** Original investigations of problems in the field of large animal surgery, therapeutics, preventive veterinary medicine or radiology. May be repeated for credit. Prerequisites: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research for thesis.

Veterinary Medicine—Interdisciplinary (VMID)

- 601. Veterinary Medicine—Interdisciplinary Study Abroad. Credit 1 to 12.** For students in approved programs abroad. May be repeated for credit. Maximum 6 hours free elective credit in a graduate program. Course will be graded on a satisfactory/unsatisfactory basis. Prerequisite: Attend TAMU the semester before and after program.
- 686. Scientific Ethics. (1-0). Credit 1.** Ethical issues of research and methods for resolution of such issues; overview of ethical issues encountered by scientists in the conduct and dissemination of their research, in their pursuit of resources, in their interactions with the press and the broader public and resulting from the extension and technological application of their findings. Prerequisite: Graduate classification.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of veterinary medicine. May be repeated for credit. Prerequisite: Approval of instructor.

Department of Veterinary Pathobiology

L. G. Adams, J. M. Ball, L. R. Berghman, D. J. Brightsmith, D. J. Caldwell, F. J. Clubb, Jr., E. W. Collisson, T. M. Craig, M. F. Criscitiello, T. L. Cyr, D. S. Davis, A. de la Concha, J. N. Derr, S. V. Dindot, J. F. Edwards, M. D. Esteve-Gassent, T. A. Ficht, A. C. R. Ficht, P. J. Holman*, M. Ihrig, M. C. Johnson, A. B. Kier, S. D. Lawhorn, J. L. Leibowitz, M. C. Libal, L. L. Logan (Head), B. Lupiani, K. J. Mansell, J. M. Musser, W. Mwangi, M. Nabity, J. B. Osterstock, S. L. Payne, S. D. Pillai, R. R. Pool, Jr., B. F. Porter, W. W. Porter, S. K. Ramaiah, S. M. Reddy, G. M. Rivera, A. Rodrigues, K. E. Russell, J. E. Samuel, C. M. Scanlan, C. M. Seabury, R. Smith, III, K. F. Snowden, J. M. Steiner, G. Stoica, R. W. Storts, I. R. Tizard, R. M. Tsoilis, S. D. Waghela, G. G. Wagner, B. R. Weeks, C. J. Welsh, J. E. Womack, S. Zhang, G. Zhu, D. B. Zimmer

* Graduate Advisor

The department offers programs of graduate instruction and research leading to the Master of Science degree in Biomedical Sciences or Laboratory Animal Medicine. The Doctor of Philosophy degree is offered in Veterinary Pathobiology or Biomedical Sciences. Degrees in the Intercollegiate Graduate programs such as Genetics, Toxicology or Biotechnology may also be pursued. Major specialty areas including infectious diseases (virology, bacteriology, parasitology), biodefense and emerging infectious diseases, metabolic diseases, genetics/genomics, neuroscience, cardiovascular science and immunology may be studied for any of the departmentally offered graduate degrees.

The department offers post-doctoral (DVM) Residency/Graduate programs in anatomic pathology, clinical pathology and clinical microbiology. Residents are required to enroll in graduate courses and may pursue either a Master of Science or Doctor of Philosophy degree. Minimum DVM Residency qualifications include a DVM/VMD degree from an accredited college of veterinary medicine and eligibility to obtain a license to practice in the state of Texas. Selection of residents is made on the basis of academic achievement, letters of recommendation and pertinent experience.

The College of Veterinary Medicine and Biomedical Sciences, Texas A&M University and the Comparative Medicine Program through the Department of Veterinary Pathobiology offer a three-year postdoctoral (DVM) Residency/Graduate program in Laboratory Animal Medicine (LAMD). Residency certificate and Master of Science degree in LAMD are awarded following successful completion of the required coursework, scholarly research and a master's thesis. A student may opt to pursue a Doctor of Philosophy degree in a related field (pathology, microbiology, genetics) following completion of the LAMD residency. A primary objective of the program is to provide postdoctoral veterinary training in the management of clinical problems of laboratory animals with an emphasis on comparative and preventive medicine, both individual and population, for a wide variety of species used for teaching and research.

The program offers training to support preparation toward American College of Laboratory Animal Medicine (ACLAM) board certification and to provide individuals with a broad foundation in laboratory animal medicine.

For further information regarding these programs, please contact Dr. Patricia Holman, Graduate Advisor, Department of Veterinary Pathobiology, (979) 845-4202, (pholman@cvm.tamu.edu). Also browsing the following websites may provide additional information: Comparative Medicine Program (cmp.tamu.edu); Veterinary Pathobiology (vetmed.tamu.edu/vtpb); Texas A&M University (tamu.edu); Office of Graduate Studies (ogs.tamu.edu); College of Veterinary Medicine and Biomedical Sciences (vetmed.tamu.edu); and a guide to the Bryan-College Station area (vetmed.tamu.edu/college/about-the-area).

Veterinary Microbiology (VTMI)

- 601. Fundamentals of Pathobiology. (5-0). Credit 5.** Encompasses the concepts of pathobiology including bacterial, viral and parasitic diseases, the host response to infectious agents, pathology, and metabolic and genetic diseases; includes animal and human diseases and provides enough background to facilitate students in advanced graduate courses. Prerequisite: Graduate classification.
- 614. Fermentation and Gastrointestinal Microbiology. (3-0). Credit 3.** Fermentation and gastrointestinal ecosystems in terms of microorganisms present, their activities and requirements and their interactions in a dynamic system. Prerequisite: Beginning microbiology and/or biochemistry or approval of instructor. Cross-listed with POSC 614 and NUTR 614.
- 615. Immunogenetics and Comparative Immunology. (3-0). Credit 3.** Genetic mechanisms used to diversify immune receptors; immunoglobulins, T cell receptors, major histocompatibility complex, natural killer cell receptors, toll-like receptors and many others; selected comparative and veterinary examples of different immune recognition systems; evolution of the immune system; theoretical immune surveillance and vaccine development. Prerequisite: Graduate classification; GENE 320 and VTPB 409, or equivalent, or permission of instructor.
- 619. Molecular Methods for Microbial. (2-2). Credit 3.** Underlying principles of molecular methods for microbial detection and characterization in natural and man-made ecosystems; emphasis on method application and data interpretation; emphasis on microbial pathogens and indicator organisms in foods and environment; laboratory covers select protocols. Prerequisite: POSC 429/FSTC 326/SCSC 405/ approval of instructor. Cross-listed with SCSC 619/FSTC 619/POSC 619.
- 629. Laboratory Quality Systems. (3-0). Credit 3.** Quality systems and method development used within a laboratory; ensuring the integrity of procedures used in lab processes, chain of custody, information management, and international laboratory standards; regulatory requirements for laboratory operation; bio-security precautions; laboratory management. Cross-listed with SCSC 629.
- 643. Pathogenic Bacteriology I. (3-4). Credit 4.** Pathogenic bacteria, their cultural and biological characteristics and pathogenicity. Prerequisite: Minimum of 8 hours of undergraduate microbiology.
- 645. Host-Agent Interaction. (3-0). Credit 3.** Basic concepts of infection versus disease; molecular approaches to problems in microbiology; inducible host responses, agent escape mechanisms and movement of potential pathogens in the ecosystem. Prerequisite: GENE 431 or equivalent.
- 647. Virology. (3-3). Credit 4.** Virus infections in animals and humans; types of infections, mode of transmission, intracellular pathology, epidemiology, isolation and identification of inciting agents; tissue cultivation, animal inoculations and diagnostic tests. Prerequisite: VTPB 438 or equivalent.
- 648. Medical Mycology. (3-3). Credit 4.** Actinomycetes, yeasts and molds that are pathogenic to humans and animals; morphology, cultural characteristics, pathogenicity and identification; practice consists of exercises in cultural methods, morphological characteristics, biochemical reactions and diagnosis. Prerequisite: Minimum of 8 hours of undergraduate microbiology.

- 649. Immunology. (3-0). Credit 3.** Cellular basis of the immune response; relationships between inflammation and acquired immunity, MHC and cell activation; the role of cytokines in immunoregulation and hypersensitivity, vaccines, and the mechanism of immunity to viruses, bacteria and parasites. Prerequisite: VTPB 409 or equivalent. Cross-listed with POSC 649.
- 650. Experimental Immunology. (3-3). Credit 4.** Familiarization, development and integration of techniques into experimental design of immunologic investigation; antibody production, protein purification, immunofluorescence, agar-gel diffusion, immunoelectrophoresis and specialized serologic tests. Cross-listed with POSC 660.
- 654. Cell Culture Techniques. (1-6). Credit 3.** Introduction to the theory and practice of cell culture and provides illustrations of its applications; how to maintain a cell culture unit and culture cell lines; how to derive new cell cultures from animal tissues, characterize cultured cells, optimize in vitro conditions and introduce genetic changes into cultured cells. Prerequisite: Approval of instructor.
- 662. Advanced Immunologic Concepts. Credit 1 to 5.** Modular course with detailed discussions, workshops and assigned reading/problem solving on advanced topics; structural organization of molecules; genetic regulation; cytokine cascades; pathophysiology of autoimmunity. May be repeated for credit. Prerequisites: VTMI 649; BICH 603 or equivalent; approval of instructor.
- 663. Molecular Biology of Viruses. (3-0). Credit 3.** In-depth studies of the biochemistry and the replication strategies of viruses and molecular mechanisms of pathogenesis for selected viral systems. Prerequisite: Graduate classification in pathology, molecular biology, biochemistry, or approval of instructor. Cross-listed with MMPA 663.
- 664. Mammalian Genome Modification for Biomedical Research. (3-0). Credit 3.** This course reviews the uses of genetic manipulation in biomedical research and provides students with a working knowledge of the various strategies used to modify mammalian genomes including transgenes, homologous recombination, gene-trapping, RNA interference, cloning, and gene therapy.
- 665. Viral Vectors and Gene Therapy. (3-0). Credit 3.** This course will describe various viral vector systems, their development and their use as research tools in biotechnology and gene therapy. The course will consist of a mixture of short lectures and discussion of papers from the literature. Prerequisites: VTMI 663, VTMI 647, PLPA 616, or PLPA 620 or approval of instructor. Cross-listed with MMPA 665 and PLPA 665.
- 681. Seminar. (1-0). Credit 1.** Review and discussion of current scientific work and research in field of microbiology and related subjects. Prerequisite: Approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Problems course in microbiology. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of veterinary microbiology. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more with a maximum of 23.** Research for thesis or dissertation.

Veterinary Parasitology (VPAR)

- 601. Parasitology. (3-3). Credit 4.** Important helminth parasites of animals and humans; their identification, distribution and life history. Prerequisites: VTPB 487 or equivalent or approval of instructor.
- 604. Parasitic Protozoa. (3-3). Credit 4.** Taxonomy, morphology, life cycle, physiology, distribution, genetics, host relations, methods and diagnosis concerned with protozoan parasites affecting vertebrates including humans. Prerequisite: VTPB 487 or ENTO 208 or BIOL 438 or equivalent or approval of instructor.
- 605. Molecular and Immunological Parasitology. (3-0). Credit 3.** Basic concepts and recent advancement in molecular biology and molecular immunology of parasitic diseases. Molecular-based host-parasite interactions.
- 685. Directed Studies. Credit 1 to 4 each semester.** Special problems concerned with parasites of animals or humans. Prerequisites: VPAR 601 or equivalent; approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of biomedical parasitology. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research for thesis.

Veterinary Pathology (VPAT)

- 601. Comparative Pathology. (3-3). Credit 4.** Pathologic processes occurring in diseased cells, tissues and organs of animals and humans; their pathogenesis and morphologic manifestations. Prerequisites: Courses in gross and microscopic mammalian anatomy and physiology and approval of instructor.
- 620. Humane, Public Health and Regulatory Aspects of Animal Use. (1-0). Credit 1.** Emphasizes thoughtful and humane use of animals in teaching, research and service; human and animal health benefits of biomedical research; governmental policies regulations, public health implications, management practices, and public relations pertaining to animal use in research and teaching.
- 640. Advanced Mechanisms of Disease. (3-0). Credit 3.** Concepts of pathogenesis of disease processes. Prerequisite: DVM degree or approval of instructor.
- 641. Systemic Pathology I. (2-4). Credit 4.** Disease manifestations in special organs and tissues and interrelations of pathologic processes in individual and functionally related organs. Prerequisite: DVM degree or equivalent.
- 642. Mechanisms of Metabolic Disease. (3-0). Credit 3.** Characteristics and mechanisms of diseases caused either by deficiency, imbalance, excess of specific nutrients or chemicals, or by regulatory disturbances of metabolism. Prerequisite: DVM degree or approval of department head.
- 643. Applied Pathology. Credit 1 or more each semester.** Application of information and concepts of anatomic and clinical pathology to the diagnosis of animal disease; gross pathological changes observed in necropsy are correlated with and corrected by histopathologic observations; confirmatory methods of clinical pathology and laboratory medicine used where indicated. May be taken more than once but not to exceed 6 hours of credit toward a graduate degree. Prerequisite: DVM degree or equivalent.
- 645. Neoplastic Diseases. Credit 1 to 8.** Theoretical, histopathological and clinical aspects of neoplasia. Diagnosis of neoplastic and related conditions in all species. May be taken more than once but not to exceed 8 hours of credit toward a graduate degree. Prerequisite: DVM degree or equivalent.
- 650. Neuropathology of Animals. Credit 1 to 4.** Pathology and pathogenesis of diseases of the central and peripheral nervous systems. Interpretation of gross and microscopic lesions of the nervous system associated with disease processes. May be taken more than once but not to exceed 4 hours of credit toward a graduate degree. Prerequisite: DVM degree or equivalent.
- 651. Systemic Pathology II. (1-3). Credit 2.** Continuation of VPAT 641. Disease manifestations in special organs and tissues and interrelations of pathologic processes in individual and functionally related organs. Prerequisite: VPAT 641.
- 653. Diseases of Laboratory Animals. (3-0). Credit 3.** Pathology and pathogenesis of spontaneous infectious, parasitic, metabolic and neoplastic diseases of laboratory animals. Prerequisite: VTPB 922 or equivalent.
- 681. Seminar. (1-0). Credit 1.** For graduate and special students in veterinary or comparative pathology; presentation and discussion of special topics and research data concerning pathology and pathogenesis of disease. Prerequisite: Approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Advanced special problems concerned with pathogenesis and pathology of disease. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of veterinary or comparative pathology. May be repeated for credit.
- 690. Theory of Research. (3-0). Credit 3.** Theory and design of research related to current biomedical problems especially those involving study of animal diseases; philosophical perspectives underlying historical advances in research pertaining to the study, prevention and treatment of disease. Prerequisite: Graduate classification. Cross-listed with VIBS 690 and VTPP 690.
- 691. Research. Credit 1 or more each semester with a maximum of 23.** Research for thesis or dissertation.

Department of Veterinary Physiology and Pharmacology

E. M. Bailey, Jr., N. P. Clarke, T. A. Cudd, M. C. Golding, G. Han, C. L. Heaps, J. D. Herman, K. Hinrichs, J. F. Hunter, I. V. Ivanov, D. H. Jones, D. C. Kraemer, G. A. Laine (Head), C. R. Long*, C. M. Quick, A. J. Roussel, Jr., S. H. Safe*, F. Schroeder, J. N. Stallone, R. H. Stewart, Y. Tian, C. Walker, J. S. Wasser, M. E. Westhusin, C. Woodman, B. Zhou

* Graduate Advisor

Graduate programs leading to the Master of Science and Doctor of Philosophy degrees in biomedical sciences or toxicology are designed to prepare the graduate for research, teaching and other related areas. Faculty specialty areas include cardiovascular sciences, reproductive sciences and toxicology. Several departmental faculty members serve on university intercollegiate faculties.

There is no departmental requirement for foreign languages. These are considered in the same status as other supplementary areas of study to be included when indicated by the individual needs of students.

Veterinary Physiology and Pharmacology (VTPP)

605. **Systemic Veterinary Physiology I. (5-0). Credit 5.** Aspects of cellular physiology, physiology of excitable membranes, physiology of body fluids, neurophysiology, and the physiology of smooth, cardiac and skeletal muscle; provides a basic understanding of mammalian physiology essential as a framework for advanced graduate studies. Prerequisite: Graduate classification.
606. **Systemic Veterinary Physiology II. (5-0). Credit 5.** In-depth study covering cardiovascular, respiratory, renal physiology, gastrointestinal and endocrine physiology; provides a basic understanding of mammalian physiology essential as a framework for advanced graduate studies. Prerequisite: VTPP 605.
610. **Physiology I. (5-2). Credit 6.** Introduction to physiology: cell physiology, cell signaling, cell cycle, body fluids, translocation of materials, membrane potentials, neurophysiology, autonomic nervous system, thermoregulation, cardiovascular, and muscle physiology. Prerequisites: Enrollment in MS/PhD program in Veterinary Physiology and Pharmacology; approval of instructor.
612. **Physiology II. (5-2). Credit 6.** Blood and lymph, respiration, renal physiology, and acid-based balance, gastrointestinal physiology, metabolism, endocrinology, and reproduction. Prerequisites: Enrollment in MS/PhD program in Veterinary Physiology and Pharmacology; approval of instructor.
623. **Biomedical Physiology I. (3-2). Credit 4.** Physiological principles, review of cellular physiology, and development of an understanding of the nervous system and muscle, cardiovascular, and respiratory physiology; clinical applications related to organ systems. Prerequisites: Graduate classification; BICH 410 and VIBS 305 recommended.
625. **Pharmacology. (3-0). Credit 3.** Introduction to pharmacokinetics and pharmacodynamics; survey of major pharmaceutical classes; uses, mechanisms of action and adverse reactions of selected agents. Prerequisites: Graduate classification; VTPP 423 or Approval of instructor.
627. **Biomedical Physiology II. (3-0). Credit 3.** Continuation of VTPP 623 Fluid balance and acid-base balance; development of an understanding of renal, gastrointestinal, endocrine and reproductive physiology using human and other mammalian models; clinical applications related to organ systems. Prerequisites: Graduate classification; VTPP 623.
628. **Pharmacology I. (4-2). Credit 5.** Pharmacokinetics, pharmacodynamics, CNS pharmacology, autonomic pharmacology, antineoplastic agents, immunopharmacology, recombinant products, fluid and electrolyte therapy, diuretics, pharmacology of the integument. Prerequisite: Approval of instructor.
629. **Pharmacology II. (2-2). Credit 3.** Antimicrobials, endocrine pharmacology, eicosanoids, anti-inflammatory agents, respiratory pharmacology, anticoagulants and hematinics, GI pharmacology, cardiovascular pharmacology. Prerequisite: Approval of instructor.
630. **Pharmacology/Toxicology. (2-2). Credit 3.** Management and treatment of toxicosis, antidotal pharmacology, toxic plants, mycotoxins, chemical toxicants, metals, euthanasia. Prerequisite: Approval of instructor.

- 634. Physiology for Bioengineers I. (3-3). Credit 4.** Cellular anatomy, cellular physiology and biochemistry; systems analysis of digestive, endocrine and musculoskeletal system function including information related to gross anatomy, histology and disease states; quantitative aspects of physiology and engineering applications to clinical medicine. Prerequisite: Biomedical Engineering major or instructor approval.
- 635. Physiology for Bioengineers II. (3-3). Credit 4.** A systems analysis of nervous, cardiovascular, respiratory and urinary function including information related to gross anatomy, histology and disease states; quantitative aspects of physiology and engineering applications to clinical medicine. Prerequisite: VTPP 634.
- 638. Analysis of Genomic Signals. (2-2). Credit 3.** Overview of current high throughput technology for data acquisition and analysis of genomic signals (e.g., mRNA or proteins); emphasis on microarray technology, methods for analyzing microarray data, and approaches to model the underlying phenomena from the systems biology perspective. Prerequisites: BIOL 451 or GENE 320/BIMS 320 or equivalent; STAT 651 or equivalent; or approval of instructor.
- 653. Endocrinology. (3-3). Credit 4.** Physiology, biochemistry and pharmacology of the endocrines. Laboratory emphasizes a number of classical experiments with clinical application. Prerequisite: Approval of instructor.
- 654. Molecular Endocrinology. (3-0). Credit 3.** Structure-function relationships of hormones, their receptors and biologic activities. Prerequisites: VTPP 653 or BIOL 649 and BICH 410 or equivalent or approval of instructor. Cross-listed with ANSC 654.
- 655. Vascular Physiology. (4-0). Credit 4.** Structure and function of blood vessels and vascular beds; molecular and cell biology of endothelium and vascular smooth muscle; microcirculation; capillary exchange; regulation of blood flow by local, neural and humoral signals. Prerequisite: MPHY 901 or approval of department head.
- 656. Physiology of the Heart. (4-0). Credit 4.** Structure and function of the heart; molecular and cell biology of cardiac myocytes; electrophysiology of myocardium, pacemaker cells and conducting tissue; cardiac mechanics; control of cardiac performance; coronary circulation. Prerequisite: MPHY 901 or 604 or approval of department head.
- 657. Cardiovascular Physiology. (3-3). Credit 4.** Physiological considerations of the circulatory system including general and integrative aspects of the heart and blood vessels. Prerequisites: Approval of instructor.
- 658. Anatomy and Physiology of the Equine Foot. (3-0). Credit 3.** In-depth study of the anatomy and physiology of the foot of the horse; includes both gross and histologic anatomy, metabolic and nutrition and biomechanics of the equine foot. Prerequisites: VTPP 323 and VTPP 423.
- 659. Gamete and Embryo Physiology. (2-2). Credit 3.** Physiology of gametes and preimplantation embryos in livestock and laboratory animals; oocyte growth and maturation in-vivo and in-vitro, fertilization in-vivo and in-vitro, embryo transfer, cryopreservation, nuclear transfer, chimera formation, gene transfer.
- 665. Pharmacology. (3-3). Credit 4.** Pharmacokinetic and pharmacodynamic principles of pharmacology, absorption, biotransformation, distribution, excretion, dose-response relationships, adverse reactions, and interactions. Prerequisites: Undergraduate, professional or equivalent course in physiology, pharmacology, biochemistry, introductory calculus.
- 667. Current Topics in Pharmacology. (3-0). Credit 3.** Discussions of literature regarding topics of current research interest; physiochemical or physiologic effects of drugs at sites from molecular to whole body. Prerequisite: Approval of instructor.
- 670. Toxicology. (3-3). Credit 4.** Fundamentals of toxicology including the disease syndromes produced in humans and animals by organic and inorganic chemicals; environmental factors in intoxications. Prerequisites: Advanced standing in biochemistry and physiology; approval of instructor.
- 671. Toxicity Testing Concepts. (2-2). Credit 4.** Approval processes for compliance with federal drug and chemical laws. Prerequisites: VTPP 665 and VTPP 670 or approval of instructor.
- 672. Toxic Plants and Biotoxins. (2-3). Credit 3.** An examination of the disease syndromes produced in animals and humans by native, ornamental and introduced plants, vertebrate and invertebrate toxins and mycotoxins; field trips for plant identification. Prerequisites: VTPP 670; approval of instructor.

- 673. Metabolic and Detoxication Mechanisms. (3-0). Credit 3.** Fate of foreign compounds; their inhibitory and antagonistic action toward normal metabolic processes of the animal body. Prerequisites: BICH 603; approval of instructor and department head.
- 674. Natural Products Toxicology. (3-0). Credit 3.** Occurrence, identification and metabolism of naturally occurring toxicants of plant, animal and microbial origin. Prerequisites: CHEM 628; approval of instructor.
- 675. Industrial and Environmental Toxicology. (3-0). Credit 3.** Fundamentals of toxicology and risk assessment; effects of selected classes of hazardous chemicals encountered in the workplace or environment on human health will be considered. Prerequisite: Approval of instructor.
- 676. Genetic and Molecular Toxicology. (3-0). Credit 3.** Mechanisms of toxicant-induced target organ toxicity with emphasis on molecular control of mammalian and cell growth differentiation. Prerequisite: Graduate course in cell biology and biochemistry.
- 677. Fluorescence Detection: Steady State, Time Resolved and Imaging. (4-0). Credit 4.** Fluorescence spectroscopy and confocal/multiphoton microscopy in research; intro of pharmacology, life science, and physical science students to fluorophores, anisotropy, ligand binding, energy transfer, cytometry, lifetime imaging, correlation spectroscopy, immunocytochemistry, and image analysis with an emphasis on instrumental/sample artifacts, fluorescence application, literature evaluation, and communication of rationales to other scientists. Prerequisite: General chemistry and biology course.
- 681. Seminar. (1-0). Credit 1.** Review and discussion of current scientific work in physiology and related subjects. Prerequisite: Approval of department head.
- 685. Directed Studies. Credit 1 to 4 each semester.** Problems in physiology, pharmacology or toxicology. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of veterinary physiology and pharmacology. May be repeated for credit. Prerequisite: Approval of instructor.
- 690. Theory of Research. (3-0). Credit 3.** Theory and design of research related to current biomedical problems especially those involving study of animal disease; philosophical perspectives underlying historical advances in research pertaining to the study, prevention and treatment of disease. Prerequisite: Graduate classification. Cross-listed with VIBS 690 and VPAT 690.
- 691. Research. Credit 1 or more each semester.** Original investigations in veterinary physiology, pharmacology or toxicology to be submitted by writing of thesis or dissertation as partial fulfillment for MS or PhD degree. Prerequisite: Approval of department head.

Department of Veterinary Small Animal Clinical Sciences

J. R. August, J. W. Barr, C. L. Barton, J. E. Bauer, B. V. Beaver, G. L. Carroll, J. Dziezyc, T. W. Fossum, S. G. Gordon, S. M. Hartsfield (Head)*, H. P. Hobson, L. M. Howe, D. A. Hulse, S. C. Kerwin, G. E. Lees, J. M. Levine, N. S. Matthews, M. W. Miller, K. S. Rogers, A. B. Saunders, W. B. Saunders, J. M. Steiner, J. S. Suchodolski, M. D. Willard, D. A. Williams, H. M. Wilson-Robles, A. M. Wolf, D. L. Zoran

* Graduate Advisor

Veterinary Small Animal Clinical Sciences (VSCS)

- 681. Seminar. (1-0). Credit 1.** Current scientific work in medical and surgical fields in and related to small animal medicine and surgery. May be repeated for credit. Prerequisite: DVM degree or approval of department head.
- 685. Directed Studies. Credit 1 to 8 each semester.** Original investigations of problems in field of small animal surgery, therapeutics or radiology. Prerequisite: DVM degree or approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 4.** Special topics in an identified area of small animal medicine or surgery. May be repeated for credit. Prerequisite: DVM degree or approval of instructor and department head.
- 691. Research. Credit 1 or more each semester.** Research for thesis.

Department of Visualization

E. Akleman, J. Bienko, R. R. Davison, H. F. Eilers, P. Galanter, K. E. Hillier, D. H. House, C. LaFayette,
T. R. Larsen, T. McLaughlin (Head), A. McNamara, F. I. Parke, V. Srinivasan, L. G. Tassinari, Y. Williams

Visualization (VIZA)

611. **Concepts of Visual Communications I. (2-4). Credit 4.** Theory and practice of visual communication using a variety of media to explore perception, form-making, color, and historic and personal sources of creativity. Prerequisite: Graduate classification in visualization or approval of instructor.
612. **Concepts of Visual Communications II. (2-4). Credit 4.** Exploration of perception, vision and self-expression for communication through visual images; image-making processes include conventional and digital media. Prerequisite: Approval of instructor.
613. **3-D Modeling and Animation. (3-2). Credit 4.** Principles of 3-D computer animation with an emphasis in aesthetics and techniques for 3-D modeling, color, texture, lighting, motion control and rendering. Prerequisite: Graduate classification in visualization or approval of instructor.
614. **Form/Installation/Environment. (2-3). Credit 3.** Aesthetic and functional concerns involving public spaces; interdisciplinary investigation of audible, visual and form potential of environmental space utilizing models and electronic imaging technology; ethical responsibilities regarding the environment and its use. Prerequisite: Graduate classification or approval of instructor.
615. **Computer Animation. (3-2). Credit 4.** Intermediate level computer animation—focusing on production of three dimensional computer generated animation which may or may not integrate video and photographic elements. Prerequisite: VIZA 613 or approval of instructor.
616. **Rendering and Shading. (2-2). Credit 3.** Exploration of advanced rendering and shading techniques for the attainment of a desired visual effect; topics may include shading languages, attainment of visual realism, integration of rendering and modeling tools, and non-photorealistic rendering. Prerequisite: VIZA 613 or approval of instructor.
617. **Advanced Animation. (2-4). Credit 4.** Development of advanced three-dimensional computer animation with emphasis on successful storytelling and visual communication; may include story development, expressive character design, motivation, acting, speech animation, choreography, stage lighting, storyboards, soundtracks, story reels, production efficiency, and successive refinement. May be taken twice. Prerequisite: VIZA 615 or approval of instructor.
618. **Facial Modeling and Animation. (2-2). Credit 3.** Design and analysis of articulated 3D models for creating facial animation; includes designing expressive 3D faces, exaggerations, facial expressions and facial animation techniques. Prerequisite: VIZA 613 or approval of instructor.
622. **Design Communication I. (2-4). Credit 4.** Theory and practice of visual communication employing a variety of digital and conventional media; emphasis on creating effective, self-expressive images employing the combined use of a variety of media. Prerequisite: VIZA 612, graduate classification or approval of instructor.
623. **Design Communication II. (1-4). Credit 3.** Development of concepts and forms in visual communications; organization of complex problems in production; synthesis of skills, information tools and methodology. Prerequisite: VIZA 622 or approval of instructor.
625. **Multi-Media Web Design. (2-2). Credit 3.** Examination of aesthetic, narrative, technical strategies; multi-media content on the web; methods of integrating imagery, animation, sound; non-linear multi-media narration. Application of multi-media techniques for navigation, interaction, animation, vector drawing, video, audio. Prerequisite: Graduate classification in visualization or approval of instructor.
626. **Generative Art and Design. (1-4). Credit 3.** Theory and creative application of generative systems in studio art practice; chance based systems include random numbers and noise; biologically inspired systems include genetic algorithms, L-systems, and artificial life; systems drawn from complexity theory include, cellular automata, fractals, finite state machines, catastrophe theory, reaction diffusion systems, and chaos. May be taken 2 times for credit. Prerequisite: Graduate classification in visualization or approval of instructor.
627. **Design Communication III. (2-2). Credit 3.** Advanced methods in video, photography and/or animation production; application of image strategies used in contemporary media. May be taken twice. Prerequisite: VIZA 622 or VIZA 643 or approval of instructor.

- 629. Digital Media: Inspiration and Process. (2-2). Credit 3.** Exploration of artwork and literature that has informed contemporary creativity provides a broad basis for discovery through reading, writing, studio projects; students will demonstrate a knowledge of creative strategies including, but not limited to mapping, database, allegory, sampling, and generative systems. Prerequisite: Graduate classification in visualization or approval of instructor.
- 630. Contemporary Art Studio/Seminar I. (2-4). Credit 4.** Critical, theoretical and historical readings on art and artists prompt visual and textual responses; development of personal ideas, methods, and processes; research, writing, discussion and preliminary studies contribute to a final, in-depth body of work situated within the context of contemporary art. Prerequisites: MFA in Visualization or approval of instructor; graduate classification.
- 631. Contemporary Art Studio/Seminar II. (2-4). Credit 4.** Theoretical and critical tools for contemporary digital art practice and technology-based cultural production; project proposal and development; exhibition planning, site selection and installation. Prerequisite: MFA in Visualization or approval of instructor; graduate classification.
- 641. Visual Storytelling. (2-2). Credit 3.** Exploration of visual storytelling techniques for the attainment of desired storytelling effects; includes character development, using shots, camera, lights, props and background elements, master plots, one and multi-panel cartoons, comics, storyboards, animatics and storyreels. Prerequisite: Graduate classification or approval of instructor.
- 643. Time Based Media I. (2-4). Credit 4.** Visual language and cinematic structure explored through time based projects; historical, critical, and practical exploration of the interaction of camera, lighting, sound, editing, special effects, and mise en scene. Prerequisite: VIZA 612 or approval of instructor.
- 644. Time Based Media II. (1-4). Credit 3.** Advanced theory and production of art forms with motion, tempo, sequencing and duration as integral components; projects may include in-depth creation using a single medium or may emphasize a combination of media such as video, audio, networked communication, animation, performance or installation. May be taken twice. Prerequisite: VIZA 643 or approval of instructor.
- 647. Color Photography. (1-4). Credit 3.** Theory and practice of still color photography; appropriate uses of color processes related to digital photography and other graphic media; exploration of vision through the photographic image as a medium of self expression. May be taken twice. Prerequisite: Graduate classification or approval of instructor.
- 652. Computing for Visualization I. (3-2). Credit 4.** Introduction to digital computing environments as used in visualization practice and research; human-computer interface, operating system tools, and programming for graphics. Prerequisites: CSCE 110 or equivalent; graduate classification or approval of instructor.
- 653. Computing for Visualization II. (3-2). Credit 4.** Techniques of design and problem solving for the construction of visualization software systems; advanced operating system tools for system maintenance; fundamentals of 2-D computer graphics, including user interface design and programming, mathematical elements, image and file structure, and software development techniques. Prerequisite: VIZA 652 or approval of instructor.
- 654. The Digital Image. (3-2). Credit 4.** Tools and techniques for generation, handling and analysis of two dimensional digital images; image representation and storage; display, media conversion, painting and drawing; warping; color space operations, enhancement, filtering and manipulation. Prerequisite: VIZA 653, graduate classification or approval of instructor. Cross-listed with CSCE 646.
- 656. Image Synthesis. (3-2). Credit 4.** Principles of image synthesis from 3-D scene descriptions; topics may include local and global illumination, shading, shadow determination, hidden surface elimination, texturing, raster graphics algorithms, transformations and projections. Prerequisite: VIZA 653 or approval of instructor. Cross-listed with CSCE 647.
- 657. Computer Aided Sculpting. (2-3). Credit 3.** Mathematical and artistic principles of 3-D modeling and sculpting; includes proportion skeletal foundation, expression and posture, line of action; curves, surfaces and volumes, interpolation and approximation, parametric and rational parametric polynomials, constructive solid geometry, and implicit representation. Prerequisite: Approval of instructor. Cross-listed with CSCE 648.

- 658. Experimental Visual Techniques. (2-2). Credit 3.** Theory and experimental techniques for computer graphics, animation, video, and other forms of electronic visualization including innovative hardware and software systems, artificial life, virtual reality, volume methods and hypermedia. May be taken twice. Prerequisite: VIZA 654 or VIZA 656 or approval of instructor.
- 659. Physically-Based Modeling. (2-2). Credit 3.** Physical simulation as used in choreography, geometric modeling, and the creation of special effects in computer graphics; a variety of problems and techniques are explored which may include particle-methods, modeling and simulation of flexible materials, kinematics and constraint systems. Prerequisite: Approval of instructor. Cross-listed with CSCE 649.
- 662. Physical Computing for Art and Design. (1-4). Credit 3.** Theory and creative application of digital technology in studio art and design practice to create dynamic environments, interactive objects, and tangible interfaces in the physical world; technologies involved include microcontrollers, basic electronics, sensors, actuators, motors, wireless and internet data communication, light, sound, and wearable devices. May be taken 2 times for credit. Prerequisites: Graduate classification in Visualization or approval of instructor.
- 665. Digital Compositing. (3-2). Credit 4.** Principles of Digital Compositing—Image based lighting and modeling, camera calibration, shape reconstruction, reconstruction of transparency and specularly and digital compositing of computer generated animations with video images. Prerequisite: VIZA 613 or approval of instructor.
- 670. Computational Geometry. (3-0). Credit 3.** Design and analysis of algorithms for solving geometrical problems; includes convex hull problems, Voronoi diagrams, range searching and proximity problems. Prerequisite: CSCE 311 or approval of instructor. Cross-listed with CSCE 620.
- 672. Computer Graphics. (3-0). Credit 3.** Representation of 3-dimensional objects, including polyhedral objects, curved surfaces, volumetric representations and CSG models' techniques for hidden surface/edge removal and volume rendering; illumination and shading; antialiasing; ray tracing; radiosity; animation; practical experience with state-of-the-art graphics hardware and software. Prerequisite: CSCE 441 or approval of instructor. Cross-listed with CSCE 641.
- 673. Robotics Programming. (3-0). Credit 3.** Manipulator dynamics, position control, hybrid position/force control, and impedance controls; advanced topics in manipulator motion planning, assembly planning and grasp planning; cell decomposition; retraction; back projection; hypothesize-and-test; and potential field methods; subassembly stability; task-level and fine motion planning; grasp stability; grasp synthesis; dexterous manipulation. Prerequisite: CSCE 452 or approval of instructor. Cross-listed with CSCE 643.
- 675. Geometric Modeling. (3-0). Credit 3.** Geometric and solid modeling concepts, Freeform curves and surfaces (splines and BeZier) with their relational, intersectional and global mathematic properties; parametric representation of solids, topology of closed curved surfaces, boundary concepts and Boolean/Euler operators; construction and display of curves and surfaces, and solid models. Prerequisites: CSCE 441 and CSCE 442 or equivalent. Cross-listed with CSCE 645.
- 679. Advanced Topics in Physically Based Modeling. (2-2). Credit 3.** Current research and advanced methods in choreographing motion for animation using a physics-based approach; mainstream research literature in animation; theoretical and methodological topics addressed, through both study and implementation. May be taken twice. Prerequisite: Graduate classification or approval of instructor.
- 680. Professional Practice in Visualization. (2-4). Credit 4.** Preparation of a portfolio, creating an internet presence, use of social media, interviews, negotiation, business practices, and fundamentals of teaching. Professional practice in pursuit of career paths for the Master of Fine Arts in Visualization. Prerequisite: Graduate classification.
- 685. Directed Studies. Credit 1 to 6.** Individual problems involving application of theory and practice in Visualization. May be repeated for credit. Prerequisites: Approval of instructor and department head.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified field of design communication and/or electronic media. May be repeated for credit.
- 691. Research. Credit 1 or more each semester.** Research for preparation of thesis. Prerequisite: Approval of instructor.
- 693. Professional Study. Credit 1 to 9.** Research and writing combined with studio projects; prepare and present a public exhibition of a final body of work; related paper submitted to a scholarly journal as approved by the committee Chair. Prerequisite(s): MFA in Visualization; graduate classification.

Water Management and Hydrological Science

J. Aitkenhead-Peterson, R. L. Autenreith, S. I. Bame, B. Batchelor, B. Boulanger, S. D. Brody, J. K. Brumbelow, A. T. Cahill, K. Chu, T. M. Dellapenna, S. E. Feagley, G. Fipps, D. M. Gatlin, III, T. Gentry, J. R. Giardino, J. R. Gilley, R. C. Griffin, I. Gulnerp, J. L. Heilman, B. E. Herbert, Y. L. Huang, F. J. Jaber, R. A. Kaiser (Chair), R. Karthikeyan, A. L. Kenimer, R. W. Knight, R. D. Laceywell, M. Li, M. Lindell, F. Marcantonio, C. Mathewson, B. A. McCarl, K. J. McInnes, J. W. Mjelde, B. Mohanty, G. W. Moore, M. A. Mora, C. L. Morgan, S. Mukhtar, C. Munster, W. H. Neill, J. W. Nielsen-Gammon, G. R. North, K. M. O'Reilly, F. Olivera, S. D. Pillai, S. M. Quiring, D. Roelke, W. D. Shaw, V. P. Singh, P. K. Smith, R. Srinivasan, J. D. Vitek, B. P. Wilcox, R. T. Woodward, R. A. Wurbs, H. Zhan

The interdisciplinary graduate water degree program offers a Master of Water Management, a MS degree and a Ph.D degree in Water Management and Hydrological Science. The degrees are designed to prepare students for academic, research and professional careers in water management and science by expanding and deepening knowledge in a primary water discipline while providing an integrated and multidisciplinary perspective on water.

Degree programs are prepared by the student in consultation with their graduate committee. Courses for the degree program are selected from various departments and colleges as designated by the interdisciplinary water faculty.

The graduate program and degrees are administered by an interdisciplinary water faculty whose membership includes faculty from the Colleges of Agriculture, Architecture, Engineering and Geosciences. Program supervision includes a Council of Participating Deans, Program Chair and the interdisciplinary water faculty.

(WMHS)

- 601. Applications and Problems in Hydrological Sciences. (3-1). Credit 3.** Integration and application of biophysical hydrologic processes affecting surface and groundwater resources; problem/resolution format; applications of experience through problem identification, data collection, analysis and identification of solutions and alternatives. Prerequisite: Approval of instructor.
- 602. Contemporary Issues in Water Resources. (3-0). Credit 3.** Examination of contemporary issues in water resource systems including water quantity, water quality, ecosystem sustainability and water supply; focus on economic, legal, political and social considerations, and alternatives in water resource systems. Prerequisite: Approval of instructor.
- 681. Seminar. (1-0). Credit 1.** Presentations on important developments and current research in hydrological sciences and water management; seminars presented by faculty, graduate students, visiting scholars and water professionals. May be repeated 3 times for credit. Prerequisite: Approval of instructor.
- 685. Directed Studies. Credit 1 to 4 each semester.** Special topics in water not within scope of thesis research and not covered by other formal courses. Prerequisite: Graduate classification and approval of instructor.
- 689. Special topics in... Credit 1 to 4.** Selected topics in an identified area of water management or hydrological science. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Research toward thesis or dissertation.

Department of Wildlife and Fisheries Sciences

C. E. Adams, J. Alvarado-Bremer, K. A. Arnold, R. L. Brinkmeyer, J. C. Cathey, K. W. Conway, S. M. Cooper, D. S. Davis, R. W. Davis, T. J. DeWitt, J. R. Dixon, N. O. Dronen, L. A. Fitzgerald, M. Fujiwara, D. M. Gatlin, III*, F. P. Gelwick, J. R. Gold, W. E. Grant, W. D. Heyman, B. J. Higginbotham, L. A. Hurtado, T. E. Lacher, A. M. Landry, Jr., A. L. Lawrence, J. E. Light, R. R. Lopez, C. D. Marshall, M. P. Masser (Head), M. Mateos, J. D. McEachran, M. A. Mora, M. L. Morrison, W. H. Neill, J. M. Packard, M. J. Peterson, T. R. Peterson, S. M. Ray, D. L. Roelke, D. Rollins, J. R. Rooker, A. Schulze, N. J. Silvy, R. D. Slack, R. R. Stickney, G. Voelker, W. M. von Zharen, R. N. Wilkins, K. O. Winemiller, G. A. Worthy, B. G. Würsig

* Graduate Advisor

Graduate programs of study and research lead to the Master of Wildlife Science and MS and PhD degrees in Wildlife and Fisheries Sciences. These programs prepare students for careers with academic institutions, governmental agencies and private business/industry. Studies in environmental conservation and education are available to those students interested in preparing themselves for public service in a number of fields

other than research and management. The non-thesis Master of Wildlife Science program is designed to give students broad academic training combined with practical experience, to develop problem-solving and management skills. The MS (thesis option) and PhD degrees require a strong background in the basic and applied agricultural and life sciences, particularly as they relate to whole-organism biological systems. The latter two degrees involve intensive research, and the resulting thesis or dissertation must demonstrate a superior knowledge and understanding of the subject area.

Graduate study in the Department of Wildlife and Fisheries Sciences normally requires some breadth in several disciplines, which differ among courses of study and are dependent on candidate background. The academic program of study is tailored to the background and educational goals of each degree candidate in consultation with his or her Graduate Advisory Committee. There are no foreign language requirements for any of the department's graduate degree programs, unless set by the student's Advisory Committee.

Research activities in the department involve vertebrates, invertebrates, plants and natural-resource systems, and span the broad fields of wildlife ecology and management, fisheries ecology and management, aquaculture, biodiversity and systematics, conservation education/museum science and the human dimensions of wildlife and fisheries resource management. Research in these fields is supported by disciplinary expertise in aut- and synecology, evolutionary biology, resource sociology, animal behavior, physiology, animal diseases and parasitology, bioenergetics, nutrition, genetics, and systems analysis and modeling. Although much of the research program is without geographic bounds, the more site-specific aspects of the program focus on Texas, Mexico and the neotropics.

Facilities for research and graduate education include over forty laboratories with modern and sophisticated scientific instrumentation; an NSF-sponsored Center for Biosystematics and Biodiversity; the Texas Cooperative Wildlife Collection, which is among the largest collections of animals and genetic tissues in the New World; the Marine Mammal Research Facilities at Galveston; an Aquacultural Research and Teaching Facility (laboratory and ponds) devoted to study of fish and invertebrate production for food and sport fishing; and, in cooperation with the U.S. Geological Survey, Biological Resources Division and Brazos Research Station, which focuses on problems of environmental toxicology. Provisions for research in marine mammalogy, marine fisheries ecology and mariculture are available at Texas A&M University in Galveston. Field studies may be conducted at the Texas A&M University System's off-campus research and extension centers. Texas A&M is a member of the Archbold Tropical Research Center on the Caribbean island of Dominica. Graduate students are eligible to apply for usage of laboratory and field facilities at both of these locations.

Some faculty members in the Department of Wildlife and Fisheries Sciences have appointments on the intercollegiate faculties of Genetics, Ecology, Nutrition and Toxicology; graduate students are eligible to seek degrees in those areas. The department also encourages interdisciplinary research efforts with other departments, and within the Institutes of Marine Life Sciences and Renewable Natural Resources.

The Department of Wildlife and Fisheries Sciences has a residency requirement for all MS and PhD students. Master of Science students must complete, on the campus at College Station, 9 credit hours during one semester. Students who enter the doctoral degree programs with baccalaureate degrees must spend four semesters, of 9 hours each, on the campus at College Station. Students who hold master's degrees when they enter doctoral degree programs must spend two semesters, of 9 hours each, in resident study on the campus. A semester may be fall, spring, a 10-week summer semester, or two 5-week summer terms. Full-time staff members of the University or of closely affiliated organizations stationed on the campus at College Station may fulfill residency requirements by completion of less-than-full course loads. Any exception to these rules must be approved in writing by the department head.

Wildlife and Fisheries Sciences (WFSC)

- 600. Field and Laboratory Methods. (3-0). Credit 3.** Experience in field studies, organizing field notes, collecting and preserving vertebrate animals for teaching and museum purposes; methods for maintaining live animals and for identifying animals collected; training in preparing skeletons, corrosion models, cleared specimens and in plastic embedding. Prerequisite: Eighteen hours of biological sciences or approval of instructor.*
- 601. Vertebrate Systematics. (1-6). Credit 3.** Theory and practice of biological systematics and taxonomy; historical development of discipline, mechanisms of speciation, the origin of higher categories and major taxonomic philosophies (numerical taxonomy, phylogenetic systematics and evolutionary systematics); theory involved in the study of vertebrates.

- 602. Field Herpetology. (0-3). Credit 1.** Field work involving collection and preservation of herpetological specimens; natural history, ecological relations. Prerequisites: WFSC 606 or registration therein; graduate classification.*
- 603. History of Ecological Thought and Conservation Practice. (3-0). Credit 3.** Survey of the philosophical roots and evolution of ecological thought and conservation practice; emphasis on theoretical foundations, seminal concepts, classic papers, and historic trends. Prerequisites: Course in general ecology and graduate classification or instructor approval.
- 604. Ecological Modeling. (3-0). Credit 3.** Philosophical basis, theoretical framework, and practical application of systems analysis and simulation within the context of ecology and natural resource management; emphasis placed on development, evaluation and use of simulation models by students. Prerequisite: Approval of instructor.
- 606. Systematic Herpetology. (2-3). Credit 3.** Distribution, evolution, speciation and new systematics of amphibians and reptiles; extensive field studies of local problem groups and philosophy and role of herpetology as a science.
- 607. Environmental Conflict Management. (3-0). Credit 3.** Students will be enabled to understand environmental conflict systemically, understand how communication contributes to environmental conflict and develop increased capacity as managers of environmental conflict. Prerequisite: Graduate classification or approval of instructor.
- 608. Public Participation in Conservation Policy. (3-0). Credit 3.** Students will have the opportunity to become familiar with and critique theories and constructs as well as strategies and techniques for enhancing public participation in environmental conservation policy. Prerequisite: Graduate classification or instructor approval.
- 609. Wildlife Research Methods. (3-0). Credit 3.** Research methods for ecology and conservation. Students will become familiar with the philosophy of natural science and develop skill in study design, grantsmanship, presentation techniques, critical evaluation of others' work, and publication in refereed journals. Prerequisites: Courses in general ecology and statistics and graduate classification or approval of instructor.
- 610. Evolutionary Ecology. (3-0). Credit 3.** Survey the development of paradigms in evolutionary ecology; incorporates phylogenies into comparative analysis and macroecology; evaluates the roles of historical and local processes in determining species diversity. Prerequisite: Graduate classification.
- 611. Estuarine Ecology. (3-3). Credit 4.** Principles governing the relationships of estuarine organisms to their environment; productivity, adaptations to environment, community structure and factors affecting the distribution and abundance of biota. Prerequisite: Invertebrate zoology and ichthyology or approval of instructor.
- 612. Conservation Biology. (3-0). Credit 3.** Examine the development of major areas in conservation-oriented research that include patterns of biodiversity, extinction, conservation genetics, conservation of populations, communities and landscapes, and ecological sustainability. Prerequisite: Graduate classification.
- 613. Animal Ecology. (2-3). Credit 3.** Concepts of animal ecology which emerge at various levels or organization; the ecosystem, the community, the population and the individual; laboratories emphasis on the quantitative analysis of field data and the simulation of population dynamics. Prerequisite: Graduate classification or approval of instructor.*
- 615. Mariculture. (3-3). Credit 4.** Environmental, physiological, behavioral, legal and economic factors which determine the success of efforts to cultivate saltwater species having economic importance; practices employed in various parts of the world to produce fishes, molluscs and crustaceans. Prerequisites: Ichthyology and invertebrate zoology or approval of instructor.
- 616. Physiological Ecology of Vertebrates. (3-4). Credit 4.** Effects of temperature, oxygen and other environmental factors on the distribution and abundance of animals; comparative behavioral and physiological adjustments to environment as an evolutionary response; students will be expected to develop and execute a research project in an appropriate subject area. Prerequisite: BIOL 388 or WFSC 417 or approval of instructor.

617. **Biology of Fishes. (3-3). Credit 4.** Fishes' physiological and morphological adaptations for life in aquatic systems; physiological and behavioral responses of fish to environments; molecular, cellular, and physiological mechanisms discussed in an evolutionary context that emphasizes the ontogeny of adaptive responses among vertebrates from basic biochemical and biophysical constraints. Prerequisite: Graduate classification or approval of instructor.
618. **Wildlife Study Design and Analysis. (3-0). Credit 3.** Students will be exposed to fundamental and advanced aspects of study design applicable to terrestrial animals; analysis and review of the scientific literature related to study design; and the development of study design for written and oral presentations. Prerequisite: Graduate classification or approval of instructor.
619. **Wildlife Restoration. (2-3). Credit 3.** Study of the fundamentals of the restoration of animal populations and the resources they require; factors that control the distribution and abundances of animals in relation to restoration; and how restoration plans for wildlife are developed. Prerequisite: Graduate classification or approval of instructor.
620. **Vertebrate Ethology. (3-2). Credit 4.** Mechanisms and control of vertebrate behavior in an ecological context, as shaped by natural selection; classical and current theories regarding the genetic basis, development, specialized sensory systems and organization of responses in changing environment; laboratory emphasizes observational skills and quantitative analysis of behavior occurring in natural settings.*
621. **Aquatic Ecology. (3-0). Credit 3.** Aquatic ecosystems from a system-level perspective; contemporary models of ecosystem structure and function; introduction to nonlinear dynamics and chaos theory, aquatic ecosystem behavior and predictability as a functional food-chain length.
622. **Behavioral Ecology. (3-0). Credit 3.** Integration of animal behavior with ecological and evolutionary principles; includes mating, predation, foraging ecology, social behavior, game theory and behavioral genetics; emphasis on quantification of behavior and strategy modeling. Prerequisites: Undergraduate ecology course; graduate classification.
623. **Aquaculture. (3-3). Credit 4.** Principle of fish production for stock enhancement and human food. Species of fish used for production, cross-breeding and selection; feeds and feeding of fish and nutritional and environmental requirements for optimum productivity; effects of fish production on land and water uses as related to conservation. Prerequisite: Graduate classification or approval of instructor.
624. **Dynamics of Populations. (3-2). Credit 4.** Principles, models and methods for analysis of population dynamics; analysis of contemporary research emphasizing theory and its uses in evaluation and management of animal populations. Laboratory emphasizes mathematical, statistical and computer modeling of population phenomena.
628. **Wetland Ecology. (3-0). Credit 3.** Wetlands as ecological systems that are prime habitats for wildlife and fish; geomorphology, hydrology, limnology, plant and animal communities, and human use and management. Prerequisite: WFSC 403 or RLEM 316 or equivalent.*
629. **Lower Foodweb Dynamics of Aquatic Ecosystems. (2-3). Credit 3.** Dynamics of the lower foodweb in estuaries, rivers and lakes, detailing the role and interactions between biota and how they are influenced by abiotic processes; effect of man's activities on natural succession patterns and ecosystem productivity, elucidating the potential for new management practices. Prerequisite: Graduate classification. Cross-listed with OCNG 629.*
630. **Ecology and Society. (3-0). Credit 3.** Students study and compare human and natural ecosystems using diversity, interrelations, cycles, and energy as the conceptual organization; central themes of the course are sustainability, stewardship and science. Prerequisite: Graduate classification or approval of instructor.
632. **Ethology. (3-0). Credit 3.** Survey of the control, ontogeny, function and natural selection of behavior in a variety of vertebrate and invertebrate species; interaction between the organism and its environment with regard to the mechanisms and adaptive significance of behavior; evolution of anti-predator, feeding, reproductive and cooperative traits. Prerequisites: BIOL 112 or equivalent; graduate classification.
633. **Conservation Genetics. (3-0). Credit 3.** Genetic concepts and techniques relevant to management and conservation of biological diversity, research and conservation strategies within a conservation genetics framework. Prerequisite: Introductory courses in genetics and ecology or biological conservation. Cross-listed with GENE 633.

- 635. Urban Wildlife and Fisheries. (3-0). Credit 3.** Urban wildlife and fisheries trains students to establish and maintain diverse, self-sustaining urban wildlife and fish populations at levels in harmony with ecological, social, and economic values of the human community and to develop optimal levels of public appreciation and use of urban wildlife and fish resources and associated habitats. Prerequisite: Graduate classification or approval of instructor.
- 636. Wildlife Habitat Management. (3-0). Credit 3.** Designed to acquaint the student with major land use practices on lands that produce wildlife, how these influences wildlife production and alterations or manipulations of habitat used to achieve specific wildlife management goals. Prerequisite: Graduate classification or approval of instructor.*
- 638. Techniques of Wildlife Management. (2-3). Credit 3.** Techniques available to directly and indirectly manipulate wild animal populations to achieve balance between socioeconomic and aesthetic values. Prerequisite: Graduate classification or approval of instructor.*
- 639. Wildlife Ecotoxicology. (3-0). Credit 3.** Distribution, fate, and effects of environmental pollutants on wildlife behavior and reproduction. Global distribution of pollutants and effects on near and remote ecosystems. Field studies, biomarkers, stable isotope and various techniques for evaluating pollutant hazards on wildlife. Prerequisites: Courses in CHEM and BICH and graduate standing or approval of instructor.
- 640. Human Dimensions of Wildlife and Fisheries Management. (3-0). Credit 3.** Theory and applications for considering human dimensions in an integrated approach to wildlife and fisheries management; a social science perspective with emphasis to diversity of human values, role of constituency groups, wildlife and fisheries policy development, conflict management, management decision-making, research methods and management case studies.
- 641. Sustainable Military Land Management. (3-0). Credit 3.** Overview of the Department of Defense (DOD) lands within a temporal, geographic, and environmental context and perspective; major policies/laws impacting military land use and areas critical to mission sustainment; management strategies important to sustaining installations and ranges. Prerequisite: Graduate classification or approval of instructor.
- 642. Field Military Land Management. (0-2). Credit 1.** Review of land management practices and challenges on military and adjacent private lands through field visits of select military installations. Field trips required during Spring Semester. Prerequisite: Graduate classification or approval of instructor. Previous or concurrent registration in WFSC 636 is strongly encouraged.
- 643. Geospatial Technology in Military Land Management. (3-0). Credit 3.** Tools for visualizing, creating, managing and analyzing geographic data on military lands and outside areas critical to mission sustainment; familiarization with ArcMap and ArcCatalog in military-related land management scenarios. Prerequisites: Graduate classification or approval of instructor; previous experience with ArcMap and ArcCatalog helpful.
- 646. Quantitative Phylogenetics. (2-3). Credit 3.** Designed to provide students with the theory and tools required for inference of phylogenetic (evolutionary) relationships among biological taxa using various types of comparative data including morphological characters, biochemical and molecular characters, and DNA sequences; hands-on analysis of data using contemporary tools. Prerequisites: ENTO 601 or approval of instructor. Cross-listed with ENTO 606 and GENE 606.
- 647. Nutritional Biochemistry of Fishes. (3-0). Credit 3.** Principles of nutritional biochemistry including nutrient metabolism and biochemical energetics with special emphasis on finfish and shell fish. Prerequisite: BICH 410 or equivalent. Cross-listed with NUTR 647.
- 648. Molecular Evolution. (2-2). Credit 3.** Theory and tools used in the analysis of molecular evolutionary patterns of DNA and protein sequences; format combines lecture presentations by instructor discussion of relevant scientific literature, computer exercises, preparation of research proposal or independent research project, and practice in peer-review process. Prerequisite: Basic courses in general Genetics and Evolution. Cross-listed with GENE 648.
- 650. Aquatic Microbial Ecology. (3-0). Credit 3.** Microbes in natural environments, including both water and sediment habitats in marine, fresh and ground water systems; process studies of microbial foodwebs and biogeochemical cycling; current methods and research directions. Prerequisites: WFSC 414 and OCNG 620 or approval of instructor. Cross-listed with OCNG 650.

- 670. Excel Biometry. (3-0). Credit 3.** Students will learn the rational and mathematics behind upper level biometrical methods; students will construct spreadsheets and analyze a common data set; topics to include multiple regressions, principle components analysis, multivariate analysis of variance and others. Prerequisites: Graduate classification; STAT 651 or equivalent.
- 681. Seminar. Credit 1 each semester.** Important current developments in wildlife or fisheries fields with special reference to literature. Students may register up to but no more than two sections of this course in the same semester.
- 684. Professional Internship. Credit 1 to 16 each semester.** On-the-job training in fields of wildlife and fisheries sciences. Prerequisite: Graduate classification in wildlife and fisheries sciences.
- 685. Directed Studies. Credit 2 to 6 each semester.** Individual study and research on selected problem approved by instructor and graduate advisor. Credit adjusted in accordance with requirements of each individual case. Prerequisite: Approved proposal.
- 689. Special Topics in... Credit 1 to 4.** Special topics in wildlife ecology, fisheries ecology, vertebrate systematics, evolutionary biology of vertebrates and conservation education. May be repeated for credit.*
- 690. Theory of Research. (2-0). Credit 2.** Theory, design, analysis and communication of research in wildlife and fisheries sciences. May be repeated for credit. Prerequisite: Approval of instructor.
- 691. Research. Credit 1 or more each semester.** Original research on selected wildlife and/or fisheries problem to be used in thesis or dissertation.

*Field trips required for which departmental fees may be assessed to cover costs.

Women's and Gender Studies

C. E. Katz (Director)

For further information, visit wgst.tamu.edu/graduate.html.

(WGST)

- 603. The Contemporary Family. (3-0). Credit 3.** Review and criticism of theories developed for study of the family; family formation, dynamics, conflicts, power, dissolution; subcultural family forms and responses to social change. Prerequisite: Graduate classification or approval of instructor. Cross-listed with: SOCI 603.
- 634. Introduction to Gender and Education. (3-0). Credit 3.** Major discussions and debates in the area of gender and education, with particular attention to the role that feminism and feminist theory have played and on the intersections of gender, race, class, ethnicity, and sexuality. Prerequisite: Graduate classification. Cross-listed with EHRD 634.
- 639. Gender, Ethnicity, and Class in Archaeological Research. (3-0). Credit 3.** This course explores: theoretical and methodological issues in engendering archaeology; ideological biases in the interpretation of roles attributed to women, men and underrepresented groups in the past; the impact of cultural transformations on underrepresented groups and gender relations; and how to formulate research questions concerning these issues. Prerequisite: Graduate classification. Cross-listed with ANTH 639.
- 645. Queer Theory. (3-0). Credit 3.** Examines origins of theories of gender and sexual diversity and their intersections with feminist theories; considers foundational and contemporary texts that address queer theory. Prerequisite: Graduate classification.
- 649. Feminist Pedagogy. (3-0). Credit 3.** Explores how educational systems and institutions have regarded women historically and contemporarily; considers practical and theoretical writings on feminist pedagogy. Prerequisite: EHRD/WGST 634 Introduction to Gender and Education. Cross-listed with EHRD 649.
- 650. Gender and International Education. (3-0). Credit 3.** Explores the intersection of formal and informal education and understandings of gender in countries beyond the United States. Prerequisites: EHRD/WGST 634 Introduction to Gender and Education. Cross-listed with EHRD 650.
- 661. Sociology of Gender. (3-0). Credit 3.** Overview of the Sociology of Gender, historical development, primary concepts, contemporary issues. Theory, methods, and applications. Prerequisite: Graduate classification. Cross-listed with SOCI 661.

- 680. Theories of Gender. (3-0). Credit 3.** Theories of gender, sexualities, feminism, embodiment, and difference with particular focus on their relationship to literary and cultural studies; emphasis on contemporary theoretical positions, discourses, and debates. Cross-listed with ENGL 680.
- 685. Directed Studies. Credit 1 to 4.** Directed individual study of selected problems in the field of women's and gender studies. Prerequisite: Approval of instructor.
- 689. Special Topics in... Credit 1 to 4.** Selected topics in an identified area of women's and gender studies. May be repeated for credit. Prerequisite: Approval of instructor.

Zoology

The aims of a PhD degree in Zoology are to train the student to do original and significant research in zoological science, to develop a broad understanding of the zoological literature, and to provide experience and training in the presentation and publication of scientific findings. The Department of Biology offers special opportunities for animal research in several zoological subdisciplines. In addition, the broad range of biological sciences represented on campus permit collaborative programs in such areas as medicine, veterinary medicine, oceanography, and wildlife and fisheries sciences.

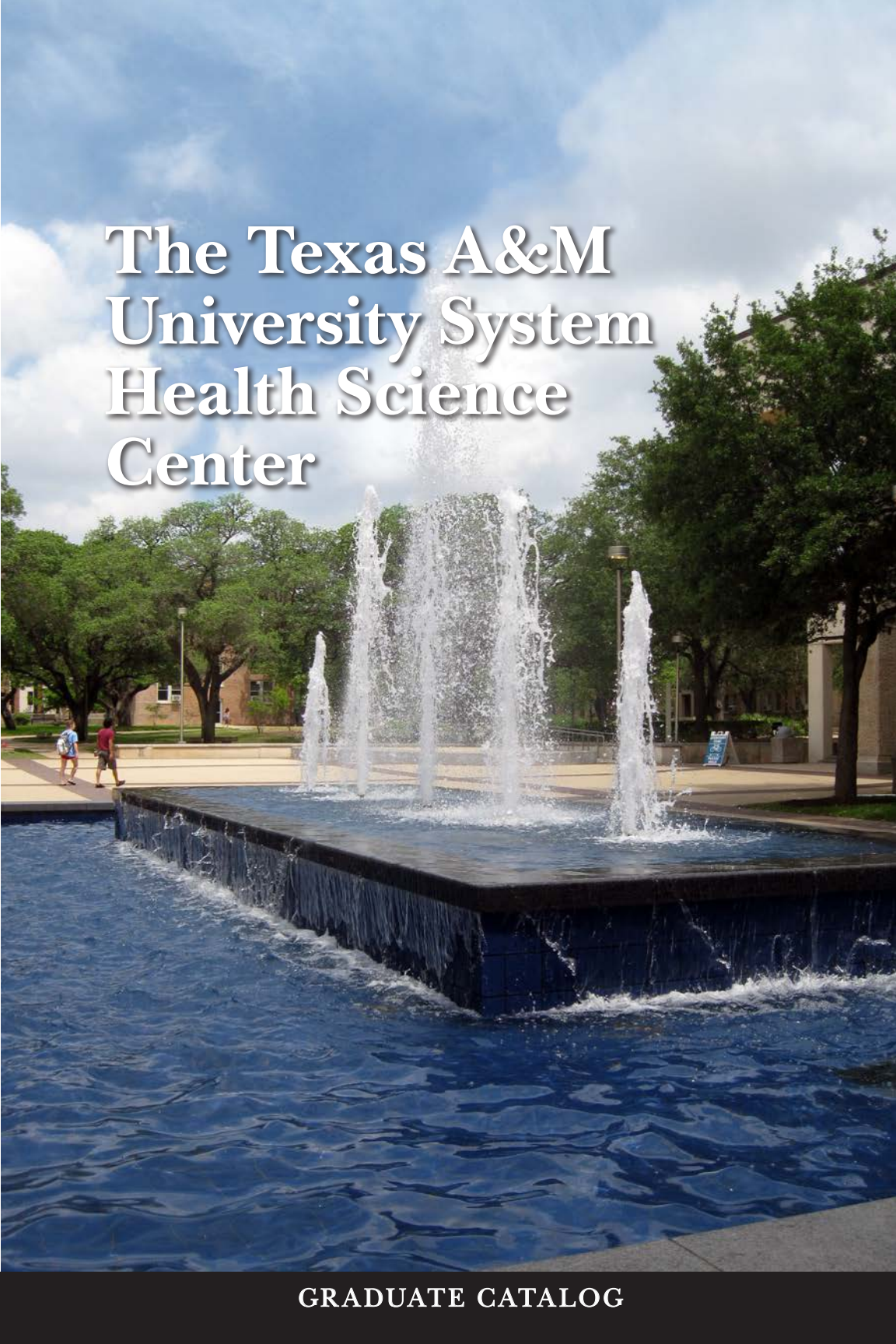
Zoology PhD students must demonstrate competence in their specific area of research and are expected to develop proficiency in four of the following six areas: evolution/systematics, ecology/behavior, physiology/anatomy, biological mathematics, genetics/development and cellular/molecular biology. In addition, the student should have a thorough depth-of-knowledge of the organism or system used in the dissertation research. An MS student must demonstrate competence in at least three of the above six areas at the time of final examination.

(ZOOL)

(faculty and courses are listed under BIOL, see [page 332](#))

- 681. Seminar. (1-0). Credit 1.** Detailed reports on specific topics in field chosen. Students may register in up to but no more than three sections of this course in the same semester.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigations in fields other than those chosen for thesis or dissertation.
- 691. Research. Credit 1 or more each semester.** Research for thesis or dissertation.

Other related graduate courses offered by the Department of Biology that may be of interest to zoology students include BIOL 611 Molecular Biology of Differentiation and Development and BIOL 689 Special Topics in...



The Texas A&M University System Health Science Center

The Texas A&M University System Health Science Center

Administrative Officers

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Dean, School of Rural Public Health	Craig H. Blakely, Ph.D., M.P.H.
Chief Legal Officer	Cullen M. "Mike" Godfrey, J.D.
Associate Vice Chancellor for Health Affairs and Chief of Staff	Lee Ann Ray, Ed.D.

Visiting Graduate Student Program between Texas A&M University and The Texas A&M University System Health Science Center

Texas A&M University and The Texas A&M University System Health Science Center offer an impressive variety of outstanding academic programs and engage in significant world-class research activities. A cooperative visiting students program has been approved by both institutions to facilitate interested, qualified students in taking advantage of unique educational opportunities at both institutions and reduce procedural requirements for such students. Specifically, the visiting graduate students program allows graduate students enrolled at either Texas A&M University or the Health Science Center to take courses or engage in research at the other component during a regular semester or summer session.

Officials at Texas A&M University and the Health Science Center have each agreed to the following:

1. Accept for course credit and GPR calculation completed coursework from one another's components;
2. Waive any transfer credit restrictions such that courses from either institution will not be included in any maximum allowable transfer credits;
3. Include completed coursework for transcript designation;
4. Provide timely approval of a student's proposed visitation, contingent on space and desired courses being readily available in the proposed visitation programs and, for participation in a research laboratory, on approval of the director or principal investigator of the laboratory;
5. Maintain enrollment of the visiting student at the home institution, subject to that institution's enrollment policies.
6. Send all official transcripts for visiting students in batch to the home institution's Registrar at the end of each semester, thus eliminating the need for individual transcript requests by the student.
 - A visiting student will not be regularly admitted by the host institution
 - A visiting student should not assume s/he would be eligible for transfer to the host institution
 - A visiting student will not be eligible to receive financial aid from the host institution and the home institution simultaneously.

Additional details of this agreement are available through the Office of the Registrar at either institution. The application for concurrent enrollment may be found at www.tamhsc.edu/education/registrar/forms/non-degree-tamu2.pdf. The Health Science Center Office of the Registrar may be reached at (979) 436-0191 or via email at registrar@tamhsc.edu.

Once the application is completed, it should be submitted to the Office of Student Affairs in the school housing the courses for which the student wishes to register. At that time, further registration instructions will be given.

The Texas A&M University System Health Science Center— School of Graduate Studies

A graduate program in biomedical sciences, leading to the degrees of Master of Science and Doctor of Philosophy, is available through the College of Medicine and School of Graduate Studies.

A special feature of the program is an emphasis on broad based instruction in biomedical sciences, inasmuch as the faculty believes that the quality of teaching and research in biomedical sciences is highest in those programs that provide a strong, conceptual framework derived from a firm foundation of formal coursework. Students who master this background in biomedical sciences are properly prepared to undertake programs of high quality research.

Traditionally, master's and doctoral degrees in biomedical sciences have been awarded in clearly subdivided disciplines such as anatomy, biochemistry, microbiology, pharmacology and physiology. However, the boundaries separating these disciplines have become less distinct because of the development of integrated programs in medical education and because of the necessity for interdisciplinary collaboration in biomedical research. While the requirements of medical schools for faculty and for medical researchers increasingly include a broad base in medical sciences, most of the graduate programs in this area continue to emphasize education along fairly narrow, traditional departmental lines. The graduate program in biomedical sciences at The Texas A&M University System Health Science Center is designed specifically to remedy this deficiency by bridging traditional disciplinary lines through both coursework and research.

Selected courses within the School of Graduate Studies may be taken for graduate credit by majors in other colleges. Only students admitted to, and in good standing in, the Office of Graduate Studies of Texas A&M will be considered for admission to these courses. The number of graduate students who can enroll in each course is limited by the availability of facilities and by the requirements of Health Science Center Students. Each graduate student seeking admission to these courses must have the approval of his or her faculty advisor and the head of the department in the college administering the course. Interested students are encouraged to consult the Office of Graduate Studies for current offerings.

The specific courses approved for graduate credit follow.

Please direct questions to: Graduate Studies, Attn: Amanda Allen, 153 Joe Reynolds Medical Building, College Station, TX 77843-1114, (979) 845-0370, or visit the website at sgs.tamhsc.edu.

Interdisciplinary Ph.D. in Neuroscience

Students interested in the dual Neuroscience degree should reference the TAMIN website tamin.tamu.edu.

School of Graduate Studies – College of Medicine (MSCI—Biomedical Sciences)

- 601. Principles of Basic Medical Sciences I. (5-0). Credit 5.** Molecular basis of cellular functions in human body: technologies for probing cellular functions and structures; plasma membrane, internal membranes and intracellular organelles; gene function; cell metabolism; cell motility and cytoskeleton. Prerequisites: BICH 303 or equivalent; BIOL 413.
- 602. Principles of Basic Medical Sciences II. (5-0). Credit 5.** Continuation of MSC1 601. Molecular basis of cellular functions in human body: Intracellular and intercellular signaling; cell growth, division and differentiation; molecular basis of immunology, neurosciences and cardiovascular sciences. Prerequisite: MSC1 601 or equivalent.
- 605. Laboratory Safety and Ethics. (1-1). Credit 2.** The course will be concerned with federal guidelines for laboratory safety, human and animal experimentation and experimental use of controlled substances. Prerequisite: Graduate classification.
- 610. Pathogenesis of Human Disease. (3-0). Credit 3.** Molecular mechanisms of human disease processes; the main goal of the course is to provide students with an understanding of basic disease processes such as cardiovascular disease, cancer, inflammatory disease, AIDS, tuberculosis, diabetes, Alzheimer's disease and spinal cord injury. Prerequisite: Approval of instructor.

- 611. Experimental Design for Biomedical Science. (3-0). Credit 3.** Students learn about the principles of experimental design. By the end of the course, the student should be able to incorporate appropriate design features into their own experiments, and critically evaluate the experimental literature for design flaws and inappropriate use of statistics. Prerequisite: Undergraduate or graduate statistics 3 hours.
- 612. Current Topics in Cell Signaling. (3-0). Credit 3.** The course provides an overview of intracellular signal transduction pathways utilized by various classes of growth factor, cytokine, integrin and G-protein coupled receptors. The course also will provide a clear understanding of the importance of these pathways in regulating cell growth, differentiation, apoptosis and other cellular processes, both under normal physiologic conditions as well as diseases.
- 620. The Scientific Basis of Medicine. (1-0). Credit 1.** This course is a journal club in which recent research papers relevant to medicine are presented by students and discussed by students and faculty. May be repeated for credit four times.
- 681. Seminar. (1-0). Credit 1.** Research presentations in areas of current interest in the medical sciences. Prerequisite: Graduate classification in appropriate field.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigation in fields other than those chosen for thesis or dissertation. Prerequisite: Approval of instructor.
- 687. Professionalism and Ethics. (1-1). Credit 1.** Students learn about professionalism and ethics in the medical sciences.
- 689. Special Topics In... Credit 1 to 4.** Selected topics in an identified area of medical sciences. May be repeated for credit. Prerequisite: Approval of instructor.
- 690. Theory of Medical Sciences Research. (2-0). Credit 2.** Design of research experiments in various fields of medical sciences; evaluation of end results with the aid of examples taken from current scientific literature. Prerequisite: Approval of instructor.
- 691. Research Credit. Credit 1 or more.** Research for thesis or dissertation. Prerequisite: Approval of supervisory professor in chosen field.
- 695. Frontiers in Medical Sciences Research. (2-0). Credit 2.** Present status of research in a variety of significant medical sciences fields. Content will depend on the availability of visiting lecturers who will be selected because of distinguished international recognition in their field of research. May be repeated for credit. Prerequisite: Graduate classification in appropriate fields.

Department of Neuroscience and Experimental Therapeutics

P. C. Brandt, W.-J. A. Chen, G. C. Chiou, D. J. Earnest, G. D. Frye, W. H. Griffith (Head), R. C. G. Miranda, D. S. Reddy, M. Rimer, F. Sohrabji, J. R. West, U. H. Winzer-Serhan

(NEXT)

- 601. Advanced Neurosciences. (1-2). Credit 2.** Details of mammalian nervous system, including humans; focus on organization of functional neural systems and their integrative action; use of original research papers. Prerequisites: NEXT 922 and approval of instructor.
- 603. Neuropsychopharmacology. (4-0). Credit 4.** Pharmacology as it relates to behavior and the central nervous system. Prerequisites: MSCI 601, 602 or equivalents or approval of instructor.
- 604. Special Regional Human Dissections. Credit 1 to 3 each semester.** Dissection of special region with more detail than in NEXT 901; histological, neural and gross anatomical material utilized. Prerequisites: NEXT 901 and approval of instructor.
- 605. Molecular Mechanisms of Drug and Toxin Action I. (4-0). Credit 4.** Introduction to the major tools and concepts of pharmacology. This is a two part series (see MPH 606). By the end of these courses, the student will understand how selectivity of drug action is determined by pharmacological principles and will have a scientific basis for a rational approach to the study of drug actions and side effects. Prerequisite: Approval of coordinator.
- 606. Molecular Mechanisms of Drug and Toxin Action II. (4-0). Credit 4.** Survey of ocular drugs, overview of molecular signaling mechanisms and selected topics in developmental neuropharmacology. Prerequisite: permission of coordinator.

- 607. Molecular Mechanisms of Drug and Toxin Action III. (4-0). Credit 4.** Interaction of drugs and toxins with neurotransmitter systems with primary emphasis on mechanisms involving receptor function that impacts central nervous system integration. Prerequisite: Approval of coordinator.
- 608. Methods in Neurohistology. (1-2). Credit 2.** Instruction in anesthetization, perfusion of animals; removal of neural tissues; histological processing, staining of tissues, including immunohistochemistry. Prerequisites: Approval of instructor.
- 609. Intracellular Signaling. Credit 1 to 2.** Introduction to signaling pathways inside cells that mediate multi-step cascades following cell surface receptor activation and how these pathways are influenced by drugs. Prerequisite: Approval of coordinator.
- 610. Organ-specific Toxicology. (1-0). Credit 1.** Introduction to critical mechanisms of toxic injury of organ systems with emphasis on liver, kidney, lung, central nervous system and reproductive tract and overview of classic toxicants. Prerequisite: Approval of coordinator.
- 621. Teaching Gross Anatomy. (3-8). Credit 2.** Provides teaching and supervisory experience for graduate students; instructs students in teaching and supervising medical students in gross anatomy (NEXT 901); student(s) observe in the laboratory and present at least one lecture. Prerequisites: completion of NEXT 901 with a grade of "B" or better and approval of course coordinator.
- 622. Teaching Medical Histology. (2-4). Credit 1.** Provides teaching and supervisory experience for graduate students; instructs students in teaching and supervising medical students in microscopic anatomy (NEXT 911); student(s) observe in the laboratory and present at least one lecture. Prerequisites: taken and passed NEXT 911.
- 623. Teaching in Medical Neuroscience. (5-3). Credit 2.** Assist in the teaching of medical neuroscience (NEXT 922), to include lecture(s), laboratories and examination setup and proctoring. Prerequisite: NEXT 922, approval of instructor, and taken and passed neurosciences.
- 681. Seminar. Credit 1.** Focus will be on critical scientific thinking. Emphasis placed on oral communications, scientific writing and grant preparation. Prerequisite: graduate student in medicine. Approval of instructor.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigation in fields other than those chosen for thesis or dissertation. Prerequisite: Approval of instructor.
- 689. Special Topics In.... Credit 1 to 4.** Selected topics in an identified area of pharmacology and toxicology. May be repeated for credit when topics vary. Prerequisite: Approval of the instructor.

Department of Molecular and Cellular Medicine

H. Amrein, K. Bayless, G. J. Bix, S. E. Bondos, S. M. Dobin, A. C. R. Ficht, T. L. Gumienny, G. M. Ihler, J. Ji, A. E. Johnson, G. M. Kapler, T. J. Kuehl, F. Liu, J. F. Martin, S. A. Maxwell, S. Musser, C. N. Pace, J. M. Scholtz (Head), R. Sitcheran, G. B. Wells, J. E. Womack

(MCMD)

- 625. Nucleic Acid-protein Interactions. (1-0). Credit 1.** Mechanisms of nucleic acid-protein interactions involved in fundamental biochemical processes such as DNA replication and rearrangement, transcription, RNA splicing and translation; original research articles presented focusing on experimental approaches, interpretation of results and overall significance. Prerequisite: Approval of instructor. Crosslisted with BICH 625.
- 671. Macromolecular Folding and Design. (1-0). Credit 1.** The Macromolecular Folding and Design Journal Club is to serve as a mechanism for oral dissemination of current knowledge regarding the structure and function of biological macromolecules. Prerequisite: Approval of the instructor. Cross-listed with BICH 671 and CHEM 671
- 672. Biological Membranes. (1-0). Credit 1.** Seminar-based course examining recent discoveries in the structure, function and assembly of biological membranes; students give an oral presentation on current literature in molecular biology, biochemistry and/or biophysics. Prerequisite: Approval of the instructor. Cross-listed with BICH 672.
- 674. Protein Folding and Stability. (1-1). Credit 1.** Selected topics from recent literature in the general areas of protein folding, structure, and stability. Prerequisite: Approval of the instructor. Cross-listed with BICH 674.

- 675. Molecular Pathogenesis. (1-0). Credit 1.** Oral presentations and discussions from current literature in the general area of the molecular mechanisms involved in disease. May be taken 12 times. Prerequisite: Approval from instructor.
- 681. Seminar. Credit 1.** Focus will be on critical scientific thinking. Emphasis placed on oral communications, scientific writing and grant preparation. Prerequisite: Graduate student in medicine. Approval of instructor.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigation in fields other than those chosen for thesis or dissertation. Prerequisite: Approval of instructor.
- 689. Special Topics In.... Credit 1 to 4.** Selected topics in an identified area of biochemistry and genetics. May be repeated for credit when topics vary. Prerequisite: Approval of the instructor.

Department of Microbial and Molecular Pathogenesis

R. C. Alaniz, J. D. Cirillo, T. W. Huber, J. L. Leibowitz, R. E. McCallum, D. N. McMurray, J. M. Quarles (Head), J. E. Samuel, J. T. Skare, V. L. Tesh, V. G. Wilson

(MMPA)

- 601. Microbial Pathogenesis of Human Disease. (3-0). Credit 3.** Principles of microbe-host interactions at the molecular level. Selected medically important infectious diseases serve as paradigms for understanding how multiple pathogenic mechanisms contribute to disease. Prerequisite: Permission of instructor.
- 602. Immunoregulation. (3-0). Credit 3.** In-depth exploration of the genetic, cellular and molecular mechanisms by which humoral and cellular immune responses are regulated; regulatory T cell circuits, molecules (interleukins, lymphokines), hormonal effects, immunoregulatory defects, experimental manipulation of immunoregulatory networks. Prerequisites: VTMI 649 or BIOL 610 and approval of instructor.
- 607. Applied Epidemiology. (3-3). Credit 4.** Application of epidemiologic concepts to the study of disease occurrence; descriptive epidemiologic methods in the study of diseases. Prerequisite: Graduate classification. Cross-listed with VAPH 607.
- 663. Molecular Biology of Animal Viruses. (3-0). Credit 3.** In-depth studies of the biochemistry and replication strategies of animal viruses and molecular mechanisms of pathogenesis for selected viral systems. Prerequisite: Graduate classification in virology, molecular biology, biochemistry or approval of the instructor. Cross-listed with VTMI 663.
- 665. Viral Vectors and Gene Therapy. (3-0). Credit 3.** This course will describe various viral vector systems, their development, and their use as research tools in biotechnology and in gene therapy. The course will consist of a mixture of short lectures and discussion of papers from the literature. Prerequisite: MMPA/VTMI 633, VTMI 647, PLPA 616, PLPA 620 or approval of the instructor. Cross-listed with VTMI 665 and PLPA 665.
- 681. Seminar. Credit 1.** Focus will be on critical scientific thinking. Emphasis placed on oral communications, scientific writing and grant preparation. Prerequisite: Graduate student in medicine. Approval of instructor.
- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigation in fields other than those chosen for thesis or dissertation. Prerequisite: Approval of instructor.
- 689. Special Topics In.... Credit 1 to 4.** Selected topics in an identified area of Microbial and Molecular Pathogenesis. May be repeated for credit when topics vary. Prerequisite: Approval of the instructor.

Department of Systems Biology and Translational Medicine

G. D. Alpini, A. A. Gashev, H. J. Granger (Head), R. K. Hester, L. Kuo, C. J. Meininger, M. Muthuchamy, J. L. Parker, A. R. Parrish, T. V. Peterson, H. W. Sampson, A. Trache, J. P. Trzeciakowski, E. Wilson, D. C. Zawicja, W. E. Zimmer

(SBTM)

- 601. Experimental Techniques in Molecular, Cell, and Systems Biology I. (2-4). Credit 4.** This course is designed as a hands-on laboratory course to introduce the beginning graduate student to a variety of cellular, biochemical molecular biological, and imaging techniques utilized in biomedical research. Information is relayed through lectures, demonstrations, and hands-on experience with the techniques discussed. The objective of this course is to help the student gain some laboratory experience and, at the same time, become familiar with basic protocols for biomedical techniques utilized in biological research. Prerequisite: Graduate classification and approval of course coordinator.
- 608. Bone Biology. (2-0). Credit 2.** Introduction to the discipline of bone; discussion includes all aspects of bone biology. Prerequisite: Graduate classification in SBTM or medical sciences, or approval of instructor.
- 612. Experimental Techniques in Molecular, Cell, and Systems Biology II. (2-4). Credit 4.** This course is designed as a hands-on laboratory course to introduce the beginning graduate student to a variety of quantitative, analytical, cellular, histological, as well as ex vivo and in vivo techniques utilized in biomedical research. Information is relayed through lectures, demonstrations, and hands-on experience with the techniques discussed. The objective of this course is to help the student gain some laboratory experience and, at the same time, become familiar with basic protocols for biomedical techniques utilized in biological research. Prerequisite: Graduate classification and approval of course coordinator.
- 613. Human Organ Systems I. Credit 5.** This course is the first course of a two-course series designed as an advanced organ systems overview for students interested in a graduate level multidisciplinary study of human organ systems. The overall goal is to teach the student to understand how higher level properties of human biology arise from the complex interactions between the numerous, interactive components of the system. The primary objective is to develop in graduate students the knowledge, appreciation, and integrated understanding of human biology, from a systems perspective. Prerequisite: MSCI 601 is preferred.
- 614. Human Organ Systems II. Credit 5.** This course is the second course of a two-course series designed as an advanced organ systems overview for students interested in a graduate level multidisciplinary study of human organ systems. The overall goal is to teach the student to understand how higher level properties of human biology arise from the complex interactions between the numerous, interactive components of the system. The primary objective is to develop in graduate students the knowledge, appreciation, and integrated understanding of human biology, from a systems perspective. Prerequisite: MSCI 601 is preferred.
- 615. Pathobiology and Therapeutics. (4-0). Credit 4.** This course is designed to help students develop the ability to learn by themselves, with the oversight of a group of faculty mentors. Each student will choose a disease model system from a chosen list of diseases/model systems that affect multiple systems of the body. Students will collect and present information on how their chosen disease or integrative model system affects various organ systems. Students will put together an integrative proposal to present to the class, followed by a final written proposal. Prerequisite: SBTM 613 and 614 or equivalent.
- 624. Computational Systems Biology: Biostatistics. (2-0). Credit 2.** Introduction to methods used to acquire, extract, organize, analyze, store and interpret the major types of data of interest in systems biology. Prerequisite: Approval of course director.
- 625. Computational Systems Biology: Bioinformatics & Image Analysis. (2-0). Credit 2.** Introduction to the methods used to acquire, extract, organize, analyze, store and interpret the major types of interest in systems biology. Prerequisite: Approval of course director.
- 681. Seminar. Credit 1.** Focus will be on critical scientific thinking. Emphasis placed on oral communications, scientific writing and grant preparation. Prerequisite: Graduate student in medicine. Approval of instructor.

- 685. Directed Studies. Credit 1 to 6 each semester.** Limited investigation in fields other than those chosen for thesis or dissertation. Prerequisite: Approval of instructor.
- 689. Special Topics In.... Credit 1 to 4.** Selected topics in an identified area of System Biology and Translational Medicine. May be repeated for credit when topics vary. Prerequisite: Approval of the instructor.

Department of Pathology and Laboratory Medicine

L. R. Bernstein, L. E. Lindner, W. B. McCombs III

(MPAT)

School of Graduate Studies

(SGSI)

- 600. Development & Commercialization of a Human Therapeutic. Credit 2.** This course will cover the fundamentals of the commercialization of human therapeutics from research and discovery through clinical development. In the course, students will gain an understanding of the process of the development and commercialization of a human therapeutic from early discovery through regulatory and product development to early clinical trials. Additionally, practical exercises in the business of building and sustaining a biotechnology company will be explored.

School of Rural Public Health

The Texas A&M University System Health Science Center School of Rural Public Health is the first of its kind in the nation. The Texas Legislature established the school in 1995 as part of a rural health initiative to better address rural health needs in the state. After receiving degree-granting authority for the Master of Public Health degree in April 1998 from the Texas Higher Education Coordinating Board, the School of Rural Public Health welcomed its inaugural class in September 1998. In January 1999, the Texas A&M University System Health Science Center was formed as a separate academic institution within The Texas A&M University System.

While still a classic school of public health, the School of Rural Public Health concentrates on the health needs of traditionally underserved rural areas. Consistent with its mission, the school offers its Master of Public Health degree program to a variety of communities across Texas, including communities in Central Texas, East Texas, the Coastal Bend region, and in the Rio Grande Valley. In 2004, the school was granted full accreditation and added to the elite list of 34 accredited schools of public health by the Council on Education for Public Health, the sole accrediting body for public health academic programs and institutions.

The school currently offers three master's degree programs: a Master of Public Health (M.P.H.), with concentrations in biostatistics, environmental and occupational health, epidemiology, health policy and management, social and behavioral health, community public health and management, and occupational safety and health; a Master of Health Administration (M.H.A.); and a Master of Science in Public Health (M.S.P.H.), with concentrations in biostatistics, environmental and occupational health, epidemiology, health policy and management, occupational safety and health, and social and behavioral health. All M.P.H. and M.H.A. students spend a semester equivalent working in a rural public health setting as a part of a requisite practicum. M.S.P.H. students complete an original research project as a part of a required thesis.

The school also offers three doctoral degree programs: a Doctor of Philosophy degree (Ph.D.) in health services research, a Doctor of Public Health (Dr.P.H.) with a concentration in epidemiology and environmental health, and a Doctor of Public Health (Dr.P.H.) with a concentration in social and behavioral health.

Please direct questions regarding the School of Rural Public Health program to: Texas A&M University System Health Science Center School of Rural Public Health, Attn: Devy Hardeman, 163F SRPH Admin. Building, College Station, TX 77843-1266, (979) 845-2387 or visit their website at srph.tamhsc.edu.

Department of Environmental and Occupational Health

J. J. Congleton, T. J. McDonald (Head), J. S. Moore

(PHEO)

- 600. Principles of Environmental and Occupational Health. Credit 3.** Overview of nature and magnitude of environmental and occupational disease; sources of exposure, methods of monitoring and modeling exposure; review of target organs and potential effects of specific chemicals; discussion of workplace hazards and monitoring programs.
- 601. Principles of Basic Medical Sciences. Credit 5.** Review of cellular and biochemical functions in human body; technologies for probing cellular functions and structures; plasma membrane, internal membranes and intracellular organelles; gene function; cell metabolism; cell motility and cytoskeleton. Prerequisites: undergraduate biology and biochemistry or equivalent. Cross-listed with MSCI 601.
- 605. Chemical Hazard Risk Assessment. Credit 3.** Chemical and biological methods for testing hazardous chemicals and complex mixtures; chemical analysis; microbial bioassays; developmental toxicity; enzyme induction; mammalian cell culture. Prerequisite: Graduate classification. Cross-listed with VAPH 605.
- 610. Basic Environmental Toxicology. Credit 3.** Examines basic concepts of toxicology in environmental and occupational surroundings. Distribution, absorption, metabolism and elimination of toxicants are discussed. Mechanisms of injury for various classes of toxicants following exposure to toxic chemicals are explored at the systemic, organ and cellular level. Prerequisites: PHEO 630 or permission of instructor.
- 612. International Environmental Health / Credit 3.** As globalization continues and the earth's natural processes transform local problems into international issues, few societies are being left untouched by major environmental problems. This course addresses some of these environmental problems that developing and underdeveloped countries face due to overpopulation, lack of natural resources, and lack of proper ways or technologies to dispose of hazardous wastes.
- 614. Biodegradation and Bioremediation. Credit 3.** Processes affecting the biodegradation of organic chemicals in the environment; assessment of the utility of various remedial procedures, including biodegradation and bioremediation in site specific situations; methods of site assessment and quantitative risk characterization. Prerequisite: Organic chemistry or approval of instructor. Cross-listed with SCSC 614.
- 615. Environmental Measurement. Credit 3.** Theory and practice of analytical methods used in the study of environmental sciences; data quality of objectives, instrumental and wet chemical techniques used in measurement of environmental quality parameters and contaminants. Prerequisites: college level chemistry or approval of instructor.
- 617. Occupational Assessment. Credit 3.** This course is designed to provide students with an understanding of occupational exposure assessment. Students will gain experience in sample collection for occupational settings and occupational exposure analysis.
- 618. Occupational Safety. Credit 3.** This course is designed to provide students with an understanding of occupational safety and health topics they will encounter as safety professionals. Students will gain experience and knowledge in the areas of construction safety, fall protection systems, aerial lift safety, emergency response communication, hazard identification, accident investigation techniques, OSHA regulations, their role as a safety professional during an OSHA inspection, workers compensation, safety in rural and developing areas and ethics in safety.
- 620. Environmental/Occupational Case Studies. Credit 3.** Considers the basic methodology of conducting case studies; using major episodes of environmental/occupational exposures examines methods of monitoring exposures and establishing causation. Emphasis on failure analysis, dosimetry and study design, results of health studies and risk assessments, and legal, political, economic, social and ethical ramifications. Prerequisites: Must complete or be enrolled in all core courses.
- 630. Environmental/Occupational Diseases. Credit 3.** Identification, evaluation and quantification of risk factors for environmental and occupational diseases, using classic and current examples of exposures involving chemical, physical and biologic agents. Selection of appropriate design and groups. Exposure assessment, including biomarkers and molecular dosimetry. Genetics, gender, age, socioeconomic and other factors affecting susceptibility. Prerequisite: College-level mathematics.

- 640. Industrial Hygiene. Credit 3.** Considers methods to measure and reduce workplace hazards; evaluation of engineering controls and personal protective equipment; includes potential chemical, physical, ergonomic and biological exposures. Review of major legislation affecting workplace environment.
- 645. Health and Safety at Hazardous Waste Sites. Credit 3.** Course covers OSHA compliance issues related to the protection of personnel engaged in on-site remediation activities. Students who satisfactorily complete the course meet the requirements for initial training under 20 CFR 1910.120 (HAZWOPER) and receive a certificate. Hands-on activities/workshops in the areas of personal protective equipment selection and use, sources of chemical information, decontamination procedures, air monitoring equipment, materials handling, and health and safety planning. Lab fee required.
- 650. Risk Assessment I. Credit 3.** Introduction to the general methodology of Quantitative Risk Assessment; introduction to methods of modeling exposure and selection of toxicity values, as well as risk characterization. Students utilize case studies to learn the general methods of risk assessment; also reviews the importance of and methods for risk communication and management.
- 655. Human Factors and Behavior-Based Safety. Credit 3.** Basic understanding of the theory and practice of human factors as well as discussion on behavior-based safety. Topics are presented within the framework of humans as functioning systems. Prerequisite: Approval of instructor.
- 675. Water and Environmental Public Health. Credit 3.** To provide a broad understanding of the elements of water and environmental public health and how these major environmental issues affect our society. It will examine water-related health issues, scientific understanding of causes and associations, and possible future approaches to understanding the major environmental health problems in developed and developing countries.
- 678. Ergonomics of the Lower Back. Credit 3.** Fundamental topics upon which models for the prevention and control of low back pain are constructed. Focus is on ergonomic assessment, design, and improvement, including biomechanics, anthropometry, strength assessment, and implementation of controls. Prerequisite: Approval of instructor.
- 679. Ergonomics of the Upper Extremities. Credit 3.** Fundamental topics upon which models for the prevention and control of distal upper extremity disorders are constructed. Focus is on topics including human anatomy, neurophysiology, electrophysiology, and worker capacity evaluation. Prerequisite: Approval of instructor.
- 681. Seminar in Environmental and Occupational Health. Not for credit.** Provides an opportunity for new students to become familiar with departmental research activities. First-year students describe proposed research; second-year students present results from original research. Students also discuss thesis proposal preparation. May be repeated.
- 682. Industrial and System Safety. Credit 3.** Course covers general concepts and techniques of safety upon which more detailed and advanced applications may be based. In addition, concepts will include current system safety analysis techniques, failure mode and effect and fault tree analysis, as well as economic analysis for presentation of alternative solutions for problem solving. Prerequisite: Approval of instructor.
- 684. Practicum. Credit 3 to 6.** Field placement experience in which students work closely with a departmental faculty member and (an) appropriate field professional(s) applying skills and techniques acquired through coursework. Prerequisite: Approval by student's academic advisor. Satisfactory/Unsatisfactory grade option only.
- 685. Directed Study. Credit 1 to 3.** Student investigation of a topic not covered by other formal courses. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.
- 686. Directed Research. Credit 1 to 3.** Student research initiative not within the scope of a thesis or dissertation. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grade option only. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.

- 689. Special Topics in Environmental and Occupational Health. Credit 1 to 4.** Revolving topics seminar in an area of specialization within the department. May be repeated for credit. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.

Department of Epidemiology and Biostatistics

J. D. Brender, D. M. Gorman (Head), D. Han

(PHEB)

- 600. Fundamentals of Epidemiology. Credit 3.** This is a core epidemiology course for non-major students. It is an overview course intended to familiarize students with the basic principles and applications of epidemiological concepts in the study of disease occurrence in populations. The focus of the course is on the interpretation and assessment of epidemiologic research, both descriptive and analytic, and its application to public health practice and relevance to the key disciplines of public health.
- 602. Biostatistics I. Credit 3.** An introduction to statistical issues in public health including basic probability, significance levels and confidence intervals, interpretation of public health data, and specific statistical techniques such as regression, analysis of variance, nonparametric techniques and categorical data.
- 603. Biostatistics II. Credit 3.** A second course in biostatistical methods that emphasizes linear models and designed experiments. Designed for students wishing a deeper understanding of topics introduced in PHEB 602. Prerequisite: PHEB 602.
- 605. Epidemiologic Methods I. Credit 3.** This is the core epidemiology course for major students in the Department of Epidemiology and Biostatistics. It is an overview course intended to familiarize students with the basic principles and applications of epidemiological concepts in the study of disease occurrence in populations. The focus of the course is on the interpretation and assessment of epidemiologic research, as well as the design and conduct of descriptive and analytic epidemiologic studies.
- 606. Survival Analysis. Credit 3.** Introduce statistical methods for survival (time-to-event) data analysis. Discuss basic concepts of survival analysis, including hazard functions, survival functions, types of censoring, Kaplan-Meier estimates, logrank tests, and Cox Proportional Hazard Regression models. Prerequisite: PHEB 602 and PHEB 603.
- 607. Sample Survey Methodology. Credit 3.** The purpose of this course is to prepare students to examine the unified set of concepts, principles and methodologies that govern sample survey methodology. It is designed to build on a foundation of coherent survey concepts and foster the understanding of the principles and methods of sampling theory, survey design, analysis and interpretation. This course is designed for epidemiology track and other public health students requiring a more thorough knowledge of the concepts and methods used in survey research. This course stresses survey designs, methodological issues and analytic methods as they relate to conduct of surveys.
- 609. Categorical Data Analysis. Credit 3.** This course will introduce the basic theory and applications of methods used to analyze categorical data. The theory will be covered but the emphasis will be on selecting appropriate analysis strategies, analyzing data and interpreting results of those analyses. No background in calculus or matrix algebra is required. Prerequisite: PHEB 602 and PHEB 603 (or STAT 651 and STAT 652).
- 610. Epidemiologic Methods II. Credit 3.** An intensive introduction to epidemiological concepts and methods for students in the epidemiology concentration and others who will collaborate in—or be required to—interpret the results of epidemiological studies. Emphasis is placed on calculation and interpretation of crude and adjusted data, measures of association, and study design. Prerequisites: Course restricted to PHEB students only or instructor approval required. PHEB 602 and PHEB 605, or concurrent enrollment in PHEB 603.
- 611. Epidemiologic Methods III. Credit 3.** In-depth treatment of key methodological and analytic topics in epidemiology. Emphasis on study design and implications for data analysis, such as confounding, model selection and effect modification. Analytic techniques using logistic regression and stratified analysis will be emphasized. Prerequisites: PHEB 610 and PHEB 603.

- 612. Data Management/Computing. Credit 3.** An introduction to the principles of data management, techniques in designing and implementing databases for large data systems, techniques for communicating between computing environments, and introduction to statistical software. Prerequisite: PHEB 600 or PHEB 605.
- 613. Statistical Methods for Genetics. Credit 3.** This is an elective course that will introduce students to the statistical methods used in the search for genetic factors that may be associated with diseases. While the mathematics underlying the methods will be presented, emphasis will be placed on the understanding concepts, using software to analyze example data and interpreting the results of those analyses. PHEB 602 and PHEB 603 or STAT 651 and STAT 652 are required prerequisites since the current course will build on concepts introduced in those classes.
- 614. Analysis Of Longitudinal and Multilevel Data. Credit 3.** This course presents modern approaches to the analysis of longitudinal and multilevel data. The random-effects model and the generalized estimating equations are studied. Both continuous and discrete outcome are considered. Missing data issue is discussed. Prerequisite: PHEB 603 and PHEB 609.
- 615. Disaster Epidemiology. Credit 3.** Students will be taught the basic principles, terms, and epidemiological tools for use in disasters. Topics to be covered include: 1) public health consequences associated with various types of disasters; 2) rapid health assessment of disaster-affected populations; 3) establishment of emergency surveillance systems in disaster settings; 4) the federal and state disaster response framework; 5) selected case studies of disasters and their effects on populations; and 6) topics related to disasters in international health settings. Each class session will have a lecture component, team exercise/case study and discussion. Prerequisite: PHEB 600.
- 618. Spatial Epidemiology I. Credit 3.** This course provides a broad introduction to the principles and methods of spatial epidemiology, with particular emphasis on the use and applications of Geographical Information Systems (GIS), and spatial analysis methods in health research and public health practice.
- 619. Infectious Disease Epidemiology. Credit 3.** Principles and practices of epidemiology appropriate for the study of communicable diseases. Course focuses on methodology, public health concerns, patterns of transmission and newly discovered infectious diseases. Prerequisite: Either PHEB 600 or PHEB 605 or permission of the instructor.
- 620. Cancer Epidemiology. Credit 3.** A review of the principles and methods used in cancer epidemiology. The course focuses on cancer etiology and control, with emphasis on race/ethnicity and urban/rural differences in cancer incidence and mortality. Prerequisite: Either PHEB 600 or PHEB 605 or permission of the instructor.
- 621. Cardiovascular Disease Epidemiology. Credit 3.** Review of principles, issues and methods in the epidemiology of cardiovascular disease. This course also considers determinants and strategies for prevention. Prerequisite: PHEB 600 or permission of the instructor.
- 622. Reproductive and Perinatal Epidemiology. Credit 3.** Epidemiology of major reproductive health outcomes, including infertility, fetal loss, birth weight, congenital malformations and infant mortality. Review of current knowledge of determinants of these outcomes. Prerequisite: PHEB 600 or PHEB 605 or permission of the instructor.
- 624. Social Epidemiology. Credit 3.** This course entails an exploration and examination of the social determinants and distribution of physical and mental health outcomes. These determinants include socioeconomic inequalities, stress, and social organization. The course focuses on the development and evaluation of testable hypotheses concerning the relationship between social conditions and health. Prerequisite: PHEB 600.
- 626. Occupational and Environmental Epidemiology. (3-0).** This course involves the examination of occupational and environmental exposures related to disease and injury. Topics covered include general methods used in occupational and environmental epidemiology, exposure assessment, surveillance, and the relation of occupational and environmental exposure to adverse reproductive outcomes, cancer, diseases and the ergonomic-related outcomes. Prerequisite: PHEB 600 or PHEB 605 or equivalent.
- 627. Chronic Disease Epidemiology. Credit 3.** This course will provide insight into the epidemiologic concepts and research needed in the study of chronic disease and its associated risk factors. This course is intended to provide students with an appreciation of the major trends in the incidence and prevalence of specific chronic diseases. The focus will be from a U.S. and international perspective. Methodological challenges relevant to chronic disease epidemiologic research will be addressed in lectures, readings, student discussions, presentation and assignments. Prerequisite: PHEB 600.

- 684. Practicum. Credit 3 to 6.** Field placement experience in which students work closely with a departmental faculty member and (an) appropriate field professional(s) applying skills and techniques acquired through coursework. Prerequisite: Approval by student's academic advisor. Satisfactory/Unsatisfactory grade option only.
- 685. Directed Study. Credit 1 to 3.** Student investigation of a topic not covered by other formal courses. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.
- 686. Directed Research. Credit 1 to 3.** Student research initiative not within the scope of a thesis or dissertation. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grade option only. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.
- 689. Special Topics in Epidemiology and Biostatistics. Credit 1 to 4.** Revolving topics seminar in an area of specialization within the department. May be repeated for credit. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.

Department of Health Policy and Management

J. L. Alexander, C. H. Blakely, J. N. Bolin, L. D. Gamm (Head), C. Hawes, C. V. Sumaya, M. Tai-Seale

(PHPM)

- 601. Rural Public Health Systems. Credit 3.** An introduction to the field of public health and to rural health conditions, issues, professions, organizations, and policies relevant to the health of rural communities.
- 605. Introduction to Health Policy and Management. Credit 3.** Prepares students for administrative or policy positions in governmental programs, voluntary health organizations, or in other health service organizations. Supports effectiveness of public health and health services professionals by providing knowledge of health organizations and services and associated management policy issues. Introduces the U.S. health system and health management areas and emphasizes policy topics.
- 606. Health Systems Management. Credit 3.** This course introduces conceptual frameworks and practices associated with key functions in the management of complex health organizations.
- 607. Workforce: Issues and Challenges Credit 3.** This course will focus on the development, impact and needs of the U.S. workforce. Options for the future direction and strategies to improve the effectiveness and efficiency of the health workforce will be analyzed.
- 614. Strategic Planning & Marketing I. Credit 3.** This course offers an introduction to strategic planning and management in health services organizations. Processes and formats employed in strategic planning and marketing are presented and applied in case studies and a final project. Elements of market assessment, environmental analysis and strategy development are presented and applied to course practices. Prerequisite: PHPM 605 or 606 prior or concurrently.
- 615. Strategic Planning & Marketing II. Credit 3.** This course builds upon strategic planning and marketing concepts introduced in PHPM 614. It provides an overview of marketing and how it can be applied effectively to healthcare organizations. The course covers the history of healthcare marketing, basic marketing concepts and tools, the process of developing and managing a marketing plan, and the nature of healthcare markets and consumers. Prerequisite: PHPM 605 or 606 prior or concurrently and PHPM 614.
- 616. Management of Human Resources. Credit 3.** An introduction to the range of human resources issues facing the health delivery system administrator from benefits to grievances and human resources management in health organizations. Course also covers personnel practices such as job analysis and description, recruitment, selection and compensation in various health delivery system settings. Prerequisite: PHPM 601 prior or concurrent.

- 617. Health Care Quality Evaluation and Utilization Management. Credit 3.** Overview of evolving health delivery system quality mechanisms and approaches for maximizing quality control in health care organizations. Includes concepts and practices of quality assessment, control and improvement, and accreditation and outcome analysis in service delivery systems. Prerequisites: PHPM 601, 605 or 606. PHEB 602 or STAT 651 or STAT 652, PHPM 631 prior or concurrently.
- 618. Program Evaluation in Health Care Management. Credit 3.** Course provides an overview of the utility of evaluation in policy planning and program management. Intent is to prepare the student to be an educated consumer of evaluation information, rather than a true evaluation researcher. Prerequisites: PHPM 601 and 605.
- 619. Organization Theory and Applications in The Study of Health Services. Credit 3.** An examination of theoretical frameworks employed in the study of health care systems as formal organizations and interorganizational arrangements. Prerequisites: Instructor approval.
- 620. Operations Management. Credit 3.** This course is organized around the types of tactical and operational decisions made by health care operations managers. Tactical decisions are medium- and long-term decisions that together determine the processes by which health care services are produced and delivered, while operational decisions are short-term decisions concerned with utilizing resources to meet the objectives of the organization in an efficient manner. Building on a “system-based” approach to the health care environment, analytical tools are examined to aid problem solving and decision-making in health care organizations. Where appropriate, spreadsheets will be used to ease computational work, facilitate analysis, and aid in the presentation of results. This course examines operational decisions through a combination of lectures, problem sets, organizational analysis, and readings. Prerequisites: PHPM 617 and 631.
- 621. Seminar in Interorganizational Research. Credit 3.** Health services research in interorganizational relations includes: applications of theories such as social exchange, transaction costs, resource dependence, organization ecology, political, economic and institutional theory; and their applications to community health networks, integrated delivery systems, and complex market and/or public policy approaches to health services. Prerequisites: PHPM 619.
- 622. Management Of Innovation In Health Services. Credit 3.** This course examines the processes through which innovation is identified, studied, implemented, evaluated, and disseminated with particular attention to organization theory applied to innovation in the development, structure, and performance of health care organizations and/or health systems. Prerequisite: PHPM 619 or PHPM 621.
- 623. Health Care Financial Management I. Credit 3.** This introductory course focuses on the most important accounting and financial management principles and concepts relevant to the management of health services organizations. The course emphasizes the development of analytical thinking and decision making skills. Class feature lecture, case studies, and discussion of current and “real life” issues within health care. At the end of the course, students should have a strong financial management foundation with an understanding of key issues, challenges, and solutions to use in their future health care organization. Prerequisites: PHPM 605 or PHPM 606 and PHPM 601 prior or concurrently.
- 624. Health Care Financial Management II. Credit 3.** This is an intermediate course on health care financial management which covers several topics from PHPM 623 in depth and introduces new topics and tools relating to capital financing, financial evaluation, and developing forecast financial statements. Several special topics are included that deal with current trends and issues (e.g., mergers and acquisitions, physician integration, and new payment mechanisms). The course consists of lectures and case studies. As a team project, students develop a long-range financial plan for a hypothetical hospital. Prerequisites: PHPM 601, PHPM 605 or PHPM 606, PHPM 623.
- 629. Organizational Assessment and Development. Credit 3.** This course provides skills needed to support collaborative processes in diagnosing organizational needs and problems and introducing innovative structures, processes, and other changes to enhance organizational responsiveness and accountability.
- 631. Health Information Management Systems. Credit 3.** Course introduces computer-based information systems, architectures and applications in the management of health services organizations. It addresses systems designs, data management systems, data access and communications, and the implications of expanding technological capacities for information management systems. Prerequisites: PHPM 601, 605 or 606.

- 633. Health Law and Ethics. Credit 3.** Course covers torts, contract law, corporate liability, malpractice, key federal and state regulations, and records management relative to healthcare. Important health case law is discussed. Ethical considerations are discussed as they relate to the law and management of health delivery systems. Prerequisites: PHPM 601, 605 or 606.
- 639. Global Health. Credit 3.** This course is intended to focus on policy needs of major public health issues that cross national boundaries and require a broader international and global perspective. There will be a critical examination of public health and health care infrastructures, variations of health care financing processes, international governance, and the sharing of health-related public goods on a global basis. A future direction and strategies to achieve a healthier world amidst formidable challenges will be discussed through course presentations, experts/visiting professors, and student-led case studies and article reviews.
- 640. Health Policy and Politics. Credit 3.** This course examines public and private sector institutions responsible for health policy development at the national and state levels, the interaction of national and regional health systems to create and implement rural health policies, and public programs providing health coverage, particularly those targeting rural residents. Prerequisite: PHPM 601.
- 641. Health Policy Analysis and Policy Formation. Credit 3.** An examination of the policy implementation process, with an emphasis on the role of interest groups, bureaucracies, and the courts in the implementation of health policies; analysis of effective policy implementation and design and factors contributing to that, as well as factors associated with failed implementation. Prerequisite: PHPM 601 or 605.
- 642. Public Health Emergency Preparedness Policy Issues. Credit 3.** This course examines design and implementation of public health policy at federal, state, and local levels. It addresses development, organization, financing, regulation, delivery and evaluation in many health policy areas. The course examines public health policy issues across the emergency preparedness continuum. Prerequisite: PHPM 601 or permission from the instructor.
- 643. Comparative Health Care Delivery Systems. Credit 3.** The course provides an overview of varying international models of health and health care delivery systems. Strengths and weaknesses and relative costs are considered. Implications for rural populations are highlighted.
- 644. Texas Training Initiative for Emergency Response (T-Tier). Credit 3.** This course develops the knowledge, skills, and abilities needed to effectively respond to bioterrorism, infectious disease outbreaks, and other public health threats and emergencies in a multi-disciplinary approach. The course will focus on competencies paralleling the critical benchmark of emergency preparedness as identified by the Centers for Disease Control and Prevention, as well as to gain the knowledge, skills and abilities along with practice to protect the public's health. Roles of the many public health workers will be explored.
- 645. Critical Issues in Health Policy. Credit 3.** Overview of how U.S. national and state health policy is formulated and considers competing interests in the political process. Considerable emphasis placed on the unique needs of special interest groups from the financially disadvantaged to special needs populations, ethnic and other minorities and rural populations. Prerequisites: PHPM 601 and 640.
- 646. Health Systems and the Aging. Credit 3.** Overview of the current U.S. infrastructure designed to provide health services to the aging. Includes federal and illustrative state policies that affect the health of the older citizens and the systems designed to meet their health care needs.
- 647. Long-Term Care Policy and Management. Credit 3.** Examination of health policy and management in provision of care for the aged and other chronic care populations. Includes instruction on access, use, market issues, quality of services and cost containment. Prerequisites: PHPM 601 and 605.
- 649. Ambulatory Care Policy and Management. Credit 3.** An examination of public policies and management practices related to the management practices appropriate to operation of rural health clinics, public health clinics and physician offices. Prerequisites: PHPM 601 and 605.
- 652. Health Care Reimbursement. Credit 3.** Study of reimbursement policies and practices of public and private third party payers, and self-insured employers. In addition the course presents an overview of the impact these difference payers have on health providers, including incentives, quality and access to care. Prerequisites: PHPM 601 and 605.

- 654. Health Insurance and Managed Care. Credit 3.** Provides an overview of health insurance in the U.S., with an emphasis on the private health insurance markets and managed care. Topics covered include the demand for insurance, insurance underwriting and rate making, the role of employer-sponsored health insurance, the impact of managed care on hospital and physician markets, and health savings accounts and consumer-directed plans. Prerequisites: PHPM 601 and PHPM 605.
- 661. Introduction to Health Economics. Credit 3.** Provides basic concepts in economic theory and analysis applied to health care delivery in the United States. Course addresses supply and demand issues for health services, reimbursement systems and health insurance. Course addresses issues in health delivery in a competitive market and public sector involvement. Prerequisite: PHPM 601.
- 663. Cost Effectiveness Analysis and Health Policy. Credit 3.** This course provides an overview of the methods of cost-effectiveness analysis and decision analysis and their applications to resource allocation decisions in public health and medicine, particularly as it relates to health policy. Prerequisite: PHPM 661.
- 668. Applied Health Services Research I. Credit 1.** This course takes students through each step in the development and execution of a research project. Faculty in the doctoral program will discuss hypothesis development, measurement strategies, data collection option, analysis plans, research ethics and other issues that arise during a health services research project. Prerequisites: Must be taken concurrently with PHPM 671.
- 669. Applied Health Services Research II. Credit 1.** Requires that students be prepared each week to discuss a research paper or research papers assigned by the instructor. Faculty in the doctoral program may also present their work or lead the discussion of specific papers during the course of the semester. Prerequisite: PHPM 668. Course must be taken concurrently with PHPM 672.
- 670. Health Policy Evaluation. Credit 3.** Comprehensive examination of approaches to evaluate health policies and programs. Includes both discussion of analytical methods and design issues. Prerequisite: PHPM 601, 640, and STAT 651.
- 671. Introduction to Health Services Research. Credit 3.** Examines issues pertaining to health care access, cost and quality across multiple health care settings. Prerequisites: PHPM 601 and 605.
- 672. Health Services Research Methods. Credit 3.** Introduces multidisciplinary approaches to conducting health services research. Course focuses on both primary and secondary data analysis for the purpose of understanding the quality and effectiveness of various health delivery systems and the policy implications for the health of citizenry. Prerequisites: PHPM 671.
- 674. Secondary Analysis of Health Data. Credit 3.** Support secondary data analysis opportunities in health services research. Includes introduction to available databases, mechanisms of access, health policy issues that can be addressed through secondary data analysis, and data cleaning and analytical techniques necessary to examine key health policy issues. Prerequisites: PHPM 601, PHPM 671, PHPM 672 and STAT 652.
- 675. Survey Research Methods. Credit 3.** Key elements in the design and execution of population and organizational surveys. Prerequisites: PHPM 671 and 672.
- 676. Analytical Issues in Health Services Research. Credit 3.** Provides an overview of analytic tools used in health services research. Primary focus is on application to non-experimental research settings. Topics include simple and multivariate regression models, dichotomous dependent variable models, polychotomous choice models, quantile regression, propensity score methods, and instrumental variables estimators. Prerequisite: PHEB 603 or equivalent.
- 684. Practicum. Credit 3 to 6.** Field placement experience where students work closely with a departmental faculty member and (an) appropriate field professional(s) applying skills and techniques acquired through coursework. Prerequisite: Approval by student's academic advisor. Satisfactory/Unsatisfactory grade option only.
- 685. Directed Study. Credit 1 to 3.** Student investigation of a topic not covered by other formal courses. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.

- 686. Directed Research. Credit 1 to 3.** Student research initiative not within the scope of a thesis or dissertation. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grade option only. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.
- 689. Special Topics in Health Policy and Management. Credit 1 to 4.** Revolving topics seminar in an area of specialization within the department. May be repeated for credit. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.

Department of Social and Behavioral Health

J. N. Burdine, A. M. Dorsey, Y. Hong, K. R. McLeroy, M. May, N. Mier, M. G. Ory, C. D. Phillips,
J. R. Sharkey, M. L. Smith

(PHSB)

- 603. Social and Behavioral Determinants of Health. Credit 3.** An overview of theories and principles focusing on social and behavioral determinants of health, the social-ecological approach to the examination of health and health behaviors, social patterns of health behavior, and an introduction to health promotion and public health interventions. Intended for non-majors.
- 604. Social Ecology and Health Behavior. Credit 3.** Social determinants of health behavior, social organization and stressors on human health, social-ecological approach to the examination of health behaviors, social patterning of disease and health behavior, basic theories of health behavior and communication, public health program diffusion and implementation. Intended for majors only; permission of instructor required for non-majors.
- 605. Social and Behavioral Research Methods. Credit 3.** Overview of quantitative and qualitative methods used by public health professionals, advantages and limitations of different methods, mechanisms for gathering data in a community setting, techniques for managing and analyzing data, and strategies for presenting information to community members. Prerequisite: PHEB 602 or equivalent, or permission of instructor.
- 610. Community Organization and Assessment. Credit 3.** The nature of both formal and informal organizations and their strategic place in community organization. The nature of community; communities as systems and nonsystems; relationships between health, community and healthy communities. Analysis and application of assessment models. Field-based community and/or organizational analysis required. Prerequisites: PHSB 603 or 604, or permission of instructor.
- 611. Program Planning. Credit 3.** Use of theory and evidence in planning public health interventions, appropriate objective development, integration of levels of intervention, consolidation of intervention strategies into coherent program design, program implementation, diffusion and institutionalization. Prerequisite: PHSB 604 or permission of the instructor.
- 612. Public Health Interventions. Credit 3.** Examination of the conceptualization and theoretical foundation, design, implementation, and effectiveness of specific public health interventions at the individual, interpersonal, organizational, community, and policy levels for addressing particular chronic or infectious diseases (specific focus may vary by semester). Prerequisite: Either PHSB 603 or 604, or permission of the instructor.
- 613. Program Evaluation. Credit 3.** Study of program evaluation techniques. The course focuses on issues relevant to the assessment and evaluation of health promotion interventions, and examines the social context of program evaluation and a variety of epistemological orientations. Prerequisite: Either PHSB 603 or 604; PHSB 605; PHSB 611 (or concurrent).

- 620 Introduction to Border Health. Credit 3.** This course introduces the U.S.-Mexico border as a dynamic region where public health problems grow out of a combination of factors in the United States and Mexico. A major focal point is community health, to which the course relates the various public health disciplines as an introduction to public health. Overarching factors such as population movement, diverse sociocultural and economic demographics, and a rapidly expanding population influence infectious disease transmission and general population health. Information about the history and cultures of the South Texas region provide background information for understanding the confluence of factors shaping regional public health. Economic forces that influence health include the maquiladora system of binational factories that operate in a free-trade zone environment and the need for hand labor in various economic sectors in different parts of the United States. Environmental challenges in the region include water pollution and scarcity, air pollution, food supply problems, and poor urban and rural infrastructure. Policy and political factors also affect population health and economics along the border (e.g., NAFTA, homeland security, and state regulation of health insurance plans).
- 635. Community Health Development. Credit 3.** The theory and practice of community development for health; a comparative study of community development models in diverse communities. Analysis of how to create systematic and sustainable community change related to health and healthy communities, with attention to rural, minority and underserved communities. Prerequisite: Either PHSB 603 or PHSB 604; PHSB 610; or permission of instructor.
- 637. Principles of Health Program Management. Credit 3.** This course prepares the student with knowledge and skills to assume a role in the management of health promotion programs. The course covers management theory, leadership, organizational assessment, planning, decision-making, organizational structure, budgeting, marketing, and human resource management.
- 638. Seminar on Alcohol, Tobacco and other Drugs. Credit 2 to 3.** In-depth study of public health issues and concerns related to alcohol, tobacco, and other drug use. Includes overview of contributing causative and mediating factors of drug use and theory-based prevention and intervention strategies and programs. Prerequisite: PHSB 604 or permission of the instructor.
- 639. HIV/AIDS: A Public Health Issue. Credit 3.** This course provides an overview of HIV/AIDS, including history of the epidemic, trends and geographic disparities, economic and social impact, high risk populations, prevention interventions, treatment and care. Both domestic and international aspects of the HIV/AIDS epidemic will be covered. The focus will be prevention and social and policy focus that divert attention away from practical steps that need to be taken to prevent the spread of HIV. Prerequisite: Graduate students only.
- 665. Proposal Writing and Grants Management. Credit 3.** Introduction to skills needed to successfully develop proposals for funding in fields related to healthcare and social services. Course focuses on best methods used by community-based organizations to develop public and private funding applications, develop and maintain relationships with the funding agency and assess organizational implications of applying for and managing grants. Prerequisite: PHSB 604 for Social and Behavioral Students and PHPM 601 for non-majors (usually offered in the summer).
- 670. Seminar in History and Context of Public Health. Credit 3.** This doctoral seminar will introduce doctoral students to major themes in public health with emphasis on the evolution of public health, public health problems, and the future of public health. This course sets public health within context and discusses relationship to other related fields of study. Prerequisites: Permission of instructor. Satisfactory/Unsatisfactory grade option only.
- 671. Seminar in Public Health Theory. Credit 3.** This doctoral seminar will review and reflect upon theories and perspectives that relate to public health problems and proposed solutions. Students will critique current social and behavioral theories, discussing commonalities and differences across multiple theoretical approaches for addressing public health problems. Prerequisites: Permission of instructor. Satisfactory/Unsatisfactory grade option only.
- 672. Seminar in Public Health Interventions. Credit 3.** This doctoral seminar will focus on the examination of the theoretical foundation, implementation and effectiveness of public health interventions from a multi-level approach. The emphasis will be on the translation from research to practice, understanding the elements of evidence-based intervention strategies. Prerequisite: Permission of instructor. Satisfactory/Unsatisfactory grade option only.

- 673. Seminar in Public Health Evaluation. Credit 3.** This doctoral seminar will review the conceptual and methodological elements of public health evaluations, providing an opportunity for reflection on the strengths and weaknesses of different public health evaluations. Students will be asked to design an evaluation strategy for a self-identified health problem/intervention approach. Prerequisite: Permission of instructor. Satisfactory/Unsatisfactory grade option only.
- 674. Seminar in Social and Behavioral Health. Credit 3.** This doctoral seminar will cover topics of interest to faculty and students within the purview of social and behavioral health. The topic will be assigned the first day of class by mutual agreement of participating students and faculty. Students will be expected to reflect critically on the assigned literature and participate in classroom discussions. May be repeated four times. Prerequisite: Permission of instructor. Satisfactory/Unsatisfactory grade option only.
- 684. Practicum. Credit 3 to 6.** Field placement experience where students work closely with a departmental faculty member and appropriate field professional(s) applying skills and techniques acquired through coursework. Prerequisite: Approval by student's academic advisor. Satisfactory/Unsatisfactory grade option only.
- 685. Directed Study. Credit 1 to 3.** Student investigation of a topic not covered by other formal courses. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.
- 686. Directed Research. Credit 1 to 3.** Student research initiative not within the scope of a thesis or dissertation. Prerequisite: Approval by student's academic advisor. May be repeated for a maximum of six credits. Satisfactory/Unsatisfactory grade option only. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.
- 689. Special Topics in Social and Behavioral Health. Credit 1 to 4.** Revolving topics seminar in an area of specialization within the department. May be repeated for credit. Satisfactory/Unsatisfactory grading option or standard grading option to be determined by the instructor and applied to all students registered for the course. Grading option will be determined prior to the first class day and outlined in the course syllabus and not be altered once the course has begun.

School of Rural Public Health (SRPH)

- 640. Public Health Informatics. Credit 3.** Provides an overview of the field of public health informatics, and focuses on PHI competencies for public health practitioners. Key informatics challenges and current topics, such as evidence-based public health data and vocabulary standards, privacy and security, interoperability and health information exchange, electronic health records and data integration, are explored. Students will learn techniques for search in public health literature and will practice informatics evaluation skills by assessing a health information system.

Graduate Faculty

A large, multi-tiered fountain with several water jets spraying upwards, set in a park-like campus environment with trees and a building in the background. The fountain is the central focus, with water cascading down its sides into a pool. The background shows a paved walkway, green trees, and a brick building under a blue sky with scattered clouds. Two people are walking on the path to the left of the fountain.

Graduate Faculty

Texas A&M University Faculty

(Updated as of May 15, 2012)

Figures in parentheses indicate date of first appointment on the University staff and date of appointment to present position, respectively.

- Abanov, Artem G.**, Associate Professor of Physics and Astronomy. (2006, 2011) B.S., Moscow Institute of Physics and Technology, 1991; M.S., Moscow Institute of Physics and Technology, 1994; Ph.D., Texas A&M University, 1998.
- Abbott, Louise C.**, Professor of Veterinary Integrative Biosciences, of Neuroscience and of Toxicology. (1994, 2012) B.A., Whitman College, 1975; Ph.D., University of Washington-Seattle, 1982; D.V.M., Washington State University, 1988.
- Abdel-Wahab, Ahmed**, Associate Professor, Department of Chemical Engineering (Texas A&M University at Qatar). B.S., Al-Minia University (Egypt), 1990; M.S., Al-Minia University (Egypt), 1995; Ph.D., Texas A&M University, 2003.
- Aberth, Oliver G.**, Professor of Mathematics (Retired). (1970) B.S., City College of New York, 1950; M.S., Massachusetts Institute of Technology, 1951; Ph.D., University of Pennsylvania, 1962.
- Abeygunawardena, Piya**, Professor and Associate Director, Department of Agricultural Economics. (2008) B.S., University of Peradeniya (Sri Lanka), 1979; M.S., Texas A&M University, 1983; Ph.D., Texas A&M University, 1986.
- Abu Al-Rub, Rashid K.**, Assistant Professor, Zachry Department of Civil Engineering, and of Materials Science and Engineering. (2007) B.S., Jordan University of Science and Technology, 1999; M.S., Jordan University of Science and Technology, 2000; Ph.D., Louisiana State University, 2004.
- Abu-Rub, Haitham**, Associate Professor, Department of Electrical and Computer Engineering (Texas A&M University at Qatar). (2006) M.S., Gdynia Maritime Academy, 1990; Ph.D., Technical University of Gdansk (Poland), 1995; Ph.D., Gdansk University (Poland), 2004.
- Abur, Ali, P.E.**, Professor, Department of Electrical and Computer Engineering, and IEEE Fellow. (1985, 1998) B.S., Middle East Technical University (Turkey), 1979; M.S., The Ohio State University, 1981; Ph.D., The Ohio State University, 1985.
- Ackerman, Jeffrey M.**, Assistant Professor of Sociology. (2003) B.S., The Pennsylvania State University, 1993; M.A., The Pennsylvania State University, 1998; Ph.D., The Pennsylvania State University, 2003.
- Acosta, Sandra**, Assistant Professor of Educational Psychology. (2008, 2009) B.A., The University of Texas; M.A., University of Wisconsin; M.Ed., St. Thomas University; Ph.D., Texas A&M University, 2010.
- Acuff, Gary R.**, Professor of Animal Science and of Food Science and Technology. (1980, 1999) B.S., Abilene Christian University, 1980; M.S., Texas A&M University, 1982; Ph.D., Texas A&M University, 1985.
- Adair, Thomas W., III**, Professor of Physics and Astronomy. (1966, 2002) B.S., A&M College of Texas, 1957; M.A., Rice University, 1960; Ph.D., Texas A&M University, 1965.
- Adams, Clark E.**, Professor of Wildlife and Fisheries Sciences. (1981, 1994) B.S., Concordia Teachers College, 1964; M.S., University of Oregon, 1966; Ph.D., University of Nebraska, 1973.
- Adams, Leslie Garry**, Professor of Veterinary Pathobiology, College of Veterinary Medicine and Biomedical Sciences, and Member of the Intercollegiate Faculty of Biotechnology. (1968, 1978) B.S., A&M College of Texas, 1963; D.V.M., Texas A&M University, 1964; Ph.D., Texas A&M University, 1968; Diplomate, American College of Veterinary Pathologists, 1970.
- Adams, Marvin Lee**, Professor, Department of Nuclear Engineering; Director of Institute for National Security Education and Research; and Holder of the HTRI Chair. (1991, 2002) B.S., Mississippi State University, 1981; M.S.E., University of Michigan, 1984; Ph.D., University of Michigan, 1986.
- Adams, Ralph James Q.**, University Distinguished Professor, Distinguished Professor of History and Holder of the Patricia and Bookman Peters Professorship in History. (1974, 2009) B.S., Indiana University, 1965; M.A., Valparaiso University, 1969; Ph.D., University of California, Santa Barbara, 1972.
- Adelson, David L.**, Associate Professor of Animal Science. (2001) B.A., University of California, San Diego, 1978; Ph.D., University of Hawaii at Manoa, Honolulu, 1985.
- Adkisson, Jean A.**, Clinical Professor of Finance. (2001, 2010) B.S., Texas A&M University, 1979; M.Agr., Texas A&M University, 1981; M.S., Texas A&M University, 1987; Ph.D., Texas A&M University, 1988.

- Agnolet, Glenn**, Professor of Physics and Astronomy. (1985, 2001) B.S., Carnegie Mellon University, 1976; M.S., Cornell University, 1980; Ph.D., Cornell University, 1983.
- Aguiar, Marcelo**, Professor of Mathematics. (2001, 2008) Licenciatura, Universidad de Uruguay, 1992; Ph.D., Cornell University, 1997.
- Ahmed, Anwer S.**, Professor of Accounting and Holder of the Ernst & Young Professorship in Accounting. (2005, 2008) B.S., London School of Economics, 1979; M.S., London Business School, 1985; Ph.D., University of Rochester, 1992.
- Ahmed, Shehab**, Assistant Professor, Department of Electrical and Computer Engineering. B.S., Alexandria University (Egypt), 1999; M.S., Texas A&M University, 2000; Ph.D., Texas A&M University, 2007.
- Aitkenhead-Peterson, Jacqueline**, Assistant Professor of Soil and Crop Sciences and of Water Management and Hydrological Science. (2006) B.S., University of Stirling, 1995; M.S., University of Aberdeen, 1996; Ph.D., University of New Hampshire, 2000.
- Akabani, Gamal**, Associate Professor, Department of Nuclear Engineering. (2008) B.S., National Autonomous University of Mexico, 1985; M.S., Texas A&M University, 1987; Ph.D., Texas A&M University, 1990.
- Akbulut, Mustafa**, Assistant Professor, Artie McFerrin Department of Chemical Engineering, and of Materials Science and Engineering. (2009) B.S., Bogazici University (Turkey), 2001; Ph.D., University of California, Santa Barbara, 2007.
- Akers, Cynthia**, Professor of Agricultural Leadership, Education, and Communications. (2000) B.S., Texas Tech University, 1991; M.S., Texas Tech University, 1992; Ed.D., Texas Tech University, 2000.
- Akleman, Derya G.**, Senior Lecturer in Statistics. (1998, 2008) B.S., Middle East Technical University (Turkey), 1987; M.S., Middle East Technical University (Turkey), 1989; M.S., Texas A&M University, 1993; Ph.D., Texas A&M University, 1996.
- Akleman, Ergun**, Professor of Visualization. (1995, 2007) B.S., Istanbul Technical University, 1981; M.S., Georgia Institute of Technology, 1986; Ph.D., Georgia Institute of Technology, 1992.
- Alaniz, Ramon G.**, Adjunct Professor of Educational Psychology (Texas A&M International University). (2006) M.S., Texas A&M University-Kingsville, 1971; Ed.D., Texas A&M University-Kingsville, 1979.
- Alaniz, Robert C.**, Assistant Professor of Microbial and Molecular Pathogenesis and of Biotechnology. (2008) B.S., Texas A&M University, 1991; Ph.D., University of Washington, 2002.
- Ale, Srinivasulu**, Assistant Professor/Texas AgriLife Research, Department of Biological and Agricultural Engineering. (2010) B.S., A.P. Agricultural University, 1989; M.S., G.B. Pant University, 1992; Ph.D., Purdue University, 2009.
- Alexander, Gerianne M.**, Professor of Psychology. (2002, 2011) B.A., Mus., St. Francis Xavier University (Canada), 1981; B.A., St. Francis Xavier University (Canada), 1984; Ph.D., McGill University (Canada), 1991.
- Alexander, James L.**, Associate Professor of Health Policy and Management. (2001) B.B.A., The University of Texas, 1967; M.A., The University of Houston, 1977; Ph.D., The University of Houston, 1978.
- Alexander, Richard M.**, P.E., Professor Emeritus of Mechanical Engineering. (1977, 1997) B.S., Texas A&M University, 1965; M.S., Texas A&M University, 1967; Ph.D., University of Texas at Arlington, 1975.
- Alexander, Steve K.**, Adjunct Member, Department of Marine Sciences (Bayou Vista, Texas). B.S., University of Houston, 1972; M.S., Louisiana State University, 1973; Ph.D., Louisiana State University, 1976.
- Alfred, Mary**, Professor of Educational Administration and Human Resource Development. (2006, 2011) B.S., University of Central Texas, 1980; M.S., University of Central Texas, 1983; Ph.D., The University of Texas at Austin, 1995.
- Alfriend, Kyle T.**, TEES Distinguished Research Chair and Professor of Aerospace Engineering. (1997) B.S., Virginia Polytechnic Institute and State University, 1962; M.S., Stanford University, 1964; Ph.D., Virginia Polytechnic Institute and State University, 1967.
- Allen, Graham Donald**, Professor of Mathematics. (1971, 1988) B.S., University of Wisconsin, 1965; M.S., University of Wisconsin, 1966; Ph.D., University of Wisconsin, 1971.
- Allen, John William**, Professor of Economics. (1967, 1978) B.S., University of Illinois, 1958; M.S., University of Illinois, 1963; Ph.D., University of Illinois, 1967.
- Allen, Roland E.**, Professor of Physics and Astronomy. (1970, 1983) B.A., Rice University, 1963; Ph.D., The University of Texas at Austin, 1968.
- Allen, Steven J.**, Adjunct Member, Department of Veterinary Physiology and Pharmacology. (1993) B.S., Rice University, 1973; M.D., The University of Texas Medical Branch, Galveston, 1977.
- Allenspach, Karin**, Adjunct Member, Department of Veterinary Pathobiology (Royal Veterinary College, University of London). Med. Vet., University of Zurich, 1993; Dr. Med. Vet., University of Zurich, 1995; Ph.D., University of Bern, 2001.

- Allred, Clinton D.**, Associate Professor of Nutrition and Food Science; Member of the Intercollegiate Faculty of Nutrition, of Genetics and of Toxicology; and Adjunct Faculty, Department of Veterinary Integrative Biosciences. (2006, 2012) B.S., University of Georgia, 1997; Ph.D., University of Illinois, 2002.
- Allsopp, Basil A.**, Adjunct Assistant Professor, Department of Veterinary Pathobiology. (1993) B.Sc. & ARCD, Imperial College, London (England), 1963; Ph.D. & DIC, Imperial College, London (England), 1967.
- Almes, Guy**, Adjunct Member, Department of Computer Science and Engineering. (2006) B.A., Rice University, 1972; Ph.D., Carnegie-Mellon University, 1980.
- Alnuweiri, Hussein**, Adjunct Visiting Professor, Department of Electrical and Computer Engineering (Texas A&M University at Qatar). (2007) B.S., University of Petroleum and Minerals, 1983; M.S., University of Petroleum and Minerals, 1984; Ph.D., University of Southern California, 1989.
- Alonzo, Armando C.**, Associate Professor of History. (1996, 1998) B.A., University of Notre Dame, 1972; M.A., University of Texas-Pan American, 1983; Ph.D., Indiana University, 1990.
- Alonzo, Juan J.**, Associate Professor of English and Director of the Film Studies Program. (2003, 2009) B.A., Williams College, 1992; M.A., The University of Texas at Austin, 1998; Ph.D., The University of Texas at Austin, 2003.
- Alouini, Mohamed-Slim**, Adjunct Professor of Electrical and Computer Engineering (Department of Electrical Engineering, Texas A&M University at Qatar). (2005) D.E.A., University Pierre and Marie Curie, 1993; M.S., Georgia Institute of Technology, 1995; Ph.D., California Institute of Technology, 1998.
- Alpern, Sara**, Associate Professor of History. (1977, 1988) B.A., Western Reserve University, 1964; M.A., University of California, Los Angeles, 1968; Ph.D., University of Maryland, 1978.
- Alpini, Gianfranco D.**, Associate Professor of Systems Biology and Translational Medicine. (1994) B.S., Terenzio Mamiani School of Classical Studies, 1976; M.S., University of the Studies of Rome (Italy), 1983; Ph.D., University of the Studies of Rome (Italy), 1984; Postdoctoral, Mount Sinai Medical Center.
- Alvarado, Christine**, Associate Professor of Poultry Science and Member of the Intercollegiate Faculty of Food Science and Technology. B.S., Texas A&M University, 1994; M.S., Texas A&M University, 1997; Ph.D., Texas A&M University, 2001.
- Alvarado, Jorge A.**, P.E., Associate Professor, Departments of Engineering Technology and Industrial Distribution and Mechanical Engineering. (2004) B.S., University of Puerto Rico at Mayaguez, 1991; M.S., University of Illinois at Urbana-Champaign, 2000; Ph.D., University of Illinois at Urbana-Champaign, 2004.
- Alvarado-Bremer, Jaime**, Associate Professor of Wildlife and Fisheries Sciences and of Marine Sciences (Galveston). (1999) B.S., Universidad Autonoma Metropolitana, 1983; M.S., University of Toronto, 1988; Ph.D., University of Toronto, 1994.
- Alvard, Michael S.**, Associate Professor of Anthropology. (2000, 2003) B.A., Colorado State University, 1984; M.S., University of New Mexico, 1987; Ph.D., University of New Mexico, 1993.
- Alvarez Zarkian, Carlos Andres**, Assistant Research Scientist, Department of Oceanography. (2004) B.S., University of Miami, 1993; M.S., University of Miami, 1998; Ph.D., University of Miami, 2003.
- Amani, Mahmood**, Associate Professor, Harold Vance Department of Petroleum Engineering. (2003) B.S., Wichita State University, 1986; M.S., Texas A&M University, 1988; Ph.D., Texas A&M University, 1997.
- Amato, Nancy M.**, Unocal Professor, Department of Computer Science and Engineering, and Holder of the Unocal Professorship. (1995, 2004) B.S., Stanford University, 1986; A.B., Stanford University, 1986; M.S., University of California at Berkeley, 1988; Ph.D., University of Illinois at Urbana-Champaign, 1995.
- Amendt, Brad A.**, Associate Professor, Health Science Center. (2006) B.S., University of Iowa, 1979; M.S., University of Iowa, 1989; Ph.D., University of Iowa, 1994.
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- Zheltikov, Aleksei**, Professor of Physics and Astronomy. (2010) M.S., Moscow State University, 1987; Ph.D., Lomonosov Moscow State University, 1990; D.Sci., Lomonosov State University, 1999.
- Zheng, Lu**, Assistant Professor of Sociology. (2006) B.A., Renmin University of China, 1997; M.A., Renmin University of China, 2001; Ph.D., Stanford University, 2007.
- Zhou, Beiyan**, Assistant Professor of Veterinary Physiology and Pharmacology and of Toxicology. (2009) B.S., Wuhan University (China), 1994; M.S., Peking University (China), 1999; Ph.D., Northwestern University, 2004.

- Zhou, Hongcai**, Professor of Chemistry and of Materials Science and Engineering. (2008) B.S., Beijing Normal University, 1984; M.S., Beijing Normal University, 1989; Ph.D., Texas A&M University, 2000.
- Zhou, Huaijun**, Assistant Professor of Poultry Science and of Genetics. (2006) B.S. Yangzhou University (China), 1988; M.S., Yangzhou University (China), 1991; Ph.D., Iowa State University, 2002; M.S., Iowa State University, 2003.
- Zhou, Jianxin**, Professor of Mathematics. (1987, 1999) B.S., Shanghai University of Science and Technology (P.R.C.), 1977; M.S., Shanghai University of Science and Technology (P.R.C.), 1982; Ph.D., Pennsylvania State University, 1986.
- Zhou, Lan**, Assistant Professor of Statistics. (2008) B.A., Beijing University, 1989; M.S., Beijing University, 1992; Ph.D., University of California at Berkeley, 1997.
- Zhu, Ding**, Associate Professor, Harold Vance Department of Petroleum Engineering. (2004, 2008) B.S., Beijing University of Science and Technology, 1982; M.S., The University of Texas at Austin, 1988; Ph.D., The University of Texas at Austin, 1992.
- Zhu, Guan**, Professor of Veterinary Pathobiology and of Genetics. (2000, 2010) B.S., Zhejiang University (China), 1983; M.S., Zhejiang University (China), 1986; Ph.D., University of Georgia, 1993.
- Zhu, Xuemei**, Assistant Professor of Architecture. (2008) B.Arch., Southeast University (China), 1999; Ph.D., Texas A&M University, 2008.
- Zhu-Salzman, Keyan**, Professor of Entomology and of Molecular and Environmental Plant Sciences. (1999, 2011) B.S., Fudan University (China), 1985; M.S., Fudan University (China), 1988; Ph.D., Purdue University, 1994.
- Zietsman, Josias**, Associate Research Engineer, Department of Landscape Architecture and Urban Planning. (1998) B.E., University of Pretoria, 1987; B.E., University of Pretoria, 1990; M.Eng., University of Pretoria, 1993; Ph.D., Texas A&M University, 2000.
- Zimmer, Danna Beth**, Associate Professor of Veterinary Pathobiology and of Neuroscience. (2003) B.A., Rice University, 1978; Ph.D., Baylor College of Medicine, 1983.
- Zimmer, Mary R.**, Clinical Associate Professor of Marketing. (2002, 2005) B.S., Northern Michigan University, 1978; M.S., Purdue University, 1981; Ph.D., The University of Texas at Austin, 1985.
- Zimmer, Warren E.**, Professor of Systems Biology and Translational Medicine, of Genetics and of Toxicology. (2003) B.S., University of Houston, 1977; Ph.D., Baylor College of Medicine, 1985.
- Zimmerman, Ryan D.**, Assistant Professor of Management. (2006) B.S., State University of New York at Albany, 1996; M.B.A., University of Iowa, 1999; Ph.D., University of Iowa, 2006.
- Zinn, Joel**, Professor of Mathematics and of Statistics. (1981, 1983) B.A., Queen's College, 1966; M.A., University of Wisconsin, 1968; Ph.D., University of Wisconsin, 1972.
- Zoghi, Behbood, P.E.**, Professor, Department of Engineering Technology and Industrial Distribution, and Holder of the Victor H. Thompson III '64 Endowed Professorship in Electronics Engineering Technology. (1987, 1999) B.S., Seattle University, 1982; M.S., The Ohio State University, 1986; Ph.D., Texas A&M University, 1993.
- Zollinger, Dan G.**, P.E., Professor, Zachry Department of Civil Engineering. (1989, 2006) B.S., Utah State University, 1977; M.S., Utah State University, 1981; Ph.D., University of Illinois at Urbana, 1989.
- Zoran, Debra L.**, Associate Professor of Veterinary Small Animal Clinical Sciences and of Nutrition. (1996, 2006) B.S., Kansas State University, 1982; D.V.M., Kansas State University, 1984; M.S., Iowa State University, 1992; Ph.D., Texas A&M University, 1997; Diplomate, American College of Veterinary Internal Medicine.
- Zoran, Mark J.**, Professor of Biology and of Neuroscience and Associate Dean for Graduate Studies, College of Science. (1991, 2011) B.A., Augustana College, 1979; M.S., Illinois State University, 1981; Ph.D., Illinois State University, 1987.
- Zou, Jun**, Associate Professor, Department of Electrical and Computer Engineering. (2004, 2011) B.S., Chongqing University, 1994; M.S., Tsinghua University, 1997; Ph.D., University of Illinois at Urbana-Champaign, 2002.
- Zourntos, Takis**, Assistant Professor, Department of Electrical and Computer Engineering. (2003) B.A.Sc., University of Toronto, 1993; M.A.Sc., University of Toronto, 1996; Ph.D., University of Toronto, 2002.
- Zubairy, Muhammad Suhail**, Professor of Physics and Astronomy. (2002, 2004) B.S., Edwardes College (Pakistan), 1971; M.S., Quaid-i-Azam University (Pakistan), 1974; Ph.D., University of Rochester, 1978.
- Zuberer, David A.**, Professor Emeritus of Soil and Crop Sciences. (1978, 2011) B.S., West Virginia University, 1969; M.S., West Virginia University, 1971; Ph.D., University of South Florida, 1976.
- Zuniga, Kelly J.**, Adjunct Lecturer, The George Bush School of Government and Public Service (Sugar Land, TX). (2011) B.S., San Diego State University, 1984; M.B.A., University of San Diego, 1991; Ed.D., University of Houston, 2005.

Appendix A

Rules and Regulations for Determining Residence Status

According to Texas Higher Education Coordinating Board Rules and Pursuant to Texas Education Code

Your status as a resident, nonresident or international (foreign) student for tuition purposes will be determined in the Office of Admissions prior to your enrollment. The determination is based on state statutes and rules and regulations promulgated by the Texas Higher Education Coordinating Board. You must be prepared to pay tuition and other required fees by specified due dates.

Students with a status of permanent resident of the United States are not automatically eligible as a Texas state resident for tuition purposes.

If you have knowledge of an error in your residency status for tuition purposes, it is your responsibility to notify the Office of Admissions immediately. You may do so by submitting a residence questionnaire which is available for download on the website registrar.tamu.edu.

Any questions should be directed to the Residency Officer at (979) 845-1059 or email residency@tamu.edu. You may also find the complete rules and regulations on the website thecb.state.tx.us.

Appendix B

Family Educational Rights and Privacy Act of 1974

Annually, Texas A&M University informs students of the Family Educational Rights and Privacy Act of 1974. This Act, with which the University intends to comply fully, is intended to protect the privacy of education records, to establish the rights of students to inspect and review their education records and to provide guidelines for the correction of inaccurate or misleading data through informal and formal hearings. Students also have the right to file complaints with the Family Policy Compliance Office of the Department of Education in Washington, D.C. concerning alleged failures by the University to comply with the Act.

The Family Educational Rights and Privacy Act of 1974 (FERPA) is a federal law which provides minimum standards for the management of student education records for universities receiving funds made available under any federal program administered by the U.S. Commissioner of Education. The Act provides, among other things, that an institution will maintain the confidentiality of student education records and students will have the right to inspect most education records an institution maintains on them.

This Policy and the procedures included within it are designed to meet the FERPA provisions. Texas A&M University is committed to the good faith implementation of this Policy. Copies of the Policy may be obtained at registrar.tamu.edu. Questions may be emailed to ferpa@tamu.edu.

In case a student, the parent of a student or any other individual has a complaint that an official of the University is violating FERPA, and the complaint cannot be satisfactorily resolved within the University, that person has the right to file a complaint with the Department of Education by contacting:

Family Policy Compliance Office
U.S. Department of Education
400 Maryland Ave., S.W.
Washington, D.C. 20202-5920

For the purposes of this Policy, Texas A&M University has used the following definitions of terms:

Student. Person who attends or has attended a program of instruction sponsored by Texas A&M University.

Education Records. Any records (in handwriting, print, tapes, film or other medium) maintained by the University, an employee of the University or agent of the University which is related to the student.

Directory Information. Under the “Family Educational Rights and Privacy Act of 1974 (FERPA),” the following directory information may be made public unless the student desires to withhold any or all of this information: the student’s name, UIN (Universal Identification Number), local address, permanent address, email address, local telephone number, permanent telephone number, program of study, classification, dates of attendance, participation in officially recognized activities and sports, degrees received, academic honors and awards received, and previous institution(s) attended.

Currently enrolled students wishing to withhold any or all directory information items may do so by:

- Going to the My Record tab in the Howdy Web portal, clicking on Withhold Directory Information under “My Information” and submitting a completed form.
- Going to registrar.tamu.edu/Current/FerpaNotice.aspx and clicking on the “Hold Directory Information” form. Print the form, complete it and bring it to the Office of the Registrar, General Services Complex, 750 Agronomy Road, Suite 1501, College Station, TX or mail it to the Office of the Registrar, P.O. Box 30018, College Station, TX 77842-3018.
- Filling out a form available at the Office of the Registrar, General Services Complex, 750 Agronomy Road, Suite 1501, College Station, TX.

Information on a student may be released unless a Hold Directory Information form is completed by the student and submitted to the Records section by the 12th class day of a fall or spring semester or by the 4th class day of a summer term (the official census day). The Hold Directory Information request remains in effect until the student revokes it or is deceased. Only currently enrolled students may request directory information be withheld.

Statement of Rights

Texas A&M University encourages students to exercise all of their rights under the Family Educational Rights and Privacy Act. 20 U.S.C. 1232g. Operating under the premise that the educational process is a cooperative venture between a student and the University, we emphasize the following rights of eligible students:

1. the right to inspect and review, with certain limited exceptions, the student's educational records, including the right to receive explanations and interpretations of the records and to obtain copies of the records when such are needed to allow the student to effectively exercise his/her right of inspection and review;
2. the right to consent to disclosures of personally identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent.

One exception which permits disclosure without consent is disclosure to school officials with legitimate educational interests. A *school official* is a person or entity: (a) employed by the university or the university system in an administrative, supervisory, academic or research, or support staff position; (b) serving on a university governing body or duly authorized panel or committee; or (c) employed by or under contract to the university to perform a special task, function, or service for the university.

A school official has a *legitimate educational interest* if the information requested is necessary for that official to (a) perform appropriate tasks that are specified in his/her position description or in the performance of regularly assigned duties by a lawful supervisor; (b) fulfill the terms of a contractual agreement; (c) perform a task related to a student's education; (d) perform a task related to the discipline of a student; or (e) provide a service or benefit relating to the student or student's family, such as health care, counseling, financial aid, job placement, or former student-related activities.

Disclosure to a school official having a legitimate educational interest does not constitute university authorization to transmit, share, or disclose any or all information received to third parties unless such disclosure is permitted or required by law.

3. the right to correct a student's education records when the records are inaccurate, misleading or otherwise in violation of FERPA;
4. the right to report violations of FERPA to the Department of Education;
5. the right to be informed about FERPA rights.

All the rights and protections given students under FERPA belong to the student. However, information in student records may be provided to parents/legal guardians without the written consent of the student if the eligible student is a financial dependent of his or her parents/legal guardians as defined under Section 152 of the Internal Revenue Code of 1954.

Records not Available for Information and Review

Students shall have access to all education records concerning them maintained by the University with the exception of the following:

1. A personal record kept by a University faculty or staff member which meets the following tests:
 - a. It is in the personal possession of the individual who made it.
 - b. Information contained in it has never been revealed or made available to any other person except the maker's temporary substitute.
2. An employment record which is used only in relation to a student's employment by the university, except where an individual in attendance at the University is employed as a result of his or her status as a student.
3. Records relating to a student which are created or maintained by a physician, psychiatrist, psychologist or other recognized professional or para-professional acting in his or her professional or para-professional capacity or assisting in that capacity which are used in connection with the provision of treatment to a student and are not disclosed to anyone other than the individuals providing the treatment.
4. Financial records and statements of a student's parents.
5. Confidential letters and statements of recommendation which were placed in the education records of a student prior to January 1, 1975.
6. Confidential letters and statements of recommendation which were placed in the education records of a student on or after January 1, 1975, if the student has waived his or her right to inspect and review the letters or statements.
7. Records concerning admissions to an academic component of the University which the student has never attended.

Any questions concerning FERPA should be directed to the Office of the Registrar.

Appendix C

Graduate Appeals Panel

Revised 2008

The Graduate Appeals Panel is governed by the most current version of Texas A&M University Student Rule 59. Rule 59 can be found on the web at student-rules.tamu.edu/rule59.

The Graduate Appeals Panel will hear appeals that involve disciplinary actions stemming from suspension or blocks for scholastic deficiency, and disputes over final course grades or evaluation of performance on examinations required by the department, intercollegiate faculty or the graduate advisory committee. Appeals will be heard when the student alleges that an arbitrary, capricious or prejudiced evaluation occurred. Appeals regarding departmental, intercollegiate faculty or Office of Graduate Studies requirements will not be heard.

The decision to request action by the Graduate Appeals Panel means that (1) the student has appealed to the department head and then the dean of the college administering the student's degree, and (2) the actions recommended at each level are unsatisfactory to the student or the examining committee. The student and/or the examining committee through its chair may file an appeal to the Graduate Appeals Panel.

Appendix D

Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act (Clery Act) (Formerly Student Right to Know and Campus Security Act of 1990)

In compliance with federal law, the following information is maintained and available through the appropriate offices listed below:

Campus Crime Statistics and Security Policies

An Annual Security Report is available that includes information on campus security policies and statistics. Security policies include: reporting crimes and emergencies, security resources, crime awareness and prevention, security of campus facilities and residence halls, alcohol, drug and weapon violations. The Annual Security Report can be found at upd.tamu.edu/documents/annual-security-report.pdf. A paper copy is available upon request.

Department of Security and University Police
Texas A&M University
MS 1231
College Station, Texas 77843-1231
(979) 845-2345
upd.tamu.edu

Higher Education Campus Fire Safety Standards and Measures

In compliance with federal law, the following information is maintained and available through the office listed below.

Campus Fire Statistics and Fire Safety Policies

An annual campus housing fire safety report is available that includes information on fire safety systems and fire statistics for on campus student housing facilities. The Annual Fire Safety Report on Student Housing is available at ehsd.tamu.edu/documents/annual-fire-report.pdf. A paper copy is available upon request at the address below.

Environmental Health and Safety
4472 TAMU
College Station, Texas 77843-4472
ehsd.tamu.edu

Appendix E

Hazing Law Summary

Education Code § 51.936 requirement to publish a summary of *Education Code Ch. 37, subchapter F. Hazing* in the University Catalog

The following is a summary of Chapter 37, subchapter F. (§§ 37.151-157) of the Texas Education Code, which prohibits hazing in Texas public or private high schools. Texas Education Code § 51.936 applies Ch. 37's prohibition on hazing to institutions of higher education. This summary of Chapter 37 is provided as required by § 51.936(d).

Summary

Hazing is a criminal violation under Texas law. A person may be found guilty of criminal conduct for hazing, encouraging hazing, permitting hazing, or having knowledge of the planning of hazing incidents and failure to report in writing his/her knowledge to the Dean of Students.

Both failing to report hazing and hazing that does not result in serious bodily injury are Class B misdemeanors. Hazing that results in serious bodily injury is a Class A misdemeanor. Hazing resulting in a death is a state jail felony. An organization found guilty of hazing may be fined \$5,000 to \$10,000 or, for incidents causing personal injury or property damage, an amount double the loss or expenses incurred because of the hazing incident. It is not a defense to prosecution that the person hazed consented to the hazing activity.

Any person reporting a specific hazing incident to the Dean of Students or other appropriate institutional official is immune from civil and criminal liability unless the report is in bad faith or malicious.

The state law does not limit or affect an educational institution's right to enforce its own penalties against hazing.

The Education Code defines hazing as "any intentional, knowing, or reckless act occurring on or off the campus of an educational institution, by one person or acting with others, directed against a student, that endangers the mental or physical health or safety of a student for the purpose of pledging, being initiated into, affiliating with, holding office in, or maintaining membership in an organization." The statute contains a list of conduct which constitutes hazing.

In order to report suspected incidents of hazing, please contact either the Office of the Dean of Student Life at (979) 845-3111 or the Texas A&M University Police Department at (979) 845-2345.

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