Science and Technology
College of Science and Technology
GRADUATE PROGRAMS

The objectives of graduate study are to develop a student’s capacity to solve problems and learn independently, to familiarize the student with past and current research in a particular field, and to enable the student to conduct research and relate it to published research, other scholarly investigations, and disciplinary principles and theories.

Graduate studies differ from undergraduate studies in that graduate students must demonstrate even more responsibility and initiative in acquiring the knowledge, methods, and skills needed to achieve success in their chosen disciplines. Graduate students must read both extensively and intensively. They must conduct original scholarly work and think creatively and productively, and participate in activities which help develop scholarly commitment and stimulate continued intellectual growth.

The College of Science and Technology offers the following graduate degrees:

**Doctor of Philosophy (PhD)**
- Coastal and Marine System Science
- Marine Biology

**Master of Science (MS)**
- Biology
- Computer Science
- Environmental Science
- Geospatial Surveying Engineering
- Fisheries and Mariculture
- Marine Biology
- Mathematics

In addition, the College offers graduate coursework in the following disciplines:
- Biomedical Sciences
- Chemistry
- Engineering Technology
- Geographic Information Science
- Geology
- Physical Science
- Physics
- Science, Mathematics, Technology Education

Centers for Research and Continuing Education
Research units within or related to the College of Science and Technology provide further opportunities for graduate student research. These units include the Harte Research Institute for Gulf of Mexico Studies, the Center for Coastal Studies, the Conrad Blucher Institute for Surveying and Science, the Center for Water Supply Studies, the National Spill Control School, and the Center for Information Assurance, Statistics, and Quality Control. See the “Research Resources” section of this catalog for further information.

Admission to Graduate Programs
Consult the graduate and academic degree requirements section of this catalog for university requirements for admission and graduate degrees. Students seeking admission to the Doctor of Philosophy program with a major in Coastal and Marine System Science or Marine Biology or the Master of Science program with a major in Biology, Computer Science, Environmental Science, Geospatial Surveying Engineering, Fisheries and Mariculture, Marine Biology, or Mathematics must submit completed applications to the Office of Graduate Studies and Research. That office will indicate the specific dates that applications should be complete for acceptance to the summer, fall, or spring semester, respectively. A complete application to a graduate degree program within the College of Science and Technology consists of the completed application form, GRE scores if required by the program, complete transcripts, and other information or documentation as required by the specific degree program. Additional requirements exist for international students. Consult the section of the graduate catalog pertaining to the degree program of interest for specific admission requirements.
Degree Program Admission Procedure

The Office of Graduate Studies and Research will compile all applications for the graduate degree programs within the College. When appropriate, that office will forward the application materials of eligible students to the College, for further forwarding to the Graduate Selection Committee of the specific degree program. The committee, usually composed of faculty from the discipline, will review the applications, make judgments concerning the acceptance or rejection of applicants, and assign graduate advisers.

An application procedure is necessary because only a limited number of students can be accepted to graduate study in any semester based upon limitations in both faculty and facility resources. When there are more qualified applicants than can be instructed adequately, students may be delayed in their acceptance to the degree program even though they have met all requirements.

An incoming student is expected to know fundamental concepts in the relevant discipline. The student, therefore, may be required to make up deficiencies in fundamentals by enrolling in appropriate foundation courses. In some cases admission may be delayed until an applicant has completed each foundation course with a “B” or better grade. In no case will a foundation course count towards the total number of hours required for the Doctor of Philosophy or Master of Science degree.

Graduate Orientation

All students seeking graduate degrees in the College of Science and Technology must attend the graduate student orientation to be held by the University in conjunction with the College and the program of their major near the beginning of their first semester of coursework at Texas A&M University-Corpus Christi.

Residency Requirement

Each degree program within the College of Science and Technology has a minimum enrollment requirement for degree candidates. Refer to the description of the specific degree program for details.

Reinstatement After Enforced Withdrawal

Students on enforced withdrawal may not re-enroll in graduate studies in the College of Science and Technology until after a period of 24 consecutive months. Refer to university section of catalog on “Scholastic Probation and Enforced Withdrawal” for additional details.

Graduate Courses

General prerequisite for 5000-level and 6000-level courses: Graduate standing. Senior undergraduates in their last semester or summer session of undergraduate work may take 5000-level courses provided that they have a cumulative grade point average of 3.0 or better, and that written approval is obtained from the Dean of the college in which the work is offered. For other conditions that may apply, see “Graduate Study by Undergraduates” in the section of the catalog entitled “Graduate Academic and Degree Requirements.”

With the exception of courses offered by those masters degree programs that require graduate leveling, students may take no more than nine graduate hours in the College of Science and Technology unless they are accepted into a graduate degree program within the College of Science and Technology. Students accepted into graduate programs in other colleges of the University may not take courses in the College of Science and Technology unless those courses are specified in the degree plan. Non-degree seeking students may take no more than one semester of courses in the College of Science and Technology. In any case, the total number of courses taken within the College of Science and Technology by students who are not yet accepted into a degree program in the College of Science and Technology may not exceed nine hours.
Weekly lecture and laboratory hours associated with each course are designated by (lecture: lab) following the semester hours in the catalog course listing.

**Directed Independent Study (DIS)**

Each area of the College offers courses in directed independent study. These courses appear with a 5X96 number (“X” ranges from 1-6 semester hours) in the course offerings of each discipline and may carry variable credit depending upon the course design. The number of credit hours must be approved by the instructor, the Department Chairperson/Director, and the Dean of the College of Science and Technology in advance of registration. These courses may be repeated to total no more than six semester credit hours.

**Final Oral Examination**

Requirements for a final oral examination may be found in the catalog section on the specific degree specialty. See the degree requirements for the particular program.

**Approval of Thesis, Project Report or Professional Paper**

The graduate thesis, project report, or professional paper must be prepared in a style and format that is prescribed by the specific degree program.

Copies of the signed thesis, project report, or professional paper must be submitted to the Office of the Dean of the College of Science and Technology on or before the last day of classes for the Dean’s approval and signature (the specific number of copies will be designated by the College). The Dean’s office will be responsible for distributing the copies to the appropriate offices. The student must pay for binding of the thesis, if required.

**Approval of Dissertation**

The process required for approval of the dissertation is described in the Coastal and Marine System Science Doctor of Philosophy and Marine Biology Doctor of Philosophy sections.
Biology

MASTER OF SCIENCE

Program Description

The Master of Science in Biology is designed for graduate students who wish to become knowledgeable leaders and professionals with an in-depth education, and specialized skills in the field of biology. This program promotes competency in the application of scientific methods of investigation to studies in biology with an emphasis on urban and coastal issues. Students develop a sense of creative independence that will allow them to practice in and contribute to a variety of professions and fields of scholarship.

Learning Outcomes

Students will:

• Possess a broad understanding of biology.
• Possess enhanced knowledge of a specific biological field including relevant scientific literature related to their thesis or professional paper.
• Understand the scientific method and be able to design and conduct experiments.
• Be able to accurately describe (orally and in writing) biological research.

Admission Requirements

To be considered for admission to the MS Program in Biology, an applicant must provide the following documents: a completed application form, application fee, official GRE scores, official transcripts of all college and university coursework, an essay (not more than 1000 words) outlining career goals, potential areas of research interest, and a list of up to three faculty members to serve as a graduate advisor, and three letters of recommendation. Students are required to contact potential advisors prior to and during the application process to discuss research opportunities and get an overall feel for the program, and should include a summary of these discussions in their essays. Additional requirements exist for international students, including an approved foreign transcript evaluation that includes a course by course comparison (refer to the Admission section of this catalog). No criterion is weighted more heavily than any other criterion. Send application documents to the university Office of Graduate Studies and Research. Incomplete applications are not considered. Applicants will be notified of the outcome of their application by letter.

Teaching Assistantships are available to graduate students admitted as degree-seeking students. The completed Teaching Assistant Application (forms available at http://www.sci.tamucc.edu/stweb/ta/index.html) and all other materials requested for evaluation should be submitted to the office indicated on that form. For full consideration, the deadline for submitting applications is February 1 for the following academic year. Faculty members conducting funded research projects often hire qualified graduate students as Research Assistants. Students will need to contact faculty members in their field of interest for information on these opportunities.

Non-degree students may enroll in courses for which they have adequate academic preparation, but they may not apply more than nine credit hours of work taken in non-degree status to a graduate degree program. Non-degree students must consult with the Life Sciences Coordinator to determine those courses in which they may enroll and those courses they may later apply to the Biology degree program, if they are admitted to the program. Students must earn a grade of “B” or better in each of the prescribed courses in order to have the courses apply to the plan of study.

Degree Requirements

Each Master of Science degree candidate must complete a minimum of 36 graduate semester credit hours. Undergraduate courses (4000-sequence or lower) are regarded as foundation work and will not count toward the total. A student may request approval for transfer of a maximum of nine semester credit hours of graduate courses from other colleges to a Master of Science in Biology degree plan.
After admission to the graduate program, the Life Sciences Coordinator will advise the student in all matters relating to degree requirements and procedures until a formal advisory committee is formed. By the end of the first semester of graduate study, the student in consultation with the Life Sciences Coordinator will select his or her Graduate Advisory Committee. This committee will advise the student in all matters pertaining to graduate requirements and procedures. A student’s Graduate Advisory Committee must consist of a minimum of three members, at least two of whom must be graduate faculty in the Department of Life Sciences. Additional committee members must be graduate faculty at Texas A&M University-Corpus Christi or adjunct graduate faculty in the Department of Life Sciences. The Chair of a student’s Graduate Advisory Committee must be graduate faculty in the Department of Life Sciences. The student and all members must mutually agree to the size and composition of the Graduate Advisory Committee. The committee will recommend a Degree Plan for the student that will then be submitted to the Dean of the College of Science and Technology for approval.

There are two plans for obtaining the Master’s Degree in Biology: the Non-Thesis Plan and the Thesis Plan.

A. Non-Thesis Plan (36 semester hours)
The non-thesis Master’s Degree is designed to provide a broad understanding of biology. The curriculum will especially benefit those individuals in professional employment who seek advancement or additional training to enhance their knowledge and skills. The student is required to write a professional paper based on work done in BIOL 5397-Directed Research. The paper will be on a topic approved by the student’s Graduate Advisory Committee and will demonstrate the student’s ability in organization, data collection, and scientific writing. Graduate students are expected to present their research at a scientific meeting (other than their graduate seminar) prior to graduation.

The following courses are required:
BIOL 5102 Graduate Research Seminar (1 semester hour)
BIOL 5397 Directed Research (3 semester hours)
MATH 5315 Statistical Methods of Research (3 semester hours)
Advanced Electives (29 semester hours minimum)*
TOTAL: 36 semester hours

*The advanced electives must be approved by the student’s advisory committee in order to be counted for credit towards the graduate degree.

B. Thesis Plan (36 semester hours)
The thesis Master’s Degree requires a thesis based upon original research. The research must include a review of relevant literature, a description of the results from original research on a topic approved by the Graduate Advisory Committee, statistical analysis when appropriate, and an appropriate discussion of the results. The research must be conducted during the period that the student is enrolled at Texas A&M University-Corpus Christi. Graduate students are encouraged to present their research at a scientific meeting (other than their graduate seminar) prior to graduation.

The following courses are required:
BIOL 5102 Graduate Research Seminar (1 semester hour)
BIOL 5392 Thesis Proposal (3 semester hours)
BIOL 5393 Thesis Research (3 semester hours)
BIOL 5394 Thesis Submission (3 semester hours)
MATH 5315 Statistical Methods of Research (3 semester hours)
Advanced Electives (23 semester hours minimum)*
TOTAL: 36 semester hours
*The advanced electives must be approved by the student’s Graduate Advisory Committee in order to be counted for credit towards the graduate degree.

Thesis students may change to the Non-Thesis Plan at any time with the approval of the Graduate Advisory Committee.

The thesis and non-thesis professional paper must follow format requirements as established in the Biology Graduate Handbook, and must be approved and signed by the members of the student’s Graduate Advisory Committee and the Dean of the College of Science and Technology.

**Academic Preparation**

Degree candidates in biology are expected to enter the program with competencies that are equivalent to those required of Texas A&M University-Corpus Christi undergraduate biology majors as described in the biology section of the undergraduate catalog. Therefore, a degree candidate who lacks adequate academic preparation may be required by his or her Graduate Advisory Committee to complete undergraduate course work prior to the completion of the MS degree. Such course work will be regarded as foundation or prerequisite work and will not count as credit towards the total required for completion of the degree.

**Enrollment Requirements**

The minimum enrollment requirements for the Master of Science degree program in Biology are:

1. Thesis and non-thesis degree students must complete a minimum of twelve semester hours of graduate level credit per academic year (fall semester to fall semester). Failure to complete this minimum will result in dismissal of the student from the program.
2. A student must register for BIOL 5940 Project Research (3 semester hours or more) unless he or she is otherwise enrolled in a minimum of twelve semester hours of degree plan courses per year.

**Final Oral Examination**

Each student must take a final oral examination during his or her final semester. The student’s Graduate Advisory Committee will administer the examination. It will cover topics related to the thesis or professional paper as well as broad aspects of biology. The student is responsible for scheduling the examination with the faculty involved. A student who fails the final oral examination may repeat it after a minimum of four months. If a student fails the second oral examination, he or she will not be permitted to continue in the program.

**For Additional Information**

Website: [http://lsci.tamucc.edu/biol](http://lsci.tamucc.edu/biol)

Campus address: Science and Technology Building
Room 319; Phone (361) 825-2754

Mailing address: Graduate Biology Program, Unit 5800
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5800

**GRADUATE COURSES**

Graduate standing is required for enrollment in 5000-level courses. Exceptions can be made for outstanding undergraduate students with the Dean’s consent. For details, see “Graduate Study by Undergraduates” in the catalog chapter titled “Academic and Degree Requirements.” Weekly lecture and laboratory hours associated with each course are designated by (lecture:lab) following the semester hours when appropriate. The laboratory hours shown are laboratory instructional time. In most cases, additional laboratory time will be required to complete assigned work. Prerequisites for entry into a course are indicated, but may be waived with permission of the instructor.
BIOL 5102. 1 sem. hr.  
GRADUATE RESEARCH SEMINAR  
Presentation of research conducted for MS degree. Should be taken the last semester of resident graduate study. Open only to MS thesis and non-thesis Degree Candidates in Biology.

BIOL. 5202. 2 sem. hrs. (0:6)  
CORAL REEF FIELD STUDIES  
Field and laboratory studies of the ecology, zonation and community structure of coral reefs. Requires a 2-3 week field expedition of a Mexican coral reef and successful completion of an on-site research project. Prerequisite: BIOL 5301 and permission of the instructor.

BIOL 5301. 3 sem. hrs. (3:0)  
CORAL REEF SYSTEMS  
Examination of the ecology, zonation and community structure of coral reefs. Also includes environmental impacts, monitoring techniques and management issues. Prerequisites: BIOL 3413 Invertebrate Zoology, and BIOL 3428 Principles of Ecology or equivalents.

BIOL 5304. 3 sem. hrs. (3:0)  
VIROLOGY  
Survey of bacteriophages and major pathogenic plant and animal viruses including Baltimore classification, viral replication, and emerging viral diseases. Emphasis on analysis and review of primary literature on viruses. Prerequisites: BIOL 2416 Genetics, BIOL 2421 Microbiology and CHEM 3412 Organic Chemistry II or equivalents.

BIOL 5308. 3 sem. hrs. (3:0)  
BIOGEOGRAPHY  
Selected reading, discussion and projects concerning the geographic distribution of plants and animals. Prerequisites: BIOL 3428 Principles of Ecology or BIOL 3414 Vertebrate Biology or equivalent.

BIOL 5309. 3 sem. hrs. (3:0)  
SYSTEMATICS  
Theories, methods, molecular and evolutionary basis of systematic biology; and rules and relationships of nomenclature used in classification.

BIOL 5310. 3 sem. hrs. (3:0)  
PHYSIOLOGICAL ADAPTATIONS IN ANIMALS  
A study of the physiological adaptations of animals to their environment, including osmoregulatory and temperature regulatory mechanisms. Prerequisite: BIOL 3430 Physiology or equivalent.

BIOL 5322. 3 sem. hrs. (3:0)  
MOLECULAR GENETICS  
In-depth study of the molecular basis of genetic interactions; focus on molecular mechanisms of mutation, suppression and recombination. Prerequisites: CHEM 3412 Organic Chemistry II, BIOL 2416 Genetics, and BIOL 3403 Molecular Biology or equivalents.

BIOL 5329. 3 sem. hrs. (3:0)  
PLANT ADAPTATIONS  
Emphasis on living gymnosperms and angiosperms and their adaptive significance.

BIOL 5333. 3 sem hrs. (3:0)  
MARINE BENTHIC ECOLOGY  
The ecology of benthic assemblages with emphasis on species and habitats below diver depths. Micro to mesoscale spatial patterns, including bathymetric distribution, abundance and size-structure, diversity gradients, energetics and feeding strategies, and zoogeography of the benthos will be covered. Hydrothermal vents, cold seeps and sea mount fauna will receive special attention.

BIOL 5335. 3 sem. hrs. (3:0)  
AQUATIC MICROBIOLOGY  
Types and distribution of microorganisms in aquatic environments. Interactions with other organisms. Role in nutrient cycling, degradation of organic substances, pollution, water purification. Prerequisite: BIOL 2421 Microbiology or equivalent.

BIOL 5340. 3 sem. hrs. (3:0)  
GENOMICS, PROTEOMICS AND BIOINFORMATICS  
Integrative biological study using genome-wide approaches and bioinformatics. The “-omics” technologies (Genomics, Proteomics, Metabolomics, etc) will be reviewed. Applications to understanding biological function in various biological disciplines will be emphasized. Prerequisites: BIOL 2416 Genetics, and BIOL 3410 Cell Biology or CHEM 4301 Biochemistry I.

BIOL 5371. 3 sem. hrs. (3:0)  
EVOLUTIONARY GENETICS  
An advanced introduction to evolutionary processes and their genetic basis, focusing on theoretical and experimental approaches to the study of population genetics, phylogeography, coalescence theory, evolutionary ecology, and molecular evolution. Prerequisites: BIOL 2416 Genetics or equivalent; and college-level mathematics course or permission of instructor.

BIOL 5392. 3 sem. hrs.  
THESIS PROPOSAL  
Thesis students must submit a completed proposal for their thesis project. A course section will be created for the student to enroll. Upon successful completion and submission of the proposal signed by the graduate committee of the student, students may then register for BIOL 5393 Thesis Research. Open only to MS Thesis Degree Candidates in Biology.

BIOL 5393. 3 sem. hrs.  
THESIS RESEARCH  
Implementation of the Thesis Proposal, and the production of a rough draft of the thesis submitted to the graduate committee of the student for initial editing and comment. A course section will be created for the student to enroll. Prerequisite: BIOL 5392 Thesis Proposal.

BIOL 5394. 3 sem. hrs.  
THESIS SUBMISSION  
Completion of the final draft of the thesis, signed by the graduate committee of the student and ready for binding and distribution. A course section will be created for the student to enroll. Prerequisite: BIOL 5393 Thesis Research. May be taken concurrently with BIOL 5393 Thesis Research.
BIOL 5396. DIRECTED INDEPENDENT STUDY
Study in areas of current interest. Credit is not given for research on the thesis project. A total of six semester hours of Directed Independent Study may be counted toward the MS degree.

BIOL 5397. DIRECTED RESEARCH
Emphasis on experimental design as related to selected biological topics. Application of research skills. For students selecting the non-thesis option. Students may register for up to 9 semester hours, but only 3 semester hours will count towards a non-thesis degree.

BIOL 5406. IMMUNOLOGIC STUDIES
An in-depth study of immunology. Emphasizes function and interaction of specific cells, cytokines, lymphokines, antibodies and molecules that are the essential components of the immune system. The course includes up-to-date coverage of both innate and adaptive immunity, and the immune system in health and disease. Prerequisite: BIOL 2421 Microbiology or equivalent (BIOL 3410 Cell Biology or BIOL 3345 Cell Physiology are strongly recommended).

BIOL 5407. MYCOLOGY
Biological classification, and ecology of the fungi. Applied aspects and current topics in mycology and mycological techniques. Prerequisite: BIOL 2421 Microbiology or equivalent.

BIOL 5409. FIELD AND LABORATORY METHODS
Experience in field studies, organizing field notes, collecting and methods of preserving organisms for teaching and museum purposes. The course includes field ecological sampling methods, environmental data collection, safety, logistics, and proper scientific equipment operation. Requires permission of the instructor.

BIOL 5410. STUDIES IN MAMMALOLOGY
The course is designed for graduate students in biology wanting to acquire a more detailed working knowledge and appreciation of mammalian diversity in structure, function, ethology, and ecology. Knowledge and skills acquired in this course will be useful to field and laboratory studies in ecology, evolution, animal behavior, biogeography, wildlife management, and related disciplines. Prerequisite: BIOL 3414 Vertebrate Biology or equivalent, or permission of instructor.

BIOL 5411. ETHOLOGY
Adaptive aspects of animal behavior. Prerequisite: BIOL 3414 Vertebrate Biology or BIOL 3428 Principles of Ecology, or equivalent.

BIOL 5412. ECOLOGY OF FRESH WATERS
Ecological relationships and productivity of freshwater communities, including rivers, lakes and wetlands. Focus is on interactions of the physical, chemical and biotic environment and influence of human activities on systems. Prerequisite: BIOL 3428 Principles of Ecology or equivalent.

BIOL 5414. GROWTH AND DEVELOPMENT
Special topics involving growth and development in plants and animals.

BIOL 5415. BIOLOGY OF ESTUARINE ORGANISMS
Life history and ecology of estuarine organisms. Special emphasis on the identification of local forms. Prerequisites: BIOL 3413 Invertebrate Zoology and BIOL 3428 Principles of Ecology or equivalents.

BIOL 5416. ADVANCED ENVIRONMENTAL BIOLOGY
Advanced study of different aspects of man's relationship with the biological and physical environment. Includes readings in current literature and research on an environmental issue.

BIOL 5417. MICROBIAL ECOLOGY
Relationships between microorganisms and their biotic and abiotic environments. Role of microorganisms in biogeochemical cycling. Methodology in microbial ecology. Biotechnological aspects. Prerequisite: BIOL 2421 Microbiology or equivalent.

BIOL 5420. APPLICATION OF MOLECULAR TECHNIQUES
Application of DNA-RNA technology to selected scientific problems. Emphasis on current research techniques. Prerequisites: BIOL 3403 Molecular Biology and CHEM 3411 Organic Chemistry I or equivalents.

BIOL 5422. PLANT BIOSYSTEMATICS
Experimental and analytical approaches to plant variation and evolution, breeding systems, cytological and molecular genetics, hybridization and phylogeny. The course will present a foundational approach to the methods, research and terminology of plant systematics and summarize information on the most recent knowledge of evolutionary relationships as well as practical information vital to field work.

BIOL 5425. ADVANCED INVERTEBRATE ZOOLOGY
In-depth study of selected invertebrate phyla. Field trips to sites along the Texas coast. Prerequisite: BIOL 3413 Invertebrate Zoology or equivalent.

BIOL 5426. AVIAN BIOLOGY
The course is designed for graduate students in biology wanting to acquire a more detailed working knowledge and appreciation of avian diversity in structure, function, ethology, and ecology. Knowledge and skills acquired in this course will be useful to field and laboratory studies in ecology, evolution, animal behavior, biogeography, wildlife management, and related disciplines. Prerequisite: BIOL 3414 Vertebrate Biology or permission of instructor.
BIOL 5427. 4 sem. hrs. (3:3)
COASTAL ECOLOGY OF TEXAS
Study of the ecology and environmental issues of the Texas coast. Includes field trips along the entire Texas coastline. Prerequisites: BIOL 3428 Principles of Ecology, BIOL 3443 Environmental Biology, or BIOL 4436 Marine Ecology or equivalent.

BIOL 5428. 4 sem. hrs. (3:3)
FISHERIES
Advanced study of theory and techniques in fisheries science including behavior of fisheries populations and applications to resource management with emphasis in tidal-influenced waters. Includes readings in the current literature and a research project. The laboratory will emphasize practical sampling design and data interpretation.

BIOL 5430. 4 sem. hrs. (3:3)
MARINE PLANKTON
Investigation of the systematics, distribution and ecology of marine plankton.

BIOL 5431. 4 sem. hrs. (3:3)
PHYCOLOGY
Study of the major groups of freshwater and marine algae; morphology, ecology, systematics, life cycles and physiology. Laboratories emphasize collection, identification and culturing techniques.

BIOL 5432. 4 sem. hrs. (3:3)
BIOLOGY OF FISHES
Commonly called “Ichthyology”, the study of fish is a branch of biology that encompasses species diversity, natural history, and evolutionary and ecological relationships of fishes. This course will consist of four major parts: (1) Evolution, (2) Systematics, (3) Biology, and (4) Ecology of fish. Laboratory identification of marine and freshwater fishes from the University archives and collected during field excursions. Prerequisite: BIOL 3414 Vertebrate Biology or equivalent.

BIOL 5435. 4 sem. hrs. (2:4)
MICROTECHNIQUES IN RESEARCH
The theory and practice of using histochemical and microscopic techniques to prepare tissues and small specimens for research analysis. Prerequisites: CHEM 3411 Organic Chemistry I or equivalent.

BIOL 5436. 4 sem. hrs. (3:3)
MARINE ECOLOGICAL PROCESSES
Advanced studies in structure and habitats of marine environments. Emphasis on factors influencing distribution of marine organisms, including field trips to areas along the Texas coast. Prerequisite: BIOL 3428 Principles of Ecology or equivalent.

BIOL 5437. 4 sem. hrs. (3:3)
ECOLOGY OF MARINE PLANTS
Marine plants are a diverse group that includes unicellular algae, seaweeds, seagrasses, salt marshes, and mangrove forests. The goal is to present taxonomic, physiological, chemical, and ecological aspects of marine plants, their adaptations, and how abiotic and biotic factors interact in their communities. The use of recent journals and original scientific research will allow the student to evaluate anthropogenic effects to these communities and develop methods of restoration and management.

BIOL 5442. 4 sem. hrs. (3:4)
STUDIES IN HERPETOLOGY
A global perspective and current research topics on the biology of amphibians and reptiles. Prerequisite: BIOL 3414 Vertebrate Biology or permission of instructor.

BIOL 5590. 1-5 sem. hrs. (1:0-3:4)
SPECIAL TOPICS
An advanced study of a biological topic. May be repeated with full credit in another area of biology.

BIOL 5940. 1-9 sem. hrs. (ind. study)
PROJECT RESEARCH
Research related to the MS project. Open only to degree candidates in biology with consent of the graduate advisor. Does not count as credit toward the MS degree in biology. Course is taken as credit/non-credit.

Graduate Credit from Other Disciplines
Graduate students in the Master of Science in Biology program may take courses from other disciplines in the College of Science and Technology such as BIMS, CHEM, ESCI, GISC, MARB, MARI, MATH and CMSS with approval from the student’s graduate committee or from the Life Sciences Coordinator if the committee has not yet been formed. Up to nine semester credit hours of graduate courses from other colleges at Texas A&M University-Corpus Christi may be included as part of a degree plan with approval from the graduate committee of the student.
Biomedical Sciences

Graduate courses in biomedical sciences are offered in support of graduate degree programs in biology, environmental science, nursing and health sciences, and education. For details concerning these particular degree programs, consult the appropriate section of the catalog.

For Additional Information

Website: http://lsci.tamucc.edu/bims
Campus address: Science and Technology Building
Room 319; Phone (361) 825-2754
Mailing address: Biomedical Sciences Program, Unit 5800
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5800

GRADUATE COURSES

BIMS 5311. 3 sem. hrs. (3:0)
PRINCIPLES OF ONCOLOGY
This course is a study of the profile of cancer cells, and the various causes of human cancer. Contribution of heredity, environmental factors, and infectious agents to oncogenesis will be studied. The latest published information on cancer screening, diagnosis, and treatment will be discussed. Various types of cancer will be presented. Prerequisite: BIOL 2416 Genetics or equivalent. Limited to individuals who have not taken BIMS 4311 (Biology of Cancer) for undergraduate credit.

BIMS 5323. 3 sem. hrs. (3:0)
NEUROSCIENCES
The anatomy and physiology of the vertebrate nervous system with emphasis on functions and actions of the central nervous system. Prerequisites: CHEM 3412 (Organic Chemistry II) or equivalent. Limited to individuals who have not taken BIMS 4323 (Neurobiology) for undergraduate credit.

BIOL 5327. 3 sem. hrs. (3:0)
TOXICOLOGY
This course will provide students requisite knowledge to design and supervise appropriate tests in vivo and in vitro in order to investigate the toxicity of substances and to assess the implications of the results. Students will be expected to have an appreciation of the toxicity of a number of representative compounds and be able to apply their knowledge to the evaluation of chemicals in pharmaceutical preparations, agriculture, food and consumer products, the work place and the environment. Limited to individuals who have not taken BIMS 4327 (Introduction to Toxicology) for undergraduate credit.

BIMS 5330. 3 sem. hrs. (3:0)
BIOLOGY OF AGING
An examination of one phase of the developmental process - the aging organism. Perspectives of aging in human beings and other organisms are reviewed. Topics include: demographics of human aging; research methodologies and measurements; development of age-related diseases; theories of aging; and anti-aging interventions. Prerequisites: CHEM 3412 (Organic Chemistry II), CHEM 4402 (Biochemistry II) and BIOL 3430 (Physiology) or equivalents. Limited to individuals who have not taken BIMS 4330 (Biological Basis of Aging) for undergraduate credit.

BIMS 5333. 3 sem. hrs. (3:0)
PUBLIC HEALTH ENTOMOLOGY
The medical, veterinary and forensic importance of arthropods: especially their relationships with host organisms, their role as hosts and vectors of disease-causing organisms, and strategies for their control. Involves discussion of research papers on these topics. Limited to individuals who have not taken BIMS 4333 (Medical Entomology) for undergraduate credit.

BIMS 5334. 3 sem. hrs. (3:0)
MEDICAL GENETICS
A study of genetic influences on health and disease. Prerequisites: CHEM 3412 (Organic Chemistry II) and BIOL 2416 (Genetics) or equivalents. Limited to individuals who have not taken BIMS 4334 (Human Genetics) for undergraduate credit.

BIMS 5374. 3 sem. hrs. (3:0)
MOLECULAR MEDICAL MICROBIOLOGY
Study of common pathogenic microorganisms in eukaryotic animals. Includes bacterial, viral, parasitic, and fungal infections, with emphasis on epidemiology, immunity, pathogenesis and treatment. Stress placed on case studies and didactic lectures, with presentations of updates on molecular basis of diseases based on current literature. Prerequisite: BIOL 2421 (Microbiology) or equivalent. BIOL/BIMS 4406 (Immunology) is strongly recommended. Limited to individuals who have not taken BIMS 4374 (Medical Microbiology) for undergraduate credit.

BIMS 5375. 3 sem. hrs. (3:0)
MICROBIAL PATHOGENESIS
Study of the mechanisms by which microorganisms invade a host and produce pathological symptoms associated with disease. Emphasis is on the chemical and molecular interaction between various pathogens and host cells, especially immune responses. Involves discussion of research papers on these topics. Pre-
requisite: BIOL 2421 (Microbiology) or equivalent. Limited to individuals who have not taken BIMS 4375 (Mechanisms of Microbial Pathogenesis) for undergraduate credit.

**BIMS 5396**  
1-3 sem. hrs.  
**DIRECTED INDEPENDENT STUDY**  
Study in an area of current interest. Credit is not given for research on the thesis project. A total of six semester hours of Directed Independent Study may be counted toward the MS degree. Prerequisite: Consent of the instructor.

**BIMS 5410.**  
4 sem. hrs. (3:3)  
**CELLS AND TISSUES**  
Analysis of tissues: their cellular and sub-cellular components, and the unique properties that emerge when they interact to form organs. Lecture and laboratory emphasize normal mammalian tissues, and students explore other aspects of tissue biology through individual research projects. Completion of a college-level course in anatomy is strongly recommended. Limited to individuals who have not taken BIMS 4410 (Histology) for undergraduate credit.

**BIMS 5590**  
1-5 sem. hrs. (1:0-3:4)  
**SPECIAL TOPICS**  
Variable content. Advanced study of a biomedical topic that may include current literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Consent of the instructor.

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**Chemistry**

Graduate courses in chemistry are offered in support of graduate degree programs in biology, environmental science and education. For details concerning these particular degree programs, consult the appropriate section of the catalog.

**For Additional Information**

Website:  
http://pens.tamu.edu/chem/

Campus address:  
Carlos F. Truan Natural Resource Center, Room 1100; Phone (361) 825-2681

Mailing address:  
Chemistry Program, Unit 5850  
College of Science and Technology  
Texas A&M University-Corpus Christi  
6300 Ocean Drive, Corpus Christi, Texas 78412-5850

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**GRADUATE COURSES**

**CHEM 5302.**  
3 sem. hrs. (3:0)  
**CURRENT TRENDS IN CHEMISTRY**  
The study and discussion of current topics and research efforts in chemistry. The course is intended to provide teachers with background and understanding that will enrich their classroom presentations in the chemistry curriculum. May be repeated for credit when topics vary. Offered on sufficient demand.

**CHEM 5417.**  
4 sem. hrs. (3:3)  
**ADVANCED ENVIRONMENTAL CHEMISTRY**  
Advanced study of the impact of chemistry on the environment. Topics will include the chemistry of the natural environment and the modifications to that environment brought about by human activities. Includes readings in current literature and research on an environmental issue. Includes a laboratory component. Prerequisite: CHEM 1312.

**CHEM 5421.**  
4 sem. hrs. (3:3)  
**AQUATIC CHEMISTRY**  
A study of the chemistry of natural and polluted waters. Topics include chemical kinetic and equilibrium principles as applied to natural and polluted waters, and the ecotoxicological aspects of aquatic chemistry. In addition, critical readings in current literature and research on environmental issues will be discussed. Includes a laboratory component.

**CHEM 5431.**  
4 sem. hrs. (3:3)  
**ENVIRONMENTAL INSTRUMENTAL ANALYSIS**  
A presentation of standard instrumental tools and instrumental methods used for the characterization of environmental pollutants and their distribution in the environment. Includes a laboratory component.

**CHEM 5490.**  
1-4 sem. hrs. (1:0-3:2)  
**ADVANCED TOPICS**  
Subject materials variable. Advanced topics including current literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Permission of instructor.

**CHEM 5596.**  
1-5 sem. hrs.  
**DIRECTED INDEPENDENT STUDY**  
Study in areas of current interest. (A total of six hours of Directed Independent Study may be counted toward the MS degree.)
Coastal and Marine System Science

DOCTOR OF PHILOSOPHY

Program Description

Coastal and Marine System Science studies the interactions within the coastal and marine environment which includes most of the critical physical and biological systems which support life on Earth. The mission of the Coastal and Marine System Science (CMSS) program is to support interdisciplinary research and scholarship on the biotic and abiotic components of this zone, including quantitative investigation of socio-economic and political processes. The program addresses this mission by integrating the tools of Earth System Science: biogeochemistry, geographic information science, ecosystem dynamics, and quantitative modeling.

With the increasing efficiency of real-time data collection, transfer, and processing, aided by autonomous observation systems such as satellite sensors, oceanic buoys, and remotely-controlled or autonomous submersibles, Coastal and Marine System Science is at the forefront of extracting meaningful scientific results from large data sets in near real time. Graduates of the CMSS program will demonstrate proficiency in understanding and applying the concepts and principles of all of the natural sciences as well as a working competence in mathematical modeling and geospatial analysis.

All students share a core of five interdisciplinary courses which cover the foundations of mathematical modeling, environmental policy, and case studies in system science. Topical specialized coursework (determined by the graduate advisory committee of each individual student) provides grounding in the specific scientific disciplines needed to effectively manage the coastal and marine system. After the completion of any required leveling courses and all core classes, students must successfully complete a comprehensive examination for advancement to doctoral candidacy. This examination must be scheduled no later than 24 months after initial enrollment. The required dissertation involves an independent, detailed research project of importance to the international scientific community. The graduate advisory committee of each student will guide them through the conception, design, construction, and execution of a systems-based inquiry. Students who earn Ph.D. degrees in the sciences are typically employed in teaching or research positions in universities, or in pure research applications at specialized institutions or governmental agencies.

Student Learning Outcomes

As part of their progression through the Coastal and Marine System Science program the students will:

• acquire the skills required for system science studies applied to coastal and marine topics such that they are prepared to conduct CMSS original research
• perform original and hypothesis-driven quantitative analyses that will lead to comprehensive verifiable models of natural systems
• emphasize mathematical and/or analytical skills to generate new data and critically evaluate models that will aid in our understanding of dynamic natural systems, become a resource capable of answering environmental “what if” questions by providing comprehensive interpretation
• develop the skills necessary to present and publish their work at national and international venues
• develop the skills necessary to teach effectively a college level class in the area of Sciences and Technology
• develop a skill set and research record such that they can secure employment in universities, federal agencies, private companies or non-governmental organizations where they can apply the skills and knowledge acquired during the program
Admission Requirements

Persons seeking admission to the CMSS Program should apply through the university Office of Graduate Studies and Research. In addition to the documents required by that office, applicants must submit GRE general test scores, an essay of no more than 1,000 words describing their educational background, career interests, goals and challenges, a curriculum vitae and three letters of evaluation from persons knowledgeable about their potential for success in graduate studies. Applicants may optionally submit other relevant materials, e.g. copies of published works or reports of past scientific research. All materials submitted will be considered. A campus visit with personal interviews involving prospective faculty mentors is highly recommended. The applicant will be notified by letter of acceptance or rejection.

Students accepted into the degree program must demonstrate proficiency in the natural sciences, mathematical modeling, and geospatial technology. This proficiency can be demonstrated by the successful completion of undergraduate classes in these topics, or by presentation of satisfactory evidence to the CMSS Program Coordinator. Students who are unable to demonstrate proficiency in the natural sciences, mathematics, or geospatial technology may be required to take undergraduate or graduate courses. These courses will not apply towards the total required for the Ph.D. degree.

Teaching assistantships, graduate research assistantships, and fellowship positions are available to admitted degree-seeking students who maintain full-time graduate student status (9 credit hours per semester). For additional information, please contact the CMSS Program Coordinator, College of Science and Technology, Texas A&M University-Corpus Christi, 6300 Ocean Dr., Corpus Christi, Texas 78412-5850.

Degree Requirements

Each student accepted to the Ph.D. in the Coastal and Marine System Science degree program must complete a minimum of 90 hours beyond the bachelor’s degree or 60 hours beyond the master’s degree. No more than one-third of the required hours may be taken at the 5000-level with approval from the student’s graduate advisory committee. The remainder must be taken at the 6000-level. A student’s advisory committee must approve the program degree plan. All students must successfully complete at least nine semester credit hours per long semester to remain in the program. All students must pass a final dissertation defense, to be administered by their advisory committee, during their last semester before graduation.

The program normally requires a minimum of 18 credit hours (for students with an M.S. degree) or 30 credit hours (for students without an M.S. degree) of regular graded coursework on a Ph.D. degree plan. Justification for exception to this rule should be prepared by the student and advisor(s), endorsed by the advisory committee, and attached to the degree plan when submitted for the department head’s signature.

A. Admission from a Bachelor’s Degree Option (90 semester credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Sem. Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMSS 6102</td>
<td>Seminar in Earth System Science (1 sem. hr x 3)</td>
<td>3</td>
</tr>
<tr>
<td>CMSS 6303</td>
<td>Systems Analysis</td>
<td>3</td>
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<tr>
<td>CMSS 6305</td>
<td>Natural Systems Modeling</td>
<td>3</td>
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<tr>
<td>CMSS 6330</td>
<td>Spatial Systems Science</td>
<td>3</td>
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<tr>
<td>CMSS 6370</td>
<td>Coastal Management and Ocean Law</td>
<td>3</td>
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<tr>
<td></td>
<td>Elective coursework supporting student’s individual research goals (Item C below)</td>
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</tr>
<tr>
<td></td>
<td>Specialized coursework, Research or Dissertation Research (Item E below)</td>
<td>54</td>
</tr>
<tr>
<td>CMSS 6699</td>
<td>Dissertation Defense</td>
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Total 90
B. Admission from a Master’s Degree Option (60 semester credit hours)

<table>
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<th>Course Code</th>
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<tbody>
<tr>
<td>CMSS 6102</td>
<td>Seminar in Earth System Science (1 sem. hr x 3)</td>
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<tr>
<td>CMSS 6303</td>
<td>Systems Analysis</td>
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<tr>
<td>CMSS 6305</td>
<td>Natural Systems Modeling</td>
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<td>CMSS 6330</td>
<td>Spatial Systems Science</td>
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</tr>
<tr>
<td>CMSS 6370</td>
<td>Coastal Management and Ocean Law</td>
<td>3</td>
</tr>
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<td>Elective coursework supporting student’s individual research goals (Item C below)</td>
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<td>Specialized coursework, Research or Dissertation Research (Item E below)</td>
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<tr>
<td>CMSS 6699</td>
<td>Dissertation Defense</td>
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</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

C. Elective, Specialized, and Topical Coursework

Elective and Specialized coursework are chosen from among approved biology, chemistry, coastal and marine system science, computer science, environmental science, geographic information science, geology, marine biology, or other course offerings, in consultation with student’s advisory committee.

Topical coursework is offered under the heading of CMSS 6590, Advanced Topics. Classes or research projects designated as part of the elective coursework requirement must receive the approval of a student’s graduate advisory committee. Students must demonstrate to the committee that the selection of classes or research projects produces a coherent course of study focused on the student’s particular area of emphasis. Depending on the emphasis area, selections may include coastal and marine system science, marine biology, the natural sciences, computer science, geographic information science, mathematics, political science, public administration, business law, or other areas as stipulated by the graduate advisory committee.

D. Dissertation Format and Style

The dissertation must be prepared in a standard format and style dictated by the advisory committee. Guidance can be found in the CMSS Student Handbook. For more information, consult the Office of Graduate Studies and Research.

Upon approval by a student’s graduate advisory committee, a copy of the dissertation will be sent to the Dean of Graduate Studies. At the time of successful completion of the dissertation exam, committee members will sign the dissertation and return it to the Dean of Graduate Studies for final approval and signature. See also “Requirements for Doctoral Programs” in the general section of this catalog.

E. Research, Dissertation Research, and Dissertation Defense

Three courses are taken for the main research component of the degree: CMSS 6996 Research (1-9 credit hours), CMSS 6998 Dissertation Research (1-9 credit hours), and CMSS 6699 Dissertation Defense (6 credit hours). During the initial phase of the program, students take CMSS 6996 Research (1 - 9 credit hours), with approval of their advisor. Students can also enroll in CMSS 6596 Directed Independent Study (1 - 5 credit hours), supervised by their advisor or other faculty members at any stage of the program progression. Once students have passed their qualifying exam and become degree candidates, they should take CMSS 6998 Dissertation Research (1 - 9 credit hours) with approval of their advisor. The courses CMSS 6996 and 6998 are graded with an S or U, and may be repeated. Finally students must enroll in CMSS 6699 Dissertation Defense (6 credit hours), during their last semester (see below). CMSS 6699 is taken as Credit/No Credit.

F. Final Dissertation Defense

Each student must pass a final dissertation defense examination during the last semester before graduation, to be administered by the student’s graduate advisory committee. The
exam will cover topics related to (1) all graduate coursework undertaken for the CMSS program, (2) a student’s dissertation research area, and (3) broad concepts of system science, including familiarity with the literature and appropriate professional societies. The student is responsible for scheduling the defense with the faculty involved. A student who fails the defense may repeat it once, but only after an interval of four months or more. If a student fails the second defense, he or she will be terminated from the program. Students must enroll in the course Dissertation Defense (CMSS 6699) during the semester in which they are planning to take the dissertation defense and/or graduate.

For Additional Information
Website: http://cmss.tamucc.edu
Campus Address: Carlos F. Truan Natural Resource Center, Room 1100
Phone: (361) 825-2681
Mailing Address: Coastal and Marine System Science Program, Unit 5850
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5850

GRADUATE COURSES
CMSS 6102. 1 sem. hr. (1:0)
SEMINAR IN EARTH SYSTEM SCIENCE
Advanced topic study and presentation by students, faculty, or visiting scientists. Meets one hour weekly. Must be taken three times by all Ph.D. students.
CMSS 6303. 3 sem. hrs. (3:0)
SYSTEMS ANALYSIS
Statistical analysis for data collected in several variables. Topics include sampling from multivariate normal distribution, multivariate analysis of variance, discriminant analysis, principle components, and factor analysis. Prerequisite: Math 5315 Statistical Methods in Research I, undergraduate equivalent, or consent of instructor.
CMSS 6305. 3 sem. hrs (3:0)
NATURAL SYSTEMS MODELING
Parameterization of natural systems through the identification and characterization of input/output pathways, regulators, and sinks. Construction, testing, and use of various types of models: conceptual, ecosystem, and numeric. Prerequisites: MATH 5315 Statistical Methods in Research I and MATH 5316 Statistical Methods in Research II, or permission of instructor.
CMSS 6323. 3 sem. hrs. (3:0)
EXPERIMENTAL DESIGN
Fundamental concepts in the design and analysis of biological experiments. Various analysis of variance models will be introduced beginning with completely randomized designs and factorial treatment structures, and proceeding through block and split-plot designs. Related topics include analysis techniques, power, sample size and checking assumptions. Prerequisite: Math 5315 Statistical Methods in Research I, undergraduate equivalent, or consent of instructor.
CMSS 6327. 3 sem. hrs. (3:0)
PHYSICAL OCEANOGRAPHY
Succinct review of basic concepts of physical oceanography followed by general presentations and discussions in three selected areas: global ocean circulation, circulation along the Gulf of Mexico continental shelf; and ocean-atmosphere interaction and impacts on climate. A significant portion of the class is based on student guided reading assignments. Prerequisites: Direct interest in physical oceanography, background that includes introductory college physics and basic mathematical knowledge of calculus and simple differential equations, or approval of class instructor.
CMSS 6330. 3 sem. hrs. (3:0)
SPATIAL SYSTEMS SCIENCE
Introduction and advanced uses of mapping datums, coordinate systems, and accuracy requirements for geographic information systems (GIS). Use of GIS tools to investigate statistical patterns and relationships among maps and geo-databases. Derivation of new maps and analysis based on spatial context, patterns, surface configuration, proximity, connectivity and flows. Prerequisites: MATH 5316 Statistical Methods in Research II; a working knowledge of ArcView and/or ArcGIS; or permission of instructor.
CMSS 6333. 3 sem. hrs. (3:0)
PALEO SYSTEMS
Study of the interrelationships of ancient organisms and their environment through interpretation of the fossil record, analog communities, and oceanographic data, such as carbon and oxygen isotopes. Theories and methods of reconstructing terrestrial, marine and freshwater biotic communities and environments. Review of classic paleoecological and paleoceanographic studies and as well as current research. Prerequisites: BIOL 3428 Principles of Ecology, GEOL 1401 Historical Geology, and ESCI 3351 Oceanography, or GEOL 4316 Marine Geoscience
CMSS 6334. 3 sem. hrs. (3:0)
GEOLGICAL OCEANOGRAPHY AND MARINE GEOCHEMISTRY
Integrated examination of the geology and geochemistry of the marine environment. Evolution of ocean basins, continental margins and plate boundaries; controls on the types, origin, and distribution of marine sediments; introduction to paleoceanography; review of the steady-state ocean concept, classification of different constituents according to their involvement in
the biological particle cycle; geochemical processes at
and near the seafloor; and chemical exchanges between
sea water and sediment, both at the sediment-water
interface and within the sediment. Prerequisites: ESCI
3351 Oceanography, or GEOL 4316 Marine Geosci-
ence, CHEM 3411 Organic Chemistry I or permission
of instructor.

CMSS 6343. 3 sem. hrs. (3:0)
TRANSPORT OF POLLUTANTS IN THE
ENVIRONMENT
Fate and transport processes in the environment. Pollut-
ant distribution among phases; solubility, volatilization,
and absorption. Equilibrium partitioning among differ-
ent phases; fugacity modeling. Modeling of physical
transport mechanisms; advection, molecular diffusion,
dispersion. Application of transport processes to surface
waters, the subsurface and the atmosphere. Air-water
exchange, non-aqueous phase liquids. Prerequisites:
CHEM 1311 General Chemistry I and 1312 General
Chemistry II.

CMSS 6352. 3 sem. hrs. (3:0)
ENVIRONMENTAL FORECASTING
Statistical techniques (classic and Bayesian) and new
artificial intelligence based techniques, such as neural
networks, for the analysis of environmental systems
with large datasets. Prerequisite: CMSS 6305.

CMSS 6355. 3 sem. hrs. (2:2)
AQUATIC ECOTOXICOLOGY
Principles and applications of toxicity testing in the
aquatic environment for: water and sediment quality
assessment and monitoring; characterization of liquid
effluents and treatment procedures; development of water
quality criteria; assessment of water quality in aquacul-
ture facilities; assessment of environmental hazard of
new chemicals. Prerequisites: BIOL 3413 Invertebrate
Zoology and BIOL 3414 Vertebrate Zoology.

CMSS 6357. 3 sem. hrs. (3:0)
GLOBAL GEOCHEMICAL CYCLES AND
CHANGE
Integrated examination of global-scale geochemical
cycles operating within and between the four compo-
nents of the Earth System (atmosphere, hydrosphere,
biosphere, and solid Earth) and their role in the evolu-
tion of our planet. Prerequisites: CHEM 1311/1312
General Chemistry I and II and CHEM 3411 Organic
Chemistry I.

CMSS 6359. 3 sem hrs. (3:0)
MARINE ECOSYSTEM DYNAMICS
Investigation of the interactions between organisms
and physical processes that regulate marine ecosystem
functions.

CMSS 6361. 3 sem. hrs. (3:0)
ORGANIC AND ISOTOPE GEOCHEMISTRY
Organic compounds of biologic and industrial origin
are used to study past sedimentary environments. Ap-
lications of oxygen, carbon, hydrogen and nitrogen
stable isotope systems are employed to complement
information gained from various organic geochemical
studies. Prerequisites: CHEM 3411 Organic Chemistry
I and GEOL 1403 Physical Geology.

CMSS 6370. 3 sem. hrs. (3:0)
COASTAL MANAGEMENT AND OCEAN LAW
Intensive study of the 1972 National Coastal Zone
Management Act and subsequent coastal management
programs. The Texas program, which is administered
by the General Land Office, will be dealt with in depth
as the central focus of the course. Statutory law relating
to citizen, state, and federal rights and duties as they
impact coastal and maritime law will be studied includ-
ing applicable Texas real property law. Students will
use case law studies relating to those rights and duties
and Public Trust Doctrine cases to gain an integral part
of understanding the responsibilities of governments
and rights of citizens.

CMSS 6401. 4 sem. hrs. (3:3)
MATHEMATICAL CONCEPTS FOR SYSTEM
SCIENCE
Course focused on calculus, linear algebra, and
differential equations used in coastal, marine, and
environmental settings. The course is designed for
entering doctoral students in the CMSS program as
well as other interested science graduate students of
the College of Science and Technology. Course con-
cepts are approached within the context of coastal and
marine systems. Prerequisites: Introductory Statistics
MATH 1342 or 1442 and Calculus I or equivalents or
permission of instructor.

CMSS 6407. 4 sem hrs. (3:3)
DATA ACQUISITION AND INTEGRATION
Principal component, mixing, and quantitative analy-
sis of very large data sets. Database design, filtering
and mining. Determination of appropriate sampling
densities for multitemporal and multiscale acquisition
campaigns. Standard mathematical techniques for
resampling, rectification, and transformation. Prepara-
tion of normalized data sets for visualization and GIS
applications. Prerequisite: CMSS 6305 or permission
of instructor.

CMSS 6425. 4 sem. hrs. (3:3)
GIS APPLICATIONS IN ECOLOGY
Development of hierarchical spatial and temporal analy-
ses relating to ecological phenomena using geographic
information system approaches. Emphasis on identify-
ing and evaluating available databases, incorporating
databases at appropriate scales, constructing pertinent
geospatial themes, and analyzing spatial and temporal
changes with habitats and biological populations. Pre-
requisite: GISC 1470 Geographic Information Systems
I and GISC 3421 Visualization for GIS.

CMSS 6442. 4 sem. hrs. (3:2)
ACOUSTIC ECOLOGY
Intended for students working in diverse research areas
in which sound conveys information that has significant
effects on the systems being studied. Topics include field
data collection methods, recording devices and media,
spectrographic analysis of acoustic signals using digital
techniques, and an introduction to statistical evaluation
of acoustic data. Prerequisite or co-requisite: Math 5315
or permission of instructor.
CMSS 6590. 1-5 sem. hrs. (1:0-3:4) ADVANCED TOPICS
An advanced study of an environmental systems topic. May be repeated with full credit in another area of environmental systems.

CMSS 6596. 1-5 sem. hrs. DIRECTED INDEPENDENT STUDY
Study in areas of current interest. A total of six semester hours of Directed Independent Study may be counted towards the Ph.D. degree.

CMSS 6996. 1-9 sem. hrs. RESEARCH
Independent research conducted under supervision of an advisor. Open to Coastal and Marine System Science students who have not yet passed the qualifying exam and with consent of their graduate advisor. The course is graded with an S or U, and may be repeated.

CMSS 6998. 1-9 sem. hrs. DISSERTATION RESEARCH
Research related to Ph.D. dissertation project. Open only to degree candidates having passed the qualifying exam in Coastal and Marine System Science with consent of their graduate advisor. The course is graded with an S or U, and may be repeated.

CMSS 6699. 6 sem. hrs. DISSERTATION DEFENSE
Open only to degree candidates in Coastal and Marine System Science with consent of their graduate advisor. Students should enroll in this course during the last semester of the CMSS PhD program. To successfully complete this course the student must pass the dissertation defense as well as have a final copy of the dissertation signed by the full graduate committee and approved for binding and distribution. A course section will be created for the student to enroll. A grade of Credit/No Credit will be assigned for the class with the possibility to assign the grade of IP or In Progress. If a grade of IP is assigned, the course must be repeated the following semester(s) until the course is passed.

Computer Science
MASTER OF SCIENCE
Program Description
The Master of Science with a major in Computer Science is designed to prepare graduate professionals who can apply the necessary knowledge of computing to information requirements of organizations in business, government, industry and education. The program provides for the education of individuals who will develop, maintain, or manage complex computer-based information systems.

The program provides the experienced professional with up-to-date specialized knowledge while developing those analytical skills necessary to stay abreast of the changing field of computing. The program also provides the recent baccalaureate graduate with additional applied and advanced knowledge, thus facilitating a more useful contribution to his/her career path. Specifically, graduates of the Computer Science MS program will be able to:

- apply the knowledge of computing to organizational information requirements in business, government, industry and education, and
- develop, maintain or manage complex computer-based information systems
- utilize their acquired analytical skills for life-long learning and advanced studies in computing

The degree requires a minimum of 36-semester hours of which at least 30 hours must be in computer science, including a three semester-hour graduate project and a formal technical report of the project.

Admission Requirements
1. In addition to meeting all University requirements, students seeking admission to the graduate degree program in computer science must submit the following to the Office of Graduate Studies and Research:
   - An application and application fee
   - Transcripts from Texas Higher Education Coordinating Board recognized institutions (international students will be required to submit relevant international transcripts)
• A statement of purpose (500-1000 words) discussing why you wish to get a Master’s degree and your areas of interest
• GRE scores (within five years of the date of application)
• International students must submit TOEFL scores and additional documents to the Office of Graduate Studies. http://gradschool.tamucc.edu/international.htm

2. A student entering the program is expected to have adequate preparation in computer science and mathematics from their undergraduate degree. For computer science, this preparation must include successful completion of coursework in data structures, a high level programming language, computer architecture, operating systems, and software engineering. In mathematics, students must have successfully completed course work in discrete mathematics, calculus, plus one additional junior level or higher mathematics course such as linear algebra, numerical analysis, or applied probability and statistics.

Students who have not successfully completed the above courses may be required to take leveling courses in any missing subjects before being formally admitted into the MS degree program. All leveling courses must be completed with a grade of “B” or better. In addition, students can take no more than 9 credits towards their degree prior to completing all leveling courses.

Degree Requirements
Requirements for the Master of Science in Computer Science degree may be met through one of two options: Thesis Option (Option I) or Project Option (Option II). Each option requires a minimum number of 36 credit hours. Both options share the same 12 credit hour core.

The Thesis Option allows for maximum flexibility in choosing elective courses. This option allows the student to concentrate on a particular field or area of computer science. The Project Option also allows for flexibility in choosing elective courses but requires the student to take at least one elective from each of the three elective concentration tracks. The concentration tracks are Software and Programming, Networking and Security, and Scientific Computing and Visualization.

Requirements for Option I – Thesis Option:
Minimum number of credit hours: 36
Core: 12 hours
Electives: Minimum of 18 credit hours
Thesis:
COSC 5398: Thesis I: 3 hours
COSC 5399: Thesis II: 3 hours

Requirements for Option II – Project Option:
Minimum number of credit hours: 36
Core: 12 hours
Additional Required Course:
COSC 5370: Advanced Software Engineering
Electives:
Minimum of 18 credit hours, with at least 3 credit hours from each concentration track
Project:
COSC 5395: Graduate Project and Technical Report: 3 hours

Core Courses (12 credit hours)
COSC 5334 – Design and Analysis of Algorithms
COSC 5351 – Advanced Computer Architecture
COSC 5352 – Advanced Operating Systems
COSC 5393 – Research Methods in Computer Science
Electives

Electives are chosen by the student but are subject to approval by the student’s graduate faculty mentor. Electives should be taken that will support the student’s graduate project or thesis. No more than six hours of approved electives may come from courses taken at another university or from outside of computer science. Credit from a master’s degree earned at another institution will not be applied to a second master’s degree at Texas A&M University-Corpus Christi. A maximum of six hours of approved Directed Independent Study may count toward the M.S. degree.

Concentration Tracks

a. Software and Programming
- COSC 5330 – Programming Languages
- COSC 5336 – Database Management Systems
- COSC 5350 – Advanced Topics in DBMS
- COSC 5353 – Compiler Design and Construction
- COSC 5370 – Advanced Software Engineering

b. Scientific Computing and Visualization
- COSC 5327 – Introduction to Computer Graphics
- COSC 5328 – Advanced Computer Graphics
- COSC 5340 – Human-Computer Interaction
- COSC 5345 – System Simulation and Modeling
- COSC 5348 – Expert Systems
- COSC 5354 – Artificial Intelligence
- COSC 5356 – Theory of Computation
- COSC 5360 – Parallel Computing
- COSC 5361 – Parallel Algorithms

c. Networking and Security
- COSC 5355 – Data Communications and Networking
- COSC 5357 – Wireless Sensor Networks
- COSC 5374 – Computer Forensics
- COSC 5375 – Information Assurance
- COSC 5376 – Network Security
- COSC 5377 – Applied Cryptography
- COSC 5379 – Advanced Information Assurance

Chronological Procedure Leading to the MS Degree

1. Completion of a degree plan
   Upon admission to the MS degree program in computer science, and prior to enrollment in any course, the student must contact the Graduate Academic Advisor in the College of Science & Technology to have a degree plan completed. The student will then be assigned a faculty advisor from the computer science faculty. Students should seek the advice of their faculty advisor on a regular basis about their progress toward their degree.

2. Progress toward the degree
   Once admitted to the graduate degree program in computer science, a student must complete at least six semester hours of credit per year toward the degree until the degree is completed. Failure to make this minimum progress will result in dismissal from the degree program with possible readmission based on the catalog in effect at the time of readmission. A student who is actively pursuing a graduate project or thesis and has completed all other course work for the degree will be given relief from this requirement, but must register continuously for the project or thesis until it is completed.
3. Thesis or Graduate Project

Thesis Option

Students choosing the thesis option must first find a computer science graduate faculty member to agree to serve as their thesis advisor. Generally this is a faculty member working in the area of the thesis. With permission from the thesis advisor, the student may register for COSC 5398 Thesis I. During the first month of Thesis I, the student and their advisor should determine the thesis committee. This committee consists of three full-time Texas A&M University-Corpus Christi faculty members. The committee chairperson and one other member must be a computer science Ph.D.-degree faculty member.

While taking Thesis I, the student will propose the topic of the thesis to the thesis committee. With satisfactory progress, the student may then register for COSC 5399 Thesis II with permission of the thesis advisor. The student must then continually register for COSC 5399 until completion of their thesis. A grade of In Progress will be assigned for COSC 5398 and all COSC 5399 courses until the student completes their thesis and passes their final exam. If the student fails to register for COSC 5399 or fails their final examination, a grade of No Credit will be assigned to COSC 5398 and all COSC 5399 courses and the student must begin the process again.

While taking COSC 5399 Thesis II, the student will produce a written thesis that discusses their work. A draft copy of the thesis will be given to all committee members and the student will make any changes required by the committee. Upon approval of the thesis committee chair, the student may schedule their final oral examination. The thesis will be published and archived in the Mary & Jeff Bell library. Guidelines for writing the thesis are available in the Computer Science office.

Graduate Project Option

Prior to their last semester, and after passing COSC 5393, the student must assemble their graduate project committee. This committee consists of three full-time Texas A&M University-Corpus Christi faculty members. The committee chairperson and one other member must be a computer science Ph.D. faculty member. The student will propose their graduate project to their committee.

After the approved graduate project proposal is placed in the student’s file, the student may register for COSC 5395 with permission of their committee chair. Once a student has registered for a graduate project, he/she must continue to register in each consecutive long semester until the project is completed and the student passes their final examination. A student who does not complete a project in the semester for which he/she has registered will receive a grade of IP (In Progress). Failure to register for an unfinished project in the next semester will terminate the project and will require that the entire project process be repeated starting with the submission of a new project proposal.

The graduate project, resulting in a technical report (see COSC 5395), may be completed in one semester; however, with continuous registration, a student will be allowed up to one calendar year to complete the project. Any extension beyond one year will require written justification on a semester-to-semester basis, to be approved by each member of the committee and the chairperson of computer science. All computer science graduate project defenses must be completed before the last day of the last full week of instruction.

4. Final examination

After the student has completed all other requirements for the MS degree in computer science, he/she must schedule an oral exam over his/her graduate program of study. The oral exam will be administered by the graduate thesis or project committee and will focus heavily on the thesis or project itself.
GRADUATE COURSES

COSC 5305. 3 sem. hrs. (3:0)
A SURVEY OF COMPUTER SOFTWARE PACKAGES
A concentrated study of selected software packages. (Does not count toward total hours required for MS in Computer Science.) Fall.

COSC 5306. 3 sem. hrs. (3:0)
INTRODUCTION TO PROGRAMMING PRINCIPLES
Addresses modern programming and provides students with experience in at least one primary high-level programming language. Students will experience solving problems using computer programming. Students will study the program development cycle, modular design, style, syntax and semantics. (This course is designed for non-computer science majors. Does not count toward total hours required for MS in Computer Science. Does not count as computer science foundation course.) Spring.

COSC 5308. 3 sem. hrs. (3:0)
FOUNDATIONS IN NETWORK DESIGN AND MANAGEMENT
A broad-based introduction to the fundamentals and all major aspects involved in planning, implementing and managing a local area network (LAN). Both logical and physical LAN technologies are covered including media options, physical topologies, network architectures and communication protocols. Functions of network operating systems are studied and compared to current marketplace products. (Does not count toward total hours required for MS in Computer Science.) Fall.

COSC 5311. 3 sem. hrs. (3:0)
FOUNDATIONS IN PROGRAMMING AND PROBLEM SOLVING I
A concentrated introductory programming course at the graduate level. Intended for students with little background in computer science who wish to program a computer in support of research or other academic interests. (Does not count toward total hours required for MS in Computer Science.) Fall, Spring.

COSC 5312. 3 sem. hrs. (3:0)
FOUNDATIONS IN PROGRAMMING AND PROBLEM SOLVING II
A continuation of COSC 5311 completing the syntax of the language used as the programming tool in COSC 5311. An introduction to data structures in multiple computing platforms. (Does not count toward total hours required for MS in Computer Science.) Prerequisite: COSC 5311. Fall, Spring, Summer.

COSC 5313. 3 sem. hrs. (3:0)
FOUNDATIONS OF COMPUTER ORGANIZATION AND ARCHITECTURE
A study of internal computer concepts with respect to the functioning of the hardware subsystems and their roles in the computing process. An in-depth study of machine and assembly language. (Does not count toward total hours required for MS in Computer Science.) Prerequisite: COSC 5311 or Permission of Instructor. Fall, Spring.

COSC 5320. 3 sem. hrs. (3:0)
DESIGN AND IMPLEMENTATION OF COMPUTERIZED INSTRUCTIONAL SYSTEMS
Provides a broad introduction to the development of computer-based learning environments. Covers the theory and practice of using the computer both in the classroom and individually for learning. Covers a wide range of possibilities from multimedia presentation of material to constructive environments and computer-based instructional systems. Prerequisite: Permission of the Instructor. (Does not count toward total hours required for MS in Computer Science.) Summer.

COSC 5321. 3 sem. hrs. (3:0)
DATA STRUCTURES
A study of the logical structures used for the organization, storage and retrieval of data. These structures are addressed from both memory-resident and file-resident points of view. Algorithms for the creation, searching, and manipulation of standard data structures used in computing are stressed. (Does not count toward total hours required for MS in Computer Science.) Prerequisite: COSC 5311. Co-requisites: MATH 2305; COSC 5312. Fall, Spring.

COSC 5325. 3 sem. hrs. (3:0)
FOUNDATIONS OF SOFTWARE ENGINEERING
This graduate course provides students with a foundation of software engineering introducing fundamental principles of the development and maintenance of quality software. Students learn various methodologies used in all phases of the software life cycle. Topics include software life cycle models, software process, analysis, design, and implementation. Prerequisite: COSC 531 or equivalent. (Does not count toward total hours required for MS in Computer Science.)

COSC 5327. 3 sem. hrs. (3:0)
INTRODUCTION TO COMPUTER GRAPHICS
This graduate course provides students with a foundation in basic principles and techniques for computer graphics on modern graphics hardware. Students will gain experience in interactive computer graphics using...
the OpenAL API. Topics include: graphics hardware, rendering, perspective, lighting, and geometry.

COSC 5328. 3 sem. hrs. (3:0)  
ADVANCED COMPUTER GRAPHICS  
This course covers advanced computer graphics techniques. Students will be introduced to state-of-the-art methods in computer graphics. This course will focus on techniques for real-time rendering and animation. Prerequisite: COSC 4328 or COSC 5327 or equivalent. Spring.

COSC 5330. 3 sem. hrs. (3:0)  
PROGRAMMING LANGUAGES  
A study of the classification, design and structure of programming languages. Data, control, and modular abstraction facilities are considered for a variety of languages. Prerequisites: COSC 5331 and MATH 2305. Spring.

COSC 5331. 3 sem. hrs. (3:0)  
FOUNDATIONS OF COMPUTER SYSTEM SOFTWARE  
A study of various system software components such as operating systems and language processors. The general underlying design philosophies, implementation approaches, and uses are discussed primarily with respect to the interface role provided by the software between programmers or users and the hardware. (Does not count toward total hours required for MS in computer science.) Prerequisite: COSC 5313. Co-requisite: COSC 5321. Fall.

COSC 5334. 3 sem. hrs. (3:0)  
DESIGN AND ANALYSIS OF ALGORITHMS  
An advanced course that concentrates on the design and analysis of algorithms used to solve a variety of problems. The methods of design covered include such topics as: divide-and-conquer, the greedy method, dynamic programming, search and traversal techniques, and backtracking. Prerequisites: COSC 5321, MATH 2413, and MATH 2305. Spring.

COSC 5335. 3 sem. hrs. (3:0)  
FOUNDATIONS OF DATABASES  
A study of fundamental database management system concepts, terminology, and methodology for design and implementation. Commercially available databases are discussed and used with emphasis upon the relational model. Proper application design techniques are stressed. (Does not count toward total hours required for MS in computer science.) Prerequisite: COSC 5312. Co-requisite: COSC 5321. Fall.

COSC 5336. 3 sem. hrs. (3:0)  
DATABASE MANAGEMENT SYSTEMS  
A study of contemporary database management concepts. Performance (indexing, query optimization, update optimization), concurrency, security and recovery issues are discussed. Also includes the study of front-end environments that access the database. Prerequisites: COSC 5335 and COSC 5321. Spring.

COSC 5340. 3 sem. hrs. (3:0)  
HUMAN-COMPUTER INTERACTION  
Graduate-level survey of the field of Human-Computer Interaction (HCI) focusing on design strategies for making software usable by real-world people for doing real-world work. Topics include the role of HCI in the software product life cycle, task analysis of the user’s work, architectures for human-computer dialogues, new and traditional approaches to user interface design, and user interface standards. Prerequisite: COSC 5331. Spring.

COSC 5345. 3 sem. hrs. (3:0)  
SYSTEM SIMULATION AND MODELING  
A study of the simulation and modeling of selected continuous and discrete systems. Prerequisites: COSC 5311, MATH 2413, and MATH 3342. Spring.

COSC 5348. 3 sem. hrs. (3:0)  
EXPERT SYSTEMS  
The overall goal of the course is to give the student the ability to design and program small expert systems while building a base for advanced study. Topics include programming techniques for expert systems, the design and construction of expert systems, the representation of knowledge, methods of inference, reasoning under uncertainty, inexact reasoning, classification, configuration, and diagnostic systems. Prerequisite: COSC 5321. Spring.

COSC 5350. 3 sem. hrs. (3:0)  
ADVANCED TOPICS IN DBMS  
The study of emerging database technologies. Topics are chosen from data warehousing, distributed databases, spatial databases and web-based applications. Prerequisites: COSC 5336. Offered on sufficient demand.

COSC 5351. 3 sem. hrs. (3:0)  
ADVANCED COMPUTER ARCHITECTURE  
An overview of computer architecture, which stresses the underlying design principles and the impact of these principles on computer performance. General topics include design methodology, processor design, control design, memory organization, system organization, and parallel processing. Prerequisite: COSC 5331. Fall.

COSC 5352. 3 sem. hrs. (3:0)  
ADVANCED OPERATING SYSTEMS  
Introduction to advanced concepts in operating systems and distributed systems. Topics include distributed system architectures, interprocess communication, distributed mutual exclusion, distributed synchronization and deadlock, agreement protocols, distributed scheduling and process management, distributed shared memory, distributed file systems, multiprocessor system architectures and operating systems, recovery and fault tolerance. Prerequisite: COSC 5331 or an equivalent undergraduate course in Operating Systems. Familiarity with C/C++ programming language. Spring.

COSC 5353. 3 sem. hrs. (3:0)  
COMPILER DESIGN AND CONSTRUCTION  
This course introduces the basic concepts and mechanisms traditionally employed in language translators, with emphasis on compilers. Topics include strategies for syntactic and semantic analysis, techniques of code optimization and approaches toward code generation. Prerequisites: COSC 5330 and MATH 2305. Fall.
COSC 5354. 3 sem. hrs. (3:0)
ARTIFICIAL INTELLIGENCE
Fundamental concepts and techniques for the design of computer-based, intelligent systems. Topics include: a brief history, methods for knowledge representation, heuristic search techniques, programming in LISP or Prolog. Prerequisite: COSC 5321 and MATH 2305. Fall.

COSC 5355. 3 sem. hrs. (3:0)
DATA COMMUNICATIONS AND NETWORKING
Areas studied include principles of computer-based communication systems, analysis and design of computer networks, and distributed data processing. Prerequisite: COSC 5331. Fall.

COSC 5356. 3 sem. hrs. (3:0)
THEORY OF COMPUTATION
An introduction to some of the theoretical foundations of modern computing. Topics include finite state machine concepts, formal grammars, and basic computability concepts. Prerequisites: COSC 5321 and MATH 2305. Summer.

COSC 5357. 3 sem. hrs. (3:0)
WIRELESS SENSOR NETWORKS
This is a graduate level course on wireless sensor networks; one of the fastest developing areas in computer science and engineering. The focus of this course is on the design of optimized architectures and protocols for such unique networks. Topics include the design principles of wireless sensor networks, energy management, MAC protocols, naming and addressing, localization, routing protocols, applications of wireless sensor networks, and associated challenges and measures.

COSC 5360. 3 sem. hrs. (3:0)
PARALLEL COMPUTING
Introduction to the hardware and software issues in parallel computing. Topics include motivation and history, parallel architectures, parallel algorithm design, and parallel performance analysis. Students will be introduced to a variety of parallel computing paradigms including message passing systems and shared memory systems. Prerequisite: COSC 5331.

COSC 5361. 3 sem. hrs. (3:0)
PARALLEL ALGORITHMS
Introduces and evaluates important models of parallel and distributed computation. Topics include a selection of parallel algorithms for various models of parallel computation, combinational circuits, parallel prefix computation, divide and conquer, pointer based data structures, linear arrays, meshes and related models, and hypercubes. Prerequisites: either COSC 5360 or an equivalent undergraduate course in Algorithms.

COSC 5370. 3 sem. hrs. (3:0)
ADVANCED SOFTWARE ENGINEERING
Areas studied include engineering principles and their application to the design, development, testing, and maintenance of large software systems, tools and processes for managing the complexities inherent in creating and maintaining large software systems. Prerequisite: COSC 5321 or equivalent. Fall.

COSC 5374. 3 sem. hrs. (3:0)
COMPUTER FORENSICS
This course will introduce students to the fundamentals of computer forensics and various software tools used in cyber-crime analysis. Students will be introduced to established methodologies for conducting computer forensic investigations, as well as to emerging international standards for computer forensics. Applicable laws and regulations dealing with computer forensic analysis will also be discussed. Prerequisite: COSC 5312. Spring.

COSC 5375. 3 sem. hrs. (3:0)
INFORMATION ASSURANCE
An introduction to information security and assurance. This course covers the basic notions of confidentiality, integrity, availability, authentication models, protection models, secure programming, audit, intrusion detection and response, operational security issues, physical security issues, personnel security, policy formation and enforcement, access controls, information flow, legal and social issues, classification, trust modeling, and risk assessment. Prerequisite: COSC 5312 or approval of the Instructor. Fall.

COSC 5376. 3 sem. hrs. (3:0)
NETWORK SECURITY
This course is a study of networking basics and security essentials with respect to information services provided over a computer network. The course covers the technical details of security threats, vulnerabilities, attacks, policies, and countermeasures such as firewalls, honeypots, intrusion detection systems, and cryptographic algorithms for confidentiality and authentication and the development of strategies to protect information services and resources accessible on a computer network. Prerequisites: COSC 5375 and approval of the Instructor. Spring.

COSC 5377. 3 sem. hrs. (3:0)
APPLIED CRYPTOGRAPHY
This course includes an introduction to cryptographic algorithms and protocols for encrypting information securely, techniques for analyzing vulnerabilities of protocols, approaches to digital signatures and information digests, and implementation approaches for the most significant cryptographic methodologies. Prerequisite: COSC 5312 or approval of the instructor. Fall.

COSC 5379. 3 sem. hrs. (3:0)
ADVANCED INFORMATION ASSURANCE
This course encompasses a broad range of topics involving information security, communications security, network security, risk analysis, operational security, health information privacy, criminal justice digital forensics, homeland security, the human element and social engineering, and applicable national and international laws. An in-depth information assurance capstone project or research paper will be required of each student to satisfy the information assurance graduate option requirements. Prerequisites: COSC 5375. Fall.
COSC 5393. 3 sem. hrs. (3:0)
RESEARCH METHODS IN COMPUTER SCIENCE
This course provides students with a range of experiences in conducting and communicating research. Students will learn major research methods and techniques. Experiences will be gained in all stages of research: reviewing literature, writing a proposal, designing an approach, and reporting results. Critical-reading/writing assignments and class discussions on state-of-the-art research in Computer Science will provide students with major research aspects. Fall, Spring

COSC 5394. 3 sem. hrs. (3:0)
GRADUATE PROJECT RESEARCH AND PROPOSAL
Preparatory and developmental research for the graduate project resulting in the preliminary design and formal proposal of the graduate project. This proposal must be accepted by the project chairperson to receive credit. Offered on credit/no-credit basis only. Students are required to complete a major field assessment test. Credit will not be recorded until the Graduate Project Proposal is accepted by the Graduate Project Committee Chair. (See graduate project procedure under MS degree requirements.) Prerequisite: COSC 5370. Fall, Spring.

COSC 5395. 3 sem. hrs. (3:0)
GRADUATE PROJECT AND TECHNICAL REPORT
An applied research project in computing from problem definition to implementation in an area of particular interest to the student that relates to the course of study. Prerequisites: COSC 5394 and formal approval of graduate project proposal. Offered on credit/no-credit basis only, with grade of IP until completed. Credit will not be recorded until technical report is accepted by the Graduate Project Committee. (See graduate project procedure under MS degree requirements.) Fall, Spring, Summer.

COSC 5396. 3 sem. hrs.
DIRECTED INDEPENDENT STUDY
Study in areas of current interest. (A maximum of six hours may be counted toward the MS degree.) Fall, Spring, Summer.

COSC 5398. 3 sem. hrs.
THESIS I
This course is for Computer Science MS students choosing the thesis option. Upon choosing a thesis advisor, students will register for this course. This course is only credit/no credit. Students will be given a grade of In-Progress until successfully completing their thesis. Prerequisites: COSC 5393 and permission of instructor.

COSC 5399. 3 sem. hrs.
THESIS II
This course is for Computer Science MS students choosing the thesis option. Students will continually register for this course until successful completion of their thesis. A grade of In-Progress will be assigned until either successful completion or failing to register. If failing to register students will receive a grade of No Credit for all 5399 and 5398 courses. Prerequisite: COSC 5398.

COSC 5590. 1-5 sem. hrs.
SELECTED TOPICS
Variable content study of specific areas of computer and information systems. May be repeated for credit when topics vary. Prerequisites: Vary depending upon topic.

ENTC 5490. 1-4 sem. hrs.
SELECTED TOPICS
Subject material variable. May be repeated for credit when topics are different. Prerequisites: Vary depending upon topic.

ENTC 5496. 1-4 sem. hrs.
DIRECTED INDEPENDENT STUDY
Requires a formal proposal of study to be completed in advance of registration, approval of supervising faculty, and chairperson. Prerequisites: Vary depending upon subject area.

Engineering Technology
Graduate courses in engineering technology are offered in support of graduate degree programs in computer science, environmental science and education. For details concerning these particular degree programs, consult the appropriate section of the catalog.

For Additional Information
Website: http://entc.tamucc.edu/
Campus address: Science and Technology, Room ST 222, Phone (361) 825-5849
Mailing address: Engineering Technology Program, Unit 5797
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5797

GRADUATE COURSES
ENTC 5490. 1-4 sem. hrs.
SELECTED TOPICS
Subject material variable. May be repeated for credit when topics are different. Prerequisites: Vary depending upon topic.
Environmental Science

MASTER OF SCIENCE

Program Description
The mission of the Master of Science program in Environmental Science is to provide a rich and rewarding setting in which students and faculty can develop and communicate innovative and practical solutions to present and future environmental challenges, with a focus on urban and coastal issues.

Graduates of the Environmental Science MS program will:
• Possess a broad understanding of environmental science, and
• possess enhanced knowledge of a specific area of environmental science, including relevant scientific literature, related to their thesis or professional paper, and
• have the ability to accurately describe and assess environmental research both orally and in writing.

Students will choose between thesis and non-thesis options. The non-thesis option is designed for students who desire a greater breadth of understanding of environmental science than the thesis option provides. The curriculum will especially benefit individuals employed in scientific or technical fields who seek advancement or additional training to enhance their knowledge and skills. Non-thesis students must complete a professional research project with a written final report and seminar. The thesis option requires a thesis based upon original research, supported by the scientific literature, and proved statistically, when appropriate. The thesis master’s degree will allow a person to pursue advanced graduate study, or to obtain employment in most areas requiring a detailed knowledge of a specific aspect of environmental science.

Students following either option will be required to take a core of interdisciplinary courses to provide a broad background, and to select elective courses in consultation with their advisory committee to provide in depth education in a particular area of emphasis related to environmental science. The elective courses may derive from one science discipline but they will often be interdisciplinary.

Admission Requirements
Applicants must comply with university procedures for admission to the degree program. Incomplete applications will not be considered. Persons seeking admission to the MS Program in Environmental Science should apply through the university Office of Graduate Studies and Research. In addition to the documents required by that office, applicants must submit GRE general test scores, an essay of at least 300 words describing their educational and career interests, goals and challenges, and three letters of evaluation from persons knowledgeable about their potential for success in graduate studies. Applicants may optionally submit other relevant materials, e.g. copies of published works, reports of past scientific research. All materials submitted will be considered. Applicants who already hold an earned graduate degree from a Texas Higher Education Coordinating Board recognized institution need not submit GRE scores. The applicant will be notified by letter of acceptance or rejection.

Students accepted to the degree program in environmental science are expected to enter the program with undergraduate degrees in science or substantial undergraduate or graduate science background. Students accepted to the degree program with insufficient background in science, computer science, mathematics, or communication skills will be required to take undergraduate or graduate prerequisite courses prescribed by their advisory committees. These courses may or may not apply towards the total required for the master’s degree.

Teaching assistant positions are available to graduate students admitted as degree-seeking students. The completed Teaching Assistant Application and letters of recommendation should be submitted to the address indicated on the application. The deadline for submitting applications is February 1 for the following academic year.
Science and Technology

Degree Requirements

Each student accepted to the Master of Science in Environmental Science degree program must complete a minimum of 36 semester hours under either the thesis or non-thesis options. At least 24 semester hours must be in the 5000-sequence. The remainder may be in the 4000-sequence and those courses must be designated in the catalog as courses that may be taken for graduate credit (3000-sequence courses and below are regarded as prerequisite work and will not count towards the total).

A graduate student who has met with his or her advisory committee, formulated a degree plan approved by the graduate committee, and has the plan on file is considered a degree candidate. A student must have advanced to degree candidacy by the end of the second full semester of graduate study following admission to the program. A student’s advisory committee must approve any subsequent changes to the degree plan. A change from thesis to non-thesis option or vice versa requires that the student file a new degree plan as approved by the advisory committee.

All students must successfully complete at least six semester hours per academic year to remain in the program. Students should enroll in ESCI 5101 (Environmental Research Seminar) as early as possible during their graduate course of study. All students must pass a final oral exam, to be administered by their advisory committee, during their last semester before graduation.

A. Thesis Option (36 sem. hrs.)*

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Sem. Hrs.</th>
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<tbody>
<tr>
<td>ESCI 5101</td>
<td>Environmental Research Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 5203</td>
<td>Professional Skills for Scientists</td>
<td>2</td>
</tr>
<tr>
<td>MATH 5315</td>
<td>Statistical Methods in Research I</td>
<td>3</td>
</tr>
<tr>
<td>Choose one:BLAW 5330</td>
<td>Environmental Law and Policy or ESCI 5302 Federal Environmental Laws and Regulations</td>
<td>3</td>
</tr>
<tr>
<td>or ESCI 5360</td>
<td>Coastal Management and Ocean Law</td>
<td>3</td>
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Electives in specialty area (to be chosen in consultation with a student’s advisory committee). At least 9 hours must be from BIOL, CHEM, CMSS, ESCI, GEOL, or PHYS.

ESCI 5292/5293/5294 Thesis I/II/III 6

Total 36

B. Non-Thesis Option (36 sem. hrs.)*

Non-Thesis students must write a professional paper and present a seminar based on work completed in Directed Research (ESCI 5397 - 3 hrs.). The paper and seminar will be on a topic approved by the student’s advisory committee and will demonstrate the student’s ability in organization, data collecting, scientific writing, and oral presentation.

<table>
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<td>Coastal Management and Ocean Law</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives in specialty area (to be chosen in consultation with a student’s advisory committee). At least 9 hours must be from BIOL, CHEM, CMSS, ESCI, GEOL, or PHYS.

ESCI 5397 Directed Research 3

Total 36
C. Emphasis Areas, Tracks, and Designated Electives

A student will define an emphasis area or track for his or her graduate studies with assistance from the graduate advisor and advisory committee. Marine Policy and Human Dimensions is one possible track; another is Coastal and Marine System Science. These are described in further detail below. The emphasis area is a unique word or phrase which best expresses the student’s intended focus of graduate studies within the broad field of environmental science. Suggested emphasis areas (not an exclusive list) include: bioremediation, coastal ecosystems, conservation, contaminants, ecotoxicology, environmental monitoring, environmental regulations, fisheries, and hydrogeology. Other emphasis areas are possible as approved by a student’s graduate committee. The emphasis area is stated on the degree plan. Students must demonstrate that the selection of electives produces a coherent graduate program focused around the emphasis area. Designated electives must receive the approval of a student’s advisory committee. Electives from the natural sciences, computer science, geographic information science, mathematics, political science, public administration, business law, or other areas may be approved.

C-1. Marine Policy and Human Dimensions Track. Students with an interest in studying the application of environmental science to ocean/coastal policy may choose the Marine Policy and Human Dimensions track. The track provides an understanding of the physical and biological coastal environment and its interaction with human behaviors and policies. This transdisciplinary program is designed to prepare students to work with a wide variety of marine and coastal constituencies to translate sound environmental science to public policy. Suggested electives include:

- ESCI 5340 Ocean Resources
- ESCI 5345 Living with Coastal Hazards
- ESCI 5360 Coastal Management and Ocean Law
- ESCI 5490 Advanced Topics: Biodiversity and Conservation Science
- ESCI 5490 Advanced Topics: GIS Applications in Environmental Science
- PADM 5325 Public Policy Analysis

C-2. Coastal and Marine System Science Track. This track is appropriate for students who may wish to apply selected Coastal and Marine System Science courses to a M.S. degree in Environmental Science, as approved by the student’s graduate committee.

D. Thesis and Professional Paper Format and Style

The thesis or professional paper must be prepared in a standard format and style dictated by the advisory committee. The format and style requirements will specify paper size, paper quality, margins, pagination, etc.

Upon approval by a student’s advisory committee, a copy of the thesis will be sent to the Office of the Dean of the College of Science and Technology. At the time of successful completion of the oral exam, committee members will sign the thesis and return it to the Dean of the College of Science and Technology for final approval and signature. All submitted copies of the thesis must be bound in prescribed buckram. The student must pay the fee for this service.

E. Grades of In Progress (IP) for Thesis or Directed Research

The following courses are eligible for awarding a permanent mark of In Progress (IP) if the work is not completed by the end of the semester in which a student has enrolled in the course: ESCI 5292 (Thesis I), 5293 (Thesis II), 5294 (Thesis III), and 5397 (Directed Research). University rules stipulate that the student must register for the same course in the subsequent semester, paying the appropriate tuition and fees, to receive a letter grade for the course.

For thesis students, the student’s graduate committee must sign the completed Thesis Proposal before the student is awarded a letter grade for ESCI 5292 (Thesis I). If the pro-
posal is not signed and on file in the College of Science and Technology (Dean’s Office) by the end of the semester, a permanent mark of IP will be awarded. The student will receive a permanent mark of IP for each semester of ESCI 5293 (Thesis II) until the student has presented a rough draft of the thesis. At that time the student’s graduate advisor will award a letter grade which reflects the overall quality of the thesis research and the draft. Finally, the student will receive a permanent mark of IP for each semester of ESCI 5294 (Thesis III) until the student has defended the thesis and the graduate committee has approved and signed the final thesis manuscript. At that time the student’s graduate advisor will award a letter grade which reflects the overall quality of the thesis defense and the manuscript itself. Thesis students who receive marks of IP must continuously enroll for ESCI 5292, 5293, or 5294 in order to receive letter grades for these hours. Any student receiving a mark of IP for ESCI 5292, 5293, or 5294 will have to enroll in more than six hours of ESCI 5292/5293/5294 in total, to earn the requisite hours of thesis credit with an assigned letter grade.

For non-thesis students, the student must have successfully defended the professional project, the student’s graduate committee must have accepted the professional paper, and a final copy must be on file in the College of Science and Technology (Dean’s Office) by the end of the semester before the student is awarded a letter grade for ESCI 5397 (Directed Research). The letter grade will reflect the overall quality of the professional project research and the final professional paper. Otherwise the student will receive a permanent mark of IP and must sign up again for ESCI 5397 in a subsequent semester to receive a letter grade for this work.

F. Final Oral Exam

Each student must pass a final oral exam during the last semester before graduation, to be administered by the student’s advisory committee. The oral exam will cover topics related to (1) all graduate coursework undertaken for the environmental science program, (2) a student’s emphasis area (including the thesis or directed research project), and (3) broad concepts of environmental science, including a familiarity with the literature and appropriate professional societies. The student is responsible for scheduling the exam with the faculty involved. A student who fails the final oral exam may repeat it once, but only after an interval of four months or more. If a student fails the second oral examination, he or she will be terminated from the program.

For Additional Information

Website: http://pens.tamucc.edu/pals/escl/Main/MasterOfScience
Campus Address: Carlos F. Truan Natural Resource Center
Room 1100; Phone (361) 825-2681
Mailing Address: Environmental Science Program, Unit 5850
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5850

GRADUATE COURSES

General prerequisite for 5000-level courses: graduate standing. Senior undergraduates in their last semester or summer session of undergraduate work may take 5000-level courses provided that they have a cumulative grade point average of 3.0 or better, and that written approval is obtained from the Dean of the college in which the work is offered.

Weekly lecture and laboratory hours associated with each course are designated by (lecture:lab) following the semester hours. The indicated laboratory hours are laboratory instructional time. In most cases, additional laboratory time will be required to complete assigned work.
ESCI 5101. 1 sem. hr. (1:0)  ENVIRONMENTAL RESEARCH SEMINAR  
Studies and analysis of pertinent literature. May be repeated for credit, but credit may count only once towards the degree plan. Course is taken as credit/no credit.

ESCI 5201. 2 sem. hrs. (2:0)  ADVANCED SCIENTIFIC DIVING TECHNIQUES  
Advanced study of the theory, science, and art of underwater diving technology and its application to scientific objectives. Course helps fulfill some training requirements of the Texas A&M University-Corpus Christi Guidelines for scientific diving. Prerequisite: PADI certification or permission of instructor.

ESCI 5203. 2 sem. hrs. (2:0)  PROFESSIONAL SKILLS FOR SCIENTISTS  
Presentation and discussion of professional skills of practicing scientists including literature searches, evaluation of information sources, oral and written communication skills, lifelong learning, careers and professional opportunities.

ESCI 5292. 2 sem. hrs.  THESIS I: THESIS PROPOSAL  
Review of the literature on a thesis topic. Completion of a written research proposal including proposed experimental design. Prerequisites: Open only to degree candidates in environmental science. Requires consent of the graduate advisor.

ESCI 5293. 2 sem. hrs.  THESIS II: THESIS RESEARCH  
Collection and organization of research data and presentation of a rough draft of the thesis manuscript to the thesis advisor. May be repeated; no more than two hours may be taken per semester. Prerequisites: Open only to degree candidates in environmental science. Requires consent of the graduate advisor and qualitative grade for ESCI 5292 (Thesis I).

ESCI 5294. 2 sem. hrs.  THESIS III: THESIS SUBMISSION  
Thesis defense and completion of the thesis manuscript including acceptance of the final copy by the advisory committee. May be repeated; no more than two hours may be taken per semester. Prerequisites: Open only to degree candidates in environmental science. Requires consent of the graduate advisor and qualitative grade for ESCI 5292 (Thesis I).

ESCI 5302. 3 sem. hrs. (3:0)  FEDERAL ENVIRONMENTAL LAWS AND REGULATIONS  
Advanced study of case histories involving the application of state and federal environmental laws and regulations. Review of permits, waste registrations, manifests, self-reporting and inspection reports. Prerequisite: science background or permission of instructor.

ESCI 5314. 3 sem. hrs. (3:0)  BIOGEOCHEMICAL PROCESSES  
Water and element cycling in the atmosphere, hydrosphere and geosphere. Microbial interactions and physical processes will be emphasized. Prerequisites: CHEM 1311/1312, and GEOL 1403 or ESCI 1401 or ESCI 3351, or permission of instructor.

ESCI 5320. 3 sem. hrs. (3:0)  ADVANCED ENVIRONMENTAL HEALTH  
Advanced study of the toxicology and epidemiology of pollutants in the air, water and soil. Associations of environmental exposure with adverse health effects such as cancer, cardiovascular disease and reproductive outcomes, also chemical markers and symptoms of disease. Pollutants studied include lead, asbestos, radiation, radon, noise, metals, halogenated hydrocarbons, aromatic hydrocarbons, silica, indoor air quality, formaldehyde, and outdoor air pollutants.

ESCI 5322. 3 sem. hrs. (3:0)  INDUSTRIAL HYGIENE  
Health protection practices in the industrial environment. Health basis for OSHA laws, regulations. Sampling and testing procedures.

ESCI 5330. 3 sem. hrs. (2:2)  OIL SPILL MANAGEMENT  

ESCI 5340. 3 sem. hrs. (3:0)  OCEAN RESOURCES  
Investigation of topics related to the discovery, distribution, and exploitation of marine resources of the ocean with a focus on the Gulf of Mexico, including the impact of resource exploitation on biological systems, and the development of marine policy.

ESCI 5345. 3 sem. hrs. (3:0)  LIVING WITH COASTAL HAZARDS  
Study of how coastal processes, such as hurricanes, sea-level rise, and erosion, intersect with human activities to create hazardous conditions and how society responds to these conditions, presented through discussion, case studies, and field trips.

ESCI 5355. 3 sem. hrs. (2:2)  INTRODUCTION TO AQUATIC ECOTOXICOLOGY  
Principles and applications of toxicity testing in the aquatic environment for: water and sediment quality assessment and monitoring; characterization of liquid effluents and treatment procedures; development of water quality criteria; assessment of water quality in aquaculture facilities; assessment of environmental hazard of new chemicals.

ESCI 5359. 3 sem. hrs. (3:0)  ECOSYSTEM DYNAMICS  
Investigation of the interactions between organisms and physical processes that regulate marine ecosystem functions.

ESCI 5360. 3 sem. hrs. (3:0)  COASTAL MANAGEMENT AND OCEAN LAW  
The legal and policy framework associated with the coastal zone and ocean environment. Public access to coastal lands and waters, public trust, wetlands
regulation; international law of the sea, fisheries law, and marine pollution.

ESCI 5370. 3 sem. hrs. (3:0)
HAZARDOUS WASTE TREATMENT TECHNOLOGIES
Review of the laws and regulations of hazardous waste management from an historical perspective followed by reports on current techniques for handling, reducing, and disposing of hazardous wastes in an environmentally safe manner.

ESCI 5397. 3 sem. hrs.
DIRECTED RESEARCH
Emphasis on experimental design as related to environmental science. For students selecting the non-thesis option. Only three semester hours will count towards the non-thesis degree. Requires presentation of results in a written paper and seminar.

ESCI 5408. 4 sem. hrs. (3:3)
ENVIRONMENTAL MICROBIOLOGY
Relationships between microorganisms and their biotic and abiotic environments. Current topics such as air quality (e.g., molds), water quality and bioremediation will be discussed. Laboratory will include techniques for sampling from soil, air and water. Prerequisites: BIOL 2421 or consent of instructor.

ESCI 5412. 4 sem. hrs. (3:2)
ENVIRONMENTAL MEASUREMENT AND DATA SYNTHESIS
Theory and concept of spatial and temporal analysis with description, reduction, and comparison of data sets. Intensive studies of the purpose, scope, and procedures used in quantitative environmental research with global environmental systems. Principal themes include spatial autocorrelation, spatial interpolation and trend surfaces. Statistical and GIS software packages are used with remote sensing and other applications for extracting descriptive and metric information from environmental datasets.

ESCI 5442. 4 sem. hrs. (3:2)
ACOUSTIC ECOLOGY
Intended for students working in diverse research areas in which sound conveys information that has significant effects on the systems being studied. Topics include field data collection methods, recording devices and media, spectrographic analysis of acoustic signals using digital techniques, and an introduction to statistical evaluation of acoustic data. Prerequisite or corequisite: Math 5315 or permission of instructor.

ESCI 5480. 4 sem. hrs. (3:2)
ENVIRONMENTAL ASSESSMENT
Interdisciplinary application of environmental regulations, risk assessment to specific examples. Knowledge of United States environmental regulations assumed; ESCI 4301 or ESCI 5302 recommended. Prerequisites: ESCI 5314 (Biogeochemical Processes) and ESCI 5412 (Environmental Measurement and Data Synthesis) or approval of student’s graduate advisor.

ESCI 5490. 1-4 sem. hrs. (1:0-3:2)
ADVANCED TOPICS
Subject materials variable. Advanced topics including current literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Permission of instructor.

ESCI 5596. 1-5 sem. hrs.
DIRECTED INDEPENDENT STUDY
Study in areas of current interest. (A total of six hours of Directed Independent Study may be counted toward the MS degree.)

ESCI 5940. 1-9 sem. hrs.
PROJECT RESEARCH
Research related to the MS project. Requires consent of graduate advisor. Does not count as credit toward the MS degree in Environmental Science. Course is taken as credit/no credit.
Fisheries and Mariculture*

MASTER OF SCIENCE

*name change pending THECB approval

Program Description
Fisheries and Mariculture Program students will learn the skills necessary for positions in both the public and private sectors of the fisheries and mariculture industries. The program is designed to provide students with academic range and depth in fisheries, mariculture, biology and business. The mariculture option (non-thesis) includes extensive practical hands-on training at research facilities and commercial farms for the refinement of various mariculture skills.

Student learning outcomes:
• Students will exhibit knowledge (breadth and depth) in the fields of fisheries and mariculture including an understanding of the basic skills, techniques and methods necessary for the successful management and culture of select marine species.
• Students will demonstrate the ability to conduct a thorough and complete survey of the relevant scientific literature pertaining to their approved topic of study.
• Students will submit for approval a detailed plan of their proposed study in the form of a proposal and will incorporate the scientific method into its design.
• Students will demonstrate the ability to collect, organize and interpret data and produce a thesis or professional paper from an experiment, study or project.
• Students will develop technical writing and communication skills that will benefit them in their professional careers.

Admission Requirements
Students applying to the program must meet University admission requirements prior to admission to the Fisheries and Mariculture degree program. In addition to the documents required by the Office of Graduate Studies and Research, applicants must submit GRE test scores and three letters of evaluation from persons knowledgeable about their past performance and potential for success in graduate studies. Students must possess a general knowledge of statistics, mathematics, chemistry and biology, and be computer literate. “Leveling” courses might be required to strengthen any deficiencies in the student’s undergraduate curriculum but will not count towards the degree. Please refer to the general description of graduate programs in the College of Science and Technology, especially the sections on “Admission to a Degree Program” and “Degree Program Admission Procedure.”

Degree Requirements
The M.S. in Fisheries and Mariculture degree requires 36 semester hours of coursework, distributed as follows:

Twelve semester hours of common courses:
• BIOL 5428  Fisheries (4 semester hours)
• MARI 5102  Graduate Seminar (1 semester hour)
• MARI 5370  Mariculture (3 semester hours)
• MARI 5421  Chemistry of Natural Waters (4 semester hours)

Plus an additional twenty-four semester hours in a specific emphasis area (fisheries or mariculture):

Fisheries area:
Twenty semester hours of core courses, plus at least four semester hours of committee-approved electives:
• BIOL 5392  Thesis Proposal (3 semester hours)
• BIOL 5393  Thesis Research (3 semester hours)
• BIOL 5394  Thesis Submission (3 semester hours)
• BIOL 5432  Biology of Fishes (4 semester hours)
• MARI 5436  Marine Ecological Processes (4 semester hours)
• MATH 5315  Statistical Methods (3 semester hours)
• Advanced Electives (4 semester hours)

Mariculture area:
Twelve semester hours of required speciality courses.
• MARI 5312  Mariculture Techniques (3 semester hours)
• MARI 5315  Aquatic Diseases and Parasites (3 semester hours)
• MARI 5314  Aquatic Animal Nutrition (3 semester hours)
• MARI 5322  Aquaculture Economics (3 semester hours)

Plus an additional three semester hours in a program-approved support course. Students with special career interests will be advised by Mariculture Program faculty concerning the selection of an appropriate graduate class. The following are examples of classes most commonly selected:

- MGMT 5310  Organizational Behavior and Communication
- MGMT 5350  Entrepreneurship
- ACCT 5312  Foundations of Accounting
- MKTG 5311  Marketing Concepts

Nine semester hours in one of two experience-related options based on the student’s career interests:

The Mariculture Internship Option focuses on development of the student’s managerial skills and techniques through nine semester hours of Internship (MARI 5398). A professional paper is required.

The Mariculture Research Option places greater emphasis on in-depth research in one or more areas of mariculture specialization, a prerequisite for further graduate study. This option requires six semester hours of Mariculture Research (MARI 5399) and three semester hours of graduate-level statistics (MATH 5315 or equivalent). A thesis is required.

Final Presentation and Examination
All students must successfully present a summary of their research/internship results and complete a comprehensive oral examination during their final semester. This examination will be administered by the student’s graduate advisory committee and will include topics related to: (1) all graduate coursework undertaken in the Fisheries and Mariculture Program, (2) the student’s internship or research project, and (3) broad concepts of fisheries or mariculture, including a familiarity with the literature and pertinent professional societies. Students are responsible for scheduling the presentation and oral examination with their graduate advisory committees. A student failing to successfully complete the comprehensive oral examination may repeat it once, but only after an interval of at least four months. A student failing the oral examination for the second time will be terminated from the program.

For Additional Information
Website:  http://lsci.tamucc.edu/mari
Campus address:  Science and Technology Building 319, Phone (361) 825-2754
Mailing address:  Fisheries and Mariculture Program, Unit 5800
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5800
GRADUATE COURSES

MARI 5102. 1 sem. hr.
GRADUATE RESEARCH SEMINAR
Formal presentation of the research or internship activities conducted for the MS degree. To be taken the final semester of resident graduate study. Open only to degree candidates in fisheries and mariculture.

MARI 5312. 3 sem. hrs. (2:2)
MARICULTURE TECHNIQUES
The study and hands-on application of biological, mechanical, and other concepts required to develop the skills and techniques necessary for efficient operation and management of public and private aquaculture facilities.

MARI 5314. 3 sem. hrs. (3:0)
AQUATIC ANIMAL NUTRITION
The study of current concepts in aquatic animal nutrition including nutrient sources and requirements, deficiency effects, ingestive/digestive/metabolic processes, formulation and processing of feeds, and practical feeding considerations for selected aquatic species.

MARI 5315. 3 sem. hrs. (2:2)
DISEASES AND PARASITES OF AQUATIC ORGANISMS
Identification, epizootiology and control of viral, bacterial, fungal, parasitic and nutritional diseases of commercially cultured molluscs, crustaceans and fish.

MARI 5322. 3 sem. hrs. (3:0)
AQUACULTURE ECONOMICS
The application of selected economic and business principles, concepts, and tools of aquaculture related ventures to maximize efficiency of operation and profitability. The student will examine start up requirements of a farm, financing options, operational costs, and basic accounting and record keeping procedures.

MARI 5370. 3 sem. hrs. (3:0)
MARICULTURE
Survey of physiological, behavioral, environmental and economic parameters governing the culture of selected aquatic species. Included are techniques and methods employed worldwide to produce various marine species. Prerequisite: Minimum of 8 sem. hrs. of biology.

MARI 5398. 9 sem. hrs. required
INTERNSHIP (offered in 3 hr. blocks)
An internship allowing students to participate and develop skills and techniques relating to the culture of certain marine species. Opportunities will be in the specialization areas of maturation and reproduction, hatchery and incubation, and grow-out. Students will participate in internship activities at selected aquaculture facilities.

MARI 5399. 6 sem. hrs. required
MARICULTURE RESEARCH (offered in 3 hr. blocks)
An in depth, approved topic of independent mariculture research. This course is designed for students desiring a more detailed experience in a specific mariculture area. Students will participate in research at selected aquaculture facilities.

MARI 5421. 4 sem. hrs. (3:3)
CHEMISTRY OF NATURAL WATERS
The examination of water as an environmental medium and how it may be monitored and managed for maximizing the growth and survival of various aquatic species. Prerequisite: CHEM 1311/1111 or equivalent.

MARI 5432. 4 sem. hrs. (3:2)
AQUATIC SYSTEM DESIGN
The study of aquatic system engineering and design for aquaculture farms, hatcheries, recirculating systems and research facilities. Additional topics covered include aquaculture site selection criteria and use of computer-aided design software.

MARI 5436. 4 sem. hrs. (3:2)
MARINE ECOLOGICAL PROCESSES
Advanced studies in structure and habitats of marine environments. Emphasis on factors influencing distribution of marine organisms, including field trips to areas along the Texas coast. Prerequisite: BIOL 3428 Principles of Ecology.

MARI 5590. 1-5 sem. hrs.
SELECTED TOPICS
In depth study and discussion of selected topics relevant to mariculture. May be repeated when topics vary. Offered on sufficient demand.

MARI 5596. 1-5 sem. hrs.
DIRECTED INDEPENDENT STUDY
Study in areas of mariculture interest.
Geographic Information Science

Graduate courses in geographic information science are offered in support of graduate degree programs in computer science, environmental science and education. For details concerning these particular degree programs, consult the appropriate section of the catalog.

Post-Baccalaureate Certificate in Geomatics

The Post-Baccalaureate Certificate in Geomatics is designed for students who hold a bachelor’s degree or master’s degree in fields other than Geomatics or Geographic Information Science and desire to continue their education to prepare for the Texas Board of Professional Land Surveying examination to become a Registered Professional Land Surveyor of Texas. Candidates for the certificate are required to complete 32 credit hours of surveying related courses; 20 of these credit hours must be taken at Texas A&M University-Corpus Christi. Students are required to meet all other academic standards. The Coordinator of the Geographic Information Science program or a designee may waive certain courses if a student has previously completed appropriate surveying courses. Students must apply for the certificate and complete a Certificate Plan approved by the Coordinator of the Geographic Information Science program or a designee.

32 Credit Hour Certificate in Geomatics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>GISC 1436</td>
<td>Digital Drafting and Design</td>
<td>4</td>
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<tr>
<td>GISC 2470</td>
<td>Geospatial Plane Measurement I</td>
<td>4</td>
</tr>
<tr>
<td>GISC 3325</td>
<td>Geodetic Science</td>
<td>3</td>
</tr>
<tr>
<td>GISC 3400</td>
<td>Geospatial Mathematical Techniques</td>
<td>4</td>
</tr>
<tr>
<td>GISC 3412</td>
<td>Geospatial Plane Measurement II</td>
<td>4</td>
</tr>
<tr>
<td>GISC 4250</td>
<td>Field Camp II</td>
<td>2</td>
</tr>
<tr>
<td>GISC 4371</td>
<td>History of Texas Land Ownership</td>
<td>3</td>
</tr>
<tr>
<td>GISC 4410</td>
<td>Cadastral Mapping and Records</td>
<td>4</td>
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<tr>
<td>GISC 4440</td>
<td>Geospatial Computations &amp; Adjustments</td>
<td>4</td>
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</table>

Students must earn at least a 2.0 overall grade point average in all GISC courses.

Post-Baccalaureate Certificate in GIS

The Post-Baccalaureate Certificate in GIS is designed for students who hold a bachelor’s degree or master’s degree in fields other than GIS or Geographic Information Science and desire to continue their education in Geographic Information Science. Candidates for the certificate are required to complete 32 credit hours of surveying related courses; 20 of these credit hours must be taken at Texas A&M University-Corpus Christi. Students are required to meet all other academic standards. The Coordinator of the Geographic Information Science program or a designee may waive certain courses if a student has previously completed appropriate surveying courses. Students must apply for the certificate and complete a Certificate Plan approved by the Coordinator of the Geographic Information Science program or a designee.

32 Credit Hour Certificate in Geographic Information Systems

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<td>Geospatial Systems I</td>
<td>4</td>
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<td>GISC 2438</td>
<td>Geospatial Software Systems I</td>
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<td>GISC 3400</td>
<td>Geospatial Mathematical Techniques</td>
<td>4</td>
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<td>GISC 3420</td>
<td>Geospatial Software Systems II</td>
<td>4</td>
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<tr>
<td>GISC 3421</td>
<td>Visualization for GIS</td>
<td>4</td>
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<tr>
<td>GISC 4420</td>
<td>Geospatial Systems Design</td>
<td>4</td>
</tr>
<tr>
<td>GISC 4431</td>
<td>Remote Sensing</td>
<td>4</td>
</tr>
</tbody>
</table>

Students must earn at least a 2.0 overall grade point average in all GISC courses.
For Additional Information
Website:     http://gisc.tamucc.edu/
Mailing address:  Geographic Information Science Program, Unit 5868
                   College of Science and Technology
                   Texas A&M University-Corpus Christi
                   6300 Ocean Drive, Corpus Christi, Texas 78412-5868

GRADUATE COURSES
The following graduate courses are offered to support graduate programs. GISC 5300 and GISC 5301 are the required leveling courses needed for entry into graduate courses in GIS given at present under the Computer Science MS Degree. All these GISC courses are also available as elective courses in various programs with the approval of the mentor/advisor.

GISC 5300. 3 sem. hrs. (3:0)
FOUNDATIONS OF GEOGRAPHIC INFORMATION SYSTEMS
This course will cover the basic principles and concepts of GIS. Topics will include maps as numbers, getting spatial digital data into the computer, use of GIS databases, principles and use of GIS software, and including applications to the K-12 environment. Prerequisite: Graduate standing and written permission of instructor.

GISC 5301. 3 sem. hrs.
CARTOGRAPHIC BASES OF GIS
This course will focus on the basic earth-to-map relationships and the visualization methods including applications in the K-12 GIS environment. Topics covered will include the principles of using digital cameras and GPS receivers in GIS. Prerequisite: GISC 5300 and written permission of instructor.

GISC 5302. 3 sem. hrs. (3:0)
SPATIAL ANALYSES IN GIS
This course will cover the elements of spatial analysis. Topics will include 2D and 3D analyses and Network analysis, preparation and organization of GIS projects, a review of mapping and analysis models in GIS, and pedagogic considerations in K-12 GIS curriculum development. Prerequisite: GISC 5301 and written permission of instructor.

GISC 5490. 1-4 sem. hrs.
SELECTED TOPICS
Subject material variable. May be repeated for credit when topics are different. Prerequisites: Vary depending upon topic.
Graduate courses in geology are offered in support of graduate degree programs in Environmental Science, Coastal and Marine System Science and Education. For details concerning these particular degree programs, consult the appropriate section of the catalog.

For Additional Information
Website: http://pens.tamucc.edu/geol
Campus address: Carlos F. Truan Natural Resource Center
Phone (361) 825-2681
Mailing address: Geology Program, Unit 5850
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5850

GRADUATE COURSES

General prerequisite for 5000-level courses: graduate standing. Senior undergraduates in their last semester or summer session of undergraduate work may take 5000-level courses provided they have a cumulative grade point average of 3.0 or better, and that written approval is obtained from the dean of the college in which the work is offered.

Weekly lecture and laboratory hours associated with each course area designated by (lecture:lab) following the semester hours. The indicated laboratory hours are laboratory instructional time. In most cases, additional laboratory time will be required to complete assigned work.

GEOL 5101. 1 sem. hr. (1:0)
GEOLOGY SEMINAR
An examination of concepts and theories in geology and their linkages to other disciplines such as environmental science, computer science, geographic information science, and education. Seminar themes may vary from year to year. May be repeated for credit but credit may be applied only once towards degree. Course is taken as credit/no credit.

GEOL 5308. 3 sem hrs. (3:0)
COASTAL GEOENVIRONMENTS AND CHANGE
Investigations of the origin, character, and processes of coastal geoenvironments with an emphasis on tracking historical and projecting future changes. Involves examination of the interactions of geological and biological processes and impacts of human activities on coastal depositional systems. Includes applications of remote sensing, ground studies, and GIS for mapping geoenvironments and analyzing change. Readings in current literature, day field trips, and a project.

GEOL 5311. 3 sem. hrs. (3:0)
CLASTIC BIOSTRATIGRAPHY AND SEQUENCE STRATIGRAPHY
This graduate-level course is for coastal and marine systems science and environmental science majors and professional geologists who would like a better understanding of the latest sequence stratigraphic techniques, principles, and clastic facies models available to geoscientists. The course will consist of an examination of current topics, techniques, and models in chronostratigraphy and sequence stratigraphy. There will be hands-on examination and analysis of data sets.

Prerequisites: GEOL 4411 or equivalent and GEOL 3441, or permission of the instructor (students with appropriate professional work experience).

GEOL 5322. 3 sem. hrs. (3:0)
ADVANCED GEOPHYSICAL TECHNIQUES SEMINAR
This graduate-level course is for coastal and marine systems science and environmental science majors and professional petroleum geologists who would like a better understanding of advanced geophysical techniques and principles available to geoscientists working subsurface problems. The course will consist of an examination of current topics, techniques, and software. New techniques and topics will be presented by geology staff and visiting experts working in those fields. Prerequisites: GEOL 4411 or equivalent and GEOL 4322, or permission of the instructor (students with appropriate professional work experience).

GEOL 5324. 3 sem. hrs. (1:3)
CLASTIC SHORELINE SEDIMENTOLOGY AND BENTHIC ECOLOGY
This graduate-level course is for coastal and marine systems science and environmental science majors, who would like a better understanding of the basic principles of modern shoreline depositional systems and sedimentology and the eco-systems associated with them and the preservation of these systems in the rock record. The course will examine modern depositional systems exposed along the Texas Gulf coast and their benthic invertebrate ecology. The class will consist of classroom lectures and 5-7 days of field trips, in the area between Galveston, Texas and Baffin Bay. Prerequisites: GEOL 4411 or equivalent, or permission of the instructor.
GEOL 5334. 3 sem. hrs. (3:0)
GROUND WATER MONITORING AND CONTAMINANT HYDROGEOLOGY
Principles of siting, construction, and installation of monitoring wells in both the saturated and vadose zones. The use of monitoring wells for characterization of subsurface contamination. Includes readings in current literature and research on a selected topic. Prerequisite: GEOL 4444 or equivalent. Recommended: GEOL 5418.

GEOL 5336. 3 sem. hrs. (3:0)
GROUND WATER GEOCHEMISTRY
Principles of the geochemistry of ground water including chemical thermodynamics. Characterization of the chemistry of natural and contaminated ground water. Chemical measurements, analyses, and calculations. Includes readings in current literature and research on a selected topic. Prerequisite: GEOL 4444 or equivalent. Recommended: GEOL 5418.

GEOL 5418. 4 sem. hrs. (3:2)
ADVANCED ENVIRONMENTAL GEOLOGY
Advanced study of humans’ relationship with the physical environment of the Earth’s surface. Geologic aspects of disease, waste disposal, resources, conservation, and land reclamation. Includes readings in current literature and research on an environmental issue.

GEOL 5436 4 sem. hrs. (3:2)
PRINCIPLES OF PETROLEUM GEOLOGY
Basic concepts of petroleum geology and techniques used in the exploration and production of hydrocarbon systems. Lectures will cover principles of stratigraphy, sedimentology, hydrocarbon generation, hydrocarbon-trapping mechanisms, reservoir characterization, seismic interpretation, well-log interpretation, and geologic risk analysis. Prerequisites: GEOL 4411 or permission of instructor. Recommended: GEOL 4421 and GEOL 4322.

GEOL 5437. 4 sem. hrs. (3:3)
COMPUTER APPLICATIONS AND MODELING IN HYDROGEOLOGY
Principles of analytical and numerical modeling in hydrogeology. Use of available software for aquifer test solutions, aquifer simulation modeling, and mass transport. Completion of modeling projects. Includes readings in current literature. Prerequisite: GEOL 4444 or equivalent. Recommended: GEOL 5418.

GEOL 5438. 4 sem. hrs (3:3)
MASS TRANSPORT MODELING IN HYDROGEOLOGY
Principles of numerical modeling of mass transport in groundwater systems. Use of software and computer systems for numerical simulations. Laboratory time devoted to completion of modeling projects. Includes readings in current literature. Prerequisite: GEOL 5437.

GEOL 5490. 1-4 sem. hrs. (1:0-3:2)
ADVANCED TOPICS
Subject varies. Advanced topics including current literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Permission of instructor.

GEOL 5596. 1-5 sem. hrs.
DIRECTED INDEPENDENT STUDY
Study in areas of current interest.
Geospatial Surveying Engineering

MASTER OF SCIENCE

Program Description

The Master of Science in Geospatial Surveying Engineering will provide students with knowledge and skills focusing on the research, design, development, and use of technologies in geospatial surveying engineering. The program builds upon the ABET accredited undergraduate Geographic Information Science program (GISC). The program satisfies the regional, state and national need for master’s-level graduates in geospatial systems design and surveying engineering. Due to the diversity of geospatial applications in industry, the 36 credit hour program is purposely designed to offer breadth in the course work.

The degree requires a minimum of 36 semester-credit hours. This must include 15 semester credit hours in the geospatial surveying engineering core, 9 semester credit hours in electives for Thesis option or 15 semester credit hours in electives for Graduate Creative Project option, a 3 semester credit hour graduate proposal and 9 semester credit hours for graduate thesis (resulting in a completed thesis) or 3 semester credit hours for Graduate Creative Project (resulting in a formal technical report).

Objectives of the program:

Graduates of the Master of Science in Geospatial Surveying Engineering will demonstrate the ability to:

1. Develop, manage, and analyze geospatial data using field and laboratory techniques, integrating surveying and engineering.
2. Develop the capacity for continued learning and professional application.
3. Apply geospatial surveying engineering technologies creatively in real-world setting to solve geospatial processes and effects.
4. Become nationally and internationally recognized professionals.

Program Outcomes:

Graduates of the Master of Science in Geospatial Surveying Engineering will have:

1. The ability to lead teams and apply problem-solving skills that include oral and written communication skills to effectively communicate professional geospatial information.
2. An awareness and utilization of external organizations and institutions that provide useful geospatial data sets and their relationships to traditional and contemporary societal issues.
3. A recognition of the need for continued learning and development of leadership skills through involvement in volunteer professional organizations and societies.

Admission Requirements

Students seeking admission to the graduate degree program in geospatial surveying engineering must hold a bachelor’s degree from a Texas Higher Education Coordinating Board recognized institution of higher education in the United States (or an equivalent foreign institution). Each applicant must also submit the following to the Office of Graduate Studies and Research:

1. An application and application fee.
2. Transcripts from Texas Higher Education Coordinating Board recognized institutions (international students will be required to submit relevant international transcripts).
3. At least two reference letters, one each from industry and academic institutions.
4. Official GRE scores.
Students who have not completed all general prerequisites listed below may be conditionally admitted subject to their completion of all foundation or prerequisite courses with grades of “B” or better.

Degree Requirements
The course of study leading to an MS degree in Geospatial Surveying Engineering is composed of four components:
I. General prerequisites (must be satisfied before the student can be formally and unconditionally accepted to the MS program).
II. Required Core Courses.
III. Elective Courses
IV. Graduate Thesis or Graduate Creative Project.

I. General Prerequisites
1. Geospatial Surveying Engineering
   Every student is expected to have achieved certain minimum competencies in geospatial science before being formally admitted to the MS degree program. Students who have not earned a baccalaureate degree in Geographic Information Science, Surveying, or a similar field must consult with the coordinator of the Geospatial Surveying Engineering Program to design a plan of appropriate leveling courses. If leveling is required, entrance into the degree program will be conditional until leveling courses are completed or courses designated by the program coordinator are approved and completed. Such courses (4000-sequence or lower) are regarded as foundation or leveling work and do not count as credit towards the total required for completion of the graduate degree.
2. Mathematics
   Every student must have minimum level of knowledge in mathematics equivalent to the mathematics courses in the BS in GISC and will be evaluated on an individual basis by Geospatial Surveying Engineering faculty.
3. English
   Every student is expected to have minimum competencies in English composition, especially in technical writing. In preparation for the technical reports that are required in the workplace, numerous reports are required during the course of study for the degree. In addition, the Graduate Proposal and Graduate Technical Report are part of the program. Students may satisfy the technical writing requirement by completing one of the following courses:
   - ENGL 3301  Principles of Professional & Report Writing
   - ENGL 3379  Writing in Computer-Network Environment
   - ENGL 3380  Advanced Writing in Computer-Network Environment
   Such courses (4000-sequence or lower) are regarded as foundation or leveling work and do not count as credit towards the total required for completion of the graduate degree.
4. Students may be required to take an entrance exam before being allowed to register for classes.

II. Required Core Courses –15 semester credit hours
All Geospatial Surveying Engineering students must complete 15 semester hours from the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Sem. Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSEN 5381</td>
<td>Cadastral Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>GSEN 5383</td>
<td>Designing Digital Surface Models</td>
<td>3</td>
</tr>
</tbody>
</table>
III. Elective Courses

Thesis option students must complete 9 semester hours from the course listed below and Graduate Creative Project option must complete 15 semester hours form the courses listed below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Sem. Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSEN 5382</td>
<td>Policy and Legal Aspects of Spatial Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>GSEN 5384</td>
<td>Generalization of Topographic Maps</td>
<td>3</td>
</tr>
<tr>
<td>GSEN 5386</td>
<td>Problems in Remote Sensing of the Environment</td>
<td>3</td>
</tr>
<tr>
<td>GSEN 5387</td>
<td>Geospatial Intelligence Techniques</td>
<td>3</td>
</tr>
<tr>
<td>GSEN 5388</td>
<td>Geospatial Internet Data Tracking</td>
<td>3</td>
</tr>
</tbody>
</table>

Total course hours (Thesis option): 24
Total course hours (Graduate Creative Project option): 30

IV. Graduate Thesis (GSEN 5398) a total of 9 semester credit hours or Graduate Creative Project (GSEN 5393) – a total of 3 semester credit hours.

Graduate Thesis (GSEN 5398) -9 semester credit hours and Graduate Project Research and Proposal (GSEN 5395) - 3 semester credit hours. (Total 12 hours)

The Geospatial Surveying Engineering Graduate Thesis requires 9 hours of research and a formal publishable thesis. When a student is within 15 semester hours of graduation, he/she may register for GSEN 5395 Graduate Project Research and Proposal to develop a proposal for graduate thesis.

Graduate Creative Project (GSEN 5393) -3 semester credit hours and Graduate Project Research and Proposal (GSEN 5395) - 3 semester credit hours. (Total 6 hours)

The Geospatial Surveying Engineering Graduate Creative Project requires 3 hours of research and a formal publishable technical report. When a student is within 15 semester hours of graduation, he/she may register for GSEN 5395 Graduate Project Research and Proposal to develop a proposal for graduate Creative Project. After the student has completed all other requirements for the MS degree in GSEN, he/she must schedule an oral exam over his/her graduate program of study and thesis.

V. Additional Courses

The following additional courses may be offered and substituted for any of the courses mentioned in II subject to approval by the student graduate mentor or committee chair.

- GSEN 5390 Advanced Topics
- GSEN 5396 Directed Independent Study

VI. Chronological Procedure Leading to the MS Degree

1. Completion of a degree plan

Upon admission to the MS degree program in Geospatial Surveying Engineering, and prior to enrollment in any course, the student must contact the Graduate Academic Advisor in the College of Science and Technology to have a degree plan completed. The student will then be assigned an academic advisor/mentor who is a graduate faculty member of the Geospatial Surveying Engineering program. Students must arrange to see this advisor/mentor each semester until graduation to have their semester course schedules approved.
2. **Progress toward the degree**
   Once admitted to the graduate degree program in Geospatial Surveying Engineering, a student must complete at least six semester credit hours per year toward the degree until the degree is completed. Failure to make this minimum progress will result in dismissal from the degree program with possible readmission based on the catalog in effect at the time of re-admission. A student who is actively pursuing a graduate project and has completed all other course work for the degree will be required to register for 3 credit hours continuously until the project is completed.

3. **Graduate Thesis and Graduate Creative Project procedure**
   Following a consultation with and permission of the advisor/mentor, the student may register for GSEN 5395 to develop a proposal for the graduate thesis or creative project. After the proposal is approved by the thesis chairperson, the proposal must be submitted to the full thesis or creative project committee. This three-member committee shall consist of at least two full-time Texas A&M University-Corpus Christi graduate faculty members. The committee chairperson must be a graduate faculty member in the geospatial surveying engineering program. The second committee member may be a graduate faculty member in geospatial surveying engineering, geographic information science, or computer science. The third member may be a graduate faculty member having distinguished professional status and expertise in the discipline of the proposed graduate thesis.

   After the approved graduate project proposal is placed in the student’s file, the student may register for GSEN 5398 or GSEN 5393. Once a student has registered for Graduate Thesis or Graduate Creative Project, he or she must continue to register in each consecutive semester until the thesis or creative project is completed. A student who does not complete a thesis or creative project in the semester for which he or she has registered will receive a grade of IP (In Progress). Failure to register for an incomplete thesis or creative project in the next semester will terminate the thesis or creative project and will require that the entire thesis or creative project process be repeated starting with the submission of a new thesis or creative project proposal.

4. **Final examination and technical report**
   After completion of all other requirements for the MS degree in Geospatial Surveying Engineering, the student must schedule an oral exam over his/her graduate program of study. The oral exam may include any material from the program of study and will be administered by the graduate committee. It will focus heavily on the thesis or creative project.

   The graduate thesis or creative project (see GSEN 5398 or GSEN 5393) may be completed in one semester; however, with continuous registration, a student will be allowed up to one calendar year to complete the thesis or creative project. Any extension beyond one year will require written justification on a semester-to-semester basis, to be approved by each member of the committee and the coordinator of the Geospatial Surveying Engineering program.

**For Additional Information**
- Website: [http://gisc.tamucc.edu](http://gisc.tamucc.edu)
- Campus Address: Conrad Blucher Institute; Phone: 361-825-3712
- Mailing Address: Geospatial Surveying Engineering Program, Unit 5868
  Texas A&M University-Corpus Christi
  6300 Ocean Drive
  Corpus Christi, TX 78412-5868
**GRADUATE COURSES**

**GSEN 5300.** 3 sem. hrs. (3:0)

**BASES OF GEOGRAPHIC INFORMATION SYSTEMS**
Basic principles and concepts of GIS via fundamental geographic and cartographic concepts. Understanding and use of GIS software to analyze data and produce maps. May not apply for credit toward the GSEN-MS degree.

**GSEN 5301.** 3 sem. hrs. (3:0)

**FOUNDATIONS OF GEOSPATIAL SURVEYING ENGINEERING**
An introduction to geospatial science and technology, including coordinate systems, datums, the Global Positioning System and quality assurance and accuracy assessment of geospatial data. May not apply for credit toward the GSEN-MS degree.

**GSEN 5355.** 3 sem. hrs. (3:0)

**DESIGN AND ANALYSIS OF GIS APPLICATIONS**
An advanced course that concentrates on the design and analysis of the development of GIS software. Course will utilize “Active X” map objects within JAVA, VB, Delphi or C++. Covers basic operation in GIS software design and software engineering procedures for final product distribution. Development of final product with associated data distributions files for stand alone, embedded and web enabled applications. Prerequisite: Permission of the Program Coordinator.

**GSEN 5365.** 3 sem. hrs. (3:0)

**GEOSPATIAL MULTIVARIATE TECHNIQUES**
Application of multivariate statistical procedures to research problems in GSEN, with emphasis on peculiarities of such applications. Spatial autocorrelation, areal aggregation, modifiable areal unit problem, spatial interpolation, and trend surfaces are investigated with statistical and GIS software packages. Prerequisite: Permission of the Program Coordinator.

**GSEN 5381.** 3 sem. hrs. (3:0)

**CADASTRAL INFORMATION SYSTEMS**
A review of the evolution of European cadastral systems and land records traditions and alternatives. Examination of the goals and purposes of land tenure systems with attention to social, political, legal, economic, organizational, and technical issues. Exploration of U.S. modernization efforts and the problems of developing countries. Prerequisite: Permission of the Program Coordinator.

**GSEN 5382.** 3 sem. hrs. (3:0)

**POLICY AND LEGAL ASPECTS OF SPATIAL INFORMATION SYSTEMS**
A study of the current and emerging status of computer law in electronic environments. Covers issues related to: privacy, freedom of information, confidentiality, copyright, and legal liability; the impact of statute and case law on use of digital databases and spatial databases; and research of legal options of conflicts related to spatial data. Prerequisite: Permission of the Program Coordinator.

**GSEN 5383.** 3 sem. hrs. (3:0)

**DESIGNING DIGITAL SURFACE MODELS**
This course will provide an in-depth examination of digital surface models (DSMs) with an emphasis on digital terrain models (DTMs). The theory of DSMs will include data acquisition, type of surface or terrain, point distribution and density, interpolation procedures, data output, and applications of DSMs. Topics covered will include digital elevation models (DEMs), vertical datums, accuracy standards, enabling technologies, quality assessment and user requirements with an introduction to terrain analysis. Prerequisite: Permission of the Program Coordinator.

**GSEN 5384.** 3 sem hrs. (3:0)

**GENERALIZATION OF TOPOGRAPHIC MAPS**
This course will cover principles of advanced cartographic generalization including cartometric evaluation and spatial and attribute transformations. Topics include an overview of vector based and raster based generalization and the mathematical foundations of topographic map design and generalization. Prerequisite: Permission of the Program Coordinator.

**GSEN 5385.** 3 sem. hrs. (3:0)

**ANALYTICAL AND DIGITAL PHOTOGRAMMETRIC ENGINEERING**
A study of the mathematical and geometric models of modern photogrammetry. Covers principles of stereoscopic vision, collinearity, coplanarity, epipolar geometry, ground control densification and extension by analytical aerotriangulation. Explores automation in photogrammetric procedures - digital aerotriangulation, automated data capture. Prerequisite: Permission of the Program Coordinator.

**GSEN 5386.** 3 sem hrs. (3:0)

**PROBLEMS IN REMOTE SENSING OF THE ENVIRONMENT**
Advanced problems in photo interpretation, photogrammetry and remote sensing within a GIS. Topics include utilization of expert computer systems, knowledge based environmental modeling, macro languages and spatial modeling languages. Operations and laboratories will cover mathematical operations on raster layers, convolution filtering, neighborhood analysis, principal components, proximity, contiguity and descriptor table manipulation. Final project includes the development of a remote sensing of the environment software program with a graphical user interface. Prerequisite: Permission of the Program Coordinator.

**GSEN 5387.** 3 sem hrs. (3:0)

**GEOSPATIAL INTELLIGENCE TECHNIQUES**
Research into geospatial intelligence tools used to assist the NGA in addressing the Intelligence Community’s needs. Topics will include change detection and motion determination for terrestrial and aerial images, intelligent image classification and categorization, and other advanced topics. Study of the sensors systems utilized in the GEOINT with multi-deployment and real-time reporting will be examined. Prerequisite: Permission of the Program Coordinator.
GSEN 5388. 3 sem hrs. (3:0)
GEOSPATIAL INTERNET DATA TRACKING
Projects will be developed that work on investigation of GEOINT being shared, scoped, or provided through the internet. Data acquisition via “Honey Pots”, IP HiJacks, Spoofs, and other method will be investigated. A method to take future GPS positioned terrestrial images into GEOINT areas on the web will be investigated. Prerequisite: Permission of the Program Coordinator.

GSEN 5390. 3 sem. hrs. (3:0)
ADVANCED TOPICS
Variable content study of specific areas of geospatial surveying engineering. May be repeated for credit when topics vary. Offered on sufficient demand. Prerequisite: Permission of the Program Coordinator.

GSEN 5393. 3 sem. hrs. (3:0)
GRADUATE CREATIVE PROJECT
An applied research group project in geospatial surveying engineering from problem definition to implementation in an area provided by faculty in the course of study. Prerequisites: GSEN 5395 and formal approval of graduate project proposal. Offered on a satisfactory/unsatisfactory (S/U) basis only, with grade of IP until completed. Credit will not be recorded until technical report is accepted by the Graduate Project Committee. May be repeated for credit. Prerequisite: Permission of the Program Coordinator.

GSEN 5395. 3 sem. hrs. (3:0)
GRADUATE PROJECT RESEARCH AND PROPOSAL
Preparatory and developmental research for the graduate thesis or creative project resulting in the preliminary design and formal proposal of the graduate project. This thesis or a creative project proposal must be reviewed and approved by the project chairperson to receive credit. Offered on a credit/no-credit basis only. Students are required to complete a major field assessment test. Credit will not be recorded until the Graduate Project Proposal is approved by the Graduate Project Committee Chair. Prerequisite: Permission of the Program Coordinator.

GSEN 5396. 3 sem. hrs. (3:0)
DIRECTED INDEPENDENT STUDY
Study in areas of current interest. Prerequisite: Permission of the Program Coordinator. (A maximum of six hours may be counted toward the MS degree.)

GSEN 5998. 3-9 sem. hrs.
GRADUATE THESIS
An applied research project in geospatial surveying engineering from problem definition to implementation in an area of particular interest to the student that relates to the course of study. Prerequisites: GSEN 5395 and formal approval of graduate thesis proposal. Offered on a satisfactory/unsatisfactory (S/U) basis only, with grade of IP until completed. Credit will not be recorded until thesis is accepted by the Graduate Project Committee. May be repeated for credit. Prerequisite: Permission of the Program Coordinator. (See graduate thesis procedure under “Chronological Procedure Leading to the MS degree.”)
Marine Biology
MASTER OF SCIENCE AND DOCTOR OF PHILOSOPHY

Program Description
The Marine Biology Program is designed for students with an interest in one or more of the subdisciplines of marine biology and who wish to pursue careers in higher education, government, or private industry. This unique, interdisciplinary degree program (IDP) combines the strengths of various departments at three universities within the Texas A&M University System: Life Sciences at Texas A&M-Corpus Christi (TAMU-CC), Marine Biology and Marine Sciences at Texas A&M University at Galveston (TAMU-G), and Wildlife and Fisheries Sciences, Oceanography and Biology at Texas A&M University (TAMU). Students can choose courses from any campus and form committees with any of the participating faculty. Advantages of the interdisciplinary degree format for Marine Biology students include a diverse, internationally recognized faculty with high scholarly productivity and extramural funding, as well as two campuses strategically located on the Gulf of Mexico.

The Marine Biology program offers the Master of Science and the Doctor of Philosophy degrees in Marine Biology. A personalized graduate advisory committee guides each student through the conception, design, construction, and execution of a marine biology-based inquiry.

Student Learning Outcomes
As part of their progression through the Marine Biology Program, Doctor of Philosophy students will:
• Possess a broad understanding of marine biology
• Acquire skills necessary for marine biological science studies
• Perform original and hypothesis-driven scholarly research grounded in marine biological concepts
• Develop the skills necessary to present and publish their work at national and international venues
• Develop a skill set and research record such that they can secure employment in universities, federal agencies, private companies or non-governmental organizations where they can apply the skills and knowledge acquired during the program

As part of their progression through the Marine Biology Program, Master of Science students will:
• Possess a broad understanding of marine biology
• Possess enhanced knowledge of a specific marine biological field including relevant scientific literature related to their thesis or professional paper
• Understand the scientific method and be able to design and conduct experiments.
• Be able to accurately describe (orally and in writing) marine biological research
• Develop a skill set such that they can secure employment in federal agencies, private companies, or non-governmental organizations where they can apply the skills and knowledge acquired during the program

Admission Requirements
Persons seeking admission to the Marine Biology Program should apply through the university Office of Graduate Studies and Research. In addition to the documents required by that office, applicants must submit an essay of no more than 1,000 words describing their educational and career goals, and interests as they relate to the faculty in the Marine Biology Program; a list of names of faculty members contacted; three letters of evaluation from people familiar with their potential for graduate studies; transcripts of all previous undergraduate/graduate work; and Graduate Record Examination (GRE) scores that are not more than 5 years old. Additional requirements exist for international students, including TOEFL scores.
from ETS taken within the last two years for students from countries where English is not the
native language, and a course by course foreign transcript evaluation through an approved
service (refer to the Admission section of this catalog). All relevant supplemental materials
(such as publications or resumes that include information about relevant experiences) that
are submitted with the application will be considered. Send application documents to the
Office of Graduate Studies and Research. A campus visit including personal interviews with
prospective faculty mentors is highly recommended.

Completed applications must be received by the Office of Graduate Studies and Research
by the specified priority deadlines:

- Fall Semester - February 1
- Spring Semester - June 1

Incomplete applications are not considered. The applicant will be notified of acceptance
or rejection by letter.

Teaching assistantships, graduate research assistantships, and fellowships may be
available to admitted degree-seeking students who maintain full-time graduate student
status (9 hours/fall and spring semester, and 3 hours/summer). The completed Teaching
Assistant Application (forms available at http://www.sci.tamucc.edu/stweb/ta/index.html)
and all other materials requested for evaluation should be submitted to the office indicated
on that form. For full consideration, the deadline for submitting applications is February 1
for the following academic year. A limited number of fellowships are available, and faculty
members conducting funded research projects often hire qualified graduate students as
Research Assistants. Students will need to contact faculty members in their field of interest
for information on these opportunities.

Non-degree students may enroll in courses for which they have adequate academic
preparation, but they may not apply more than nine credit hours of work taken in non-degree
status to a graduate degree program. Non-degree students must consult with the Marine Bi-
ology Program Coordinator to determine those courses in which they may enroll and those
courses they may later apply to a Marine Biology degree, should they be admitted into the
program. Students must earn a grade of “B” or better in each of the prescribed courses in
order to have the courses apply to the plan of study.

Academic Preparation

Students entering the Marine Biology Program are expected to have a strong background
in biological and physical sciences, with competencies equivalent to those required of Texas
A&M University-Corpus Christi undergraduate biology majors (see the biology section of
the undergraduate catalog). Therefore, a student who lacks adequate academic preparation
in a particular subject area, but who is otherwise well-qualified to enter the graduate pro-
gram, may be required to complete appropriate undergraduate course work in addition to
that specified for the graduate degree. Such courses (4000-sequence or lower) are regarded
as foundation or leveling work and do not count as credit towards the total required for
completion of the graduate degree.

Advising and the Graduate Advisory Committee

After admission to the graduate program, the Marine Biology Program Coordinator
will advise the student in all matters relating to degree requirements and procedures until a
formal Graduate Advisory Committee (GAC) is formed. By the end of the first semester of
graduate study, a student will select a GAC whose members should represent the student’s
field of study. The GAC including the advisor(s)/Chair(s) consists of no fewer than three
members for M.S. students and no fewer than four members for Ph.D. students. The Chair
(or one Co-Chair) of the GAC must be a member of the Marine Biology graduate faculty.
Recognized scholars who are not members of the Marine Biology Participating Graduate
Faculty may serve as Adjunct Members following nomination and approval by Marine
Biology faculty and the Office of Graduate Studies and Research. Additional committee
members may also be added as “Special Appointments” by submitting a letter of request
from the advisor, through the TAMU-CC Marine Biology Program Coordinator. The GAC will advise the student in all matters pertaining to graduate requirements and procedures, and (together with the student) will develop a personalized Degree Plan (including foundation or leveling work). After the student’s GAC approves the degree plan, it will be submitted to Marine Biology Program Coordinator who will forward it to the Chair of the Department of Life Sciences and the Dean of the College of Science and Technology for approval.

**Enrollment Requirements**

All students are required to maintain continuous registration until completion of all requirements for graduation unless a specific leave of absence is granted (in writing) by the department. Students funded through scholarships, fellowships and assistantships are required to maintain a minimum number of credit hours per semester. These requirements are detailed in the Graduate Catalog, but students holding assistantship/fellowships must be enrolled as a full-time student (9 hours/fall and spring semester, and 3 hours/summer). To continue to maintain the proper number of hours after completing all formal coursework on the degree plan, a student may register for MARB 5940/6940 Project Research.

**Coursework and Research**

Courses and research for the graduate degrees can be taken from TAMU-CC, TAMU, or TAMU-G with the approval of the student’s GAC. Students must demonstrate to the GAC that the selection of classes or research projects produces a coherent course of study focused on the student’s particular area of emphasis. Depending on the emphasis area, elective and specialized coursework selections may be chosen from biology, biomedical sciences, chemistry, coastal and marine system science, computer science, environmental science, geographic information science, geology, mariculture, mathematics, or other course offerings as stipulated and approved by the GAC.

A. **Elective, Specialized, and Topical Coursework**

The program specifies the minimum number of semester credit hours (SCH) that must be earned from regular, graded (non-research, non-variable credit) coursework: for students in the M.S. non-thesis option, 33 SCH; for students in the M.S. thesis option, 24 SCH; for Ph.D. students with only a bachelor’s degree, 41 SCH; and for Ph.D. students with an appropriate master’s degree, 19 SCH. Topical coursework is offered under the heading of MARB 5590/6590, Special Topics. Classes or research projects designated as part of the specialized coursework requirement must receive the approval of a student’s GAC.

B. **Research Coursework**

Three courses form the required research component of the degree for M.S. (thesis) and Ph.D. students: MARB 5292/6392 Thesis/Dissertation Proposal, MARB 5293/6393 Thesis/Dissertation Research, and MARB 5294/6394 Thesis/Dissertation Submission. For non-thesis M.S. students, the required research course is MARB 5397 (Directed Research). Once Ph.D. students have passed their qualifying exam and become degree candidates, they should take MARB 6940, and this course is graded credit/non-credit and may be repeated. Student must enroll in MARB 5294/6394 Thesis/Dissertation Submission during their last semester when thesis/dissertation will be completed.

**Doctoral Candidacy and the Comprehensive/Qualifying Examinations**

To be admitted to candidacy for the Marine Biology Ph.D. degree, a student must have a cumulative GPA and a degree plan GPA of at least 3.0, satisfy the residence requirement (completion of 9 credit hours in two consecutive long semesters) and pass formal Comprehensive/Qualifying Examinations (often referred to as “preliminary examinations”). The doctoral qualifying examination covers all areas within the scope of the student’s doctoral program, and usually involves written examinations from each GAC member, followed by an oral examination administered by the GAC as a whole. A student’s Comprehensive/Qualifying Examinations may be scheduled when he or she has completed all required leveling courses.
and is within approximately 6 hours of completing formal degree plan coursework (i.e., except Dissertation Project Research MARB 6940) but must be scheduled before the end of the semester following completion of regular coursework on the degree plan. A doctoral student must pass the comprehensive examination and be admitted to degree candidacy at least 1 year before the date of the final dissertation defense/oral examination. The Office of Graduate Studies and Research will not authorize a final dissertation defense/oral examination for any doctoral student who has not been admitted to candidacy.

**Format and Style of Professional Papers, Theses and Dissertations**

The non-thesis professional paper and thesis must follow format requirements established in the Marine Biology Graduate Handbook and must be approved and signed by the members of the student’s GAC, the Chair of the Department of Life Sciences and the Deans of the College of Science and Technology and Office of Graduate Studies and Research. The dissertation must be prepared in a standard format and style dictated by the GAC. Guidance can be found in the Marine Biology Student Handbook. For more information, consult the Office of Graduate Studies and Research.

Once the thesis/dissertation is completed and approved by the GAC, the results of the research must be presented orally and publicly. The final defense/oral examination usually takes place immediately following the seminar. Graduate students are expected to present their research at a scientific meeting (other than their graduate seminar) prior to graduation.

Upon approval by a student’s GAC, a copy of the thesis/dissertation will be sent to the Dean of Graduate Studies. At the time of successful completion of the thesis/dissertation exam, committee members will sign the thesis/dissertation and return it to the Dean of Graduate Studies for final approval and signature. See also “Requirements for Doctoral Programs” in the general section of this catalog.

**Final Defense**

Each student must pass a final defense examination during the last semester before graduation. The student’s GAC administers this examination which covers topics related to (1) all graduate coursework undertaken for the Marine Biology program, (2) the student’s specific research area, and (3) broad concepts of general and marine biology including familiarity with the literature and appropriate professional societies. The student is responsible for scheduling the defense with the faculty involved. A student who fails the defense may repeat it once, but only after an interval of four months or more. If a student fails the second defense, he or she will be terminated from the program. Both M.S. options require a final examination: students pursuing the thesis option may schedule the final examination after completion of all course work and after at least the first draft of the thesis has been submitted to their GAC for review; non-thesis students may schedule the final examination after completion of all course work. Doctoral students must enroll in the course Dissertation Submission (MARB 6394) during the semester in which they are planning to defend their dissertation and/or graduate.

**Specific Degrees and Their Requirements**

**A. The Master of Science in Marine Biology**

The M.S. in Marine Biology is designed for graduate students who wish to become knowledgeable leaders and professionals with an in-depth education and specialized skills in the field. Students will develop a sense of creative independence that will allow them to practice in and contribute to a variety of professions and fields of scholarship. A student may request approval for transfer of a maximum of nine semester credit hours of graduate courses from other colleges to a M.S. in Marine Biology degree plan. For M.S. students, the program offers thesis and a non-thesis degree options (see below). Thesis students may change between the Thesis and Non-Thesis option at any time with the approval of the GAC. Specific option/degree requirements must be met. The following courses are required for all M.S. students:
1. **Non-Thesis Option**

   The non-thesis Master’s Degree is designed to provide a broad understanding of marine biology. The curriculum will especially benefit those individuals in professional employment who seek advancement or additional training to enhance their knowledge and skills. The student is required to write a professional paper based on work done in Directed Research (MARB 5397). The paper will be on a topic approved by the student’s GAC and will demonstrate the student’s ability in organization, data collection, and scientific writing. To graduate under the non-thesis degree plan, a student must complete a minimum of 36 graduate semester credit hours. The student will complete:

   **Sem. Hrs.**
   - MARB 5102  Graduate Research Seminar (1cr/yr; 2 towards degree) 2
   - MATH 5315  Statistical Methods of Research 3
   - MARB 5397  Directed Research 3
   - Elective, specialized, and topical coursework (see above) 28
   - **Total** 36

2. **Thesis Option**

   The thesis Master’s Degree requires a thesis based upon original research conducted during the period that the student is enrolled at Texas A&M University-Corpus Christi. The research must include a review of relevant literature, a description of the results from original research on a topic approved by the GAC, statistical analysis when appropriate, and an appropriate discussion of the results. To graduate under the thesis degree plan, a student must complete a minimum of 32 graduate semester credit hours. The student will complete:

   **Sem. Hrs.**
   - MARB 5102  Graduate Research Seminar (1cr/yr; 2 towards degree) 2
   - MARB 5292  Thesis Proposal 2
   - MARB 5293  Thesis Research 2
   - MARB 5294  Thesis Submission 2
   - MATH 5315  Statistical Methods of Research 3
   - Elective, specialized, and topical coursework (see above) 19
   - Elective(s) or MARB 5940 Thesis Project Research 2
   - **Total** 32

B. **The Doctor of Philosophy in Marine Biology**

   Students who earn a Ph.D. in Marine Biology typically find employment in teaching or research positions at universities, or in pure research applications at specialized institutions or governmental agencies. Students accepted to the Marine Biology Ph.D. program with an M.S. degree in an appropriate discipline are required to take fewer semester hours of credit than students accepted with only a bachelor’s degree.

1. **Ph.D. Students Admitted with Only a Bachelor’s Degree**

   Students accepted to the Marine Biology Ph.D. Program with only a bachelor’s degree (i.e., without an M.S. degree in an appropriate discipline) must complete a minimum of 96 semester hours of coursework and research.

   **Sem. Hrs.**
   - MARB 6102  Marine Biology Seminar (1cr/yr; 2 towards degree) 2
   - MARB 6436  Marine Ecological Processes 4
   - MARB 6392  Ph.D. Dissertation Proposal 3
   - MARB 6393  Ph.D. Dissertation Research 3
   - MARB 6394  Ph.D. Dissertation Submission 3

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Select at least one of the following:  
CMSS 6303  Systems Analysis  
CMSS 6323  Experimental Design  

Elective, specialized, and topical coursework (see above)  32  
MARB 6940  Project Research  46  

Total  96

2. Ph.D. Students Admitted with a Master’s Degree

Students accepted to the Marine Biology Ph.D. Program with an M.S. degree in an appropriate discipline must complete a minimum of 64 hours of coursework and research.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Sem. Hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARB 6102</td>
<td>Marine Biology Seminar (1cr/yr; 2 towards degree)</td>
<td>2</td>
</tr>
<tr>
<td>MARB 6436</td>
<td>Marine Ecological Processes</td>
<td>4</td>
</tr>
<tr>
<td>MARB 6392</td>
<td>Ph.D. Dissertation Proposal</td>
<td>3</td>
</tr>
<tr>
<td>MARB 6393</td>
<td>Ph.D. Dissertation Research</td>
<td>3</td>
</tr>
<tr>
<td>MARB 6394</td>
<td>Ph.D. Dissertation Submission</td>
<td>3</td>
</tr>
</tbody>
</table>

Select at least one of the following:  
CMSS 6303  Systems Analysis  
CMSS 6323  Experimental Design  

Elective, specialized, and topical coursework (see above)  10  
MARB 6940  Project Research  36  

Total  96

For Additional Information

Website:  http://marinebiology.tamucc.edu  
Campus address:  Science and Technology Building, Room 319;  
Phone (361) 825-2754  
Mailing address:  Marine Biology Program, Unit 5800  
College of Science and Technology  
Texas A&M University-Corpus Christi  
6300 Ocean Drive, Corpus Christi, Texas 78412-5800

GRADUATE COURSES

Graduate standing is required for enrollment in 5000 and 6000-level courses. Exceptions can be made for outstanding undergraduate students with the Dean’s consent. For details, see “Graduate Study by Undergraduates” in the catalog section titled “Academic and Degree Requirements.” Weekly lecture and laboratory hours associated with each course are designated by (lecture:lab) following the semester hours when appropriate. The laboratory hours shown are instructional time. In most cases, additional laboratory time will be required to complete assigned work. Prerequisites for entry into a course are indicated, but may be waived with permission of the instructor.

Graduate Credit from other Disciplines and other Campuses

Graduate students in the M.S./Ph.D. Marine Biology program may take courses from other disciplines such as BIMS, BIOL, CHEM, ESCI, GISC, MARI, MATH and CMSS with approval from the student’s graduate committee or from the Marine Biology Program Coordinator if the committee has not yet been formed. Graduate students may also take courses from the Marine Biology and Marine Sciences Department at Texas A&M University at Galveston and Wildlife and Fisheries Sciences, and Oceanography and Biology Departments at Texas A&M University.
MARB 5102. 1 sem. hr. (1:0)
GRADUATE RESEARCH SEMINAR
Advanced topic study and presentation by students, faculty, or visiting scientists. Meets one hour weekly. Must be taken once per year by all M.S. students.

MARB 5292. 2 sem. hrs.
THESIS PROPOSAL
Thesis students must submit a completed proposal for their thesis project. A course section will be created for the student to enroll. Upon successful completion and submission of the proposal signed by the graduate committee of the student, students may then register for MARB 5293 Thesis Research. Open only to M.S. Degree Candidates in Marine Biology.

MARB 5293. 2 sem. hrs.
THESIS RESEARCH
Implementation of the Thesis Proposal, and the production of a rough draft of the thesis submitted to the graduate committee of the student for initial editing and comment. A course section will be created for the student to enroll. Prerequisite: MARB 5292 Thesis Proposal.

MARB 5294. 2 sem. hrs.
THESIS SUBMISSION
Completion of the final draft of the thesis, signed by the graduate committee of the student and ready for binding and distribution. A course section will be created for the student to enroll. Prerequisite: MARB 5293 Thesis Research. May be taken concurrently with MARB 5293 Thesis Research. Open only to M.S. students selecting the non-thesis option. Students may register for up to 9 semester hours, but only 3 semester hours will count towards a non-thesis degree.

MARB 5295. 1-5 sem. hrs. (1:0 3:4)
SPECIAL TOPICS
An advanced study of a marine biological topic. May be repeated with full credit in another area of marine biology.

MARB 5310. 3 sem. hrs. (3:0)
CORAL REEF SYSTEMS
Coral reef ecology encompasses physiological ecology, population biology, and community structure and ecosystem dynamics. The course ends with consideration of human impacts and economic importance of reef habitats to coastal communities. This course is designed as an intensive program that integrates lectures, reading, and in-class exercises and attempts to focus on reefs of local concern (i.e. the Flower Garden Banks National Marine Sanctuary). Prerequisites: BIOL 3413 Invertebrate Zoology, and BIOL 3428 Principles of Ecology or permission of instructor.

MARB 5311. 3 sem. hrs. (3:0)
APPLIED CORAL REEF ECOLOGY
Applied coral reef ecology focuses on “hands-on” approaches to studying coral biodiversity, coral disease, reef bleaching, fisheries ecology, invertebrate biology, and tropical biology. Students will snorkel and SCUBA dive on the reefs and learn about form and function of corals and their associated organisms. This course requires a 2-3 week field expedition of a Mexican coral reef and successful completion of an on-site research project. Prerequisite: MARB 6301 and permission of the instructor.

MARB 5314. 3 sem. hrs. (3:0)
AQUATIC ANIMAL NUTRITION
The study of current concepts in aquatic animal nutrition including nutrient sources and requirements, deficiency effects, ingestive/digestive/metabolic processes, formulation and processing of feeds, and practical feeding considerations for selected aquatic species.

MARB 5333. 3 sem. hrs. (3:0)
MARINE BENTHIC ECOLOGY
The ecology of benthic assemblages with emphasis on species and habitats below diver depths. Micro to mesoscale spatial patterns, including bathymetric distribution, abundance and size-structure, diversity gradients, energetics and feeding strategies, and zhood of the benthos will be covered. Hydrothermal vents, cold seeps and sea mount fauna will receive special attention.

MARB 5335. 3 sem. hrs. (3:0)
AQUATIC MICROBIOLOGY
Types and distribution of microorganisms in aquatic environments. Interactions with other organisms. Role in nutrient cycling, degradation of organic substances, pollution, water purification. Prerequisite: An undergraduate course in microbiology.

MARB 6102. 1 sem. hr. (1:0)
GRADUATE RESEARCH SEMINAR
Advanced topic study and presentation by students, faculty, or visiting scientists. Meets one hour weekly. Must be taken once per year by all Ph.D. students.
Science and Technology

with focus on the marine realm. Methods for assessing and quantifying diversity will be included. Threats to biodiversity, including resource extraction, invasive species, habitat alteration, global warming and ocean acidification, will be covered, as will techniques for recovering and restoring damaged ecosystems. Marine ecosystem management will be discussed, including marine protected areas, and state, federal and international fisheries and resource management issues. Advanced courses in Ecology or Marine Biology would benefit students.

MARB 6392. 3 sem. hrs. 
DISSERTATION PROPOSAL
Ph.D. students must submit a completed proposal for their dissertation project. A course section will be created for the student to enroll. Upon successful completion and submission of the proposal signed by the graduate committee of the student, students may then register for MARB 6394 Dissertation Research.

MARB 6393. 3 sem. hrs. 
DISSERTATION RESEARCH
Implementation of the Dissertation Proposal, and the production of a rough draft of the dissertation submitted to the graduate committee of the student for initial editing and comment. A course section will be created for the student to enroll. Prerequisite: MARB 6392 Dissertation Proposal.

MARB 6394. 3 sem. hrs. 
DISSERTATION SUBMISSION
Completion of the final draft of the dissertation, signed by the graduate committee of the student and ready for binding and distribution. A course section will be created for the student to enroll. Prerequisite: MARB 6394 Dissertation Research. May be taken concurrently with MARB 6394 Dissertation Research.

MARB 6427. 4 sem. hrs. (3:3)
COASTAL ECOLOGY OF TEXAS
This graduate course covers a comprehensive approach on the ecology of the Texas coast. Lectures will include geography, geology, and ecology of the Texas coast, with emphasis on coastal communities

MARB 6428. 4 sem. hrs. (3:3)
FISHERIES ECOLOGY
Advanced study of theory and techniques in fisheries science including behavior of fisheries populations and applications to resource management with emphasis in tidal-influenced waters. Includes readings in the current literature and a research project. The laboratory will emphasize practical sampling design and data interpretation.

MARB 6430. 4 sem. hrs. (3:3)
MARINE PLANKTON
Investigation of the systematics, distribution and ecology of marine plankton.

MARB 6431. 4 sem. hrs. (3:3)
PHYCOLOGY
Study of the major groups of freshwater and marine algae; morphology, ecology, systematics, life cycles and physiology. Laboratories emphasize collection, identification and culturing techniques.

MARB 6436. 4 sem. hrs. (3:3)
MARINE ECOLOGY
Advanced studies in structure and habitats of marine environments. Emphasis on factors influencing distribution of marine organisms, including field trips to areas along the Texas coast. Prerequisite: BIOL 3428 Principles of Ecology or equivalent.

MARB 6590. 1-5 sem. hrs. (1:0 3:4)
SPECIAL TOPICS
An advanced study of a biological topic. May be repeated with full credit in another area of marine biology.

MARB 6596. 1-5 sem. hrs.
DIRECTED INDEPENDENT STUDY
Study in areas of current interest. A total of six semester hours of Directed Independent Study may be counted towards the Ph.D. degree.

MARB 6940. 1-9 sem. hrs.
DISSERTATION PROJECT RESEARCH
Research related to the dissertation project. Open only to doctoral students in marine biology with consent of the graduate advisor. Does not count as credit toward regular graded (non-research, non-variable credit) coursework for Ph.D. degree requirement in marine biology. Course is taken as credit/non-credit.
Mathematics
MASTER OF SCIENCE
Program Description

Program Mission
The mission of the Graduate Mathematics program is to increase understanding and the ability to apply mathematics through in-depth study, novel applications, and research. The areas of emphasis are mathematics education and applications of mathematics and statistics. The faculty engages in research and scholarly activities at the forefront of their specialties, with established and developing connections with the mathematics and education communities at large, and leads students through program research activities and projects or theses. The program prepares students for careers in education, science, and industry and serves the community by providing expertise to local schools, coastal industry, and research centers.

Program Tracks
Students pursuing the Master of Science degree with a major in Mathematics will choose between an Applied and Computational Mathematics and a Curriculum Content option. The Applied and Computational Mathematics option will especially benefit individuals employed in scientific, technical, or education fields who seek advancement or additional training to enhance their knowledge and skills. The Curriculum Content option specifically addresses the needs of in-service teachers wishing to enhance their knowledge and skills in learning, teaching and understanding mathematics. In each option, a capstone course allows students to focus their coursework on broad applications. The Applied and Computational Mathematics option requires a thesis; the Curriculum Content option allows for a thesis or project. The thesis option starts with a broad foundation, and then encourages a specialized study culminating in a thesis based upon original research, supported by the mathematical literature. The thesis requirement for the master’s degree will allow a person to pursue advanced graduate study, or to obtain employment in most areas that require a detailed knowledge of a specific aspect of mathematics. The project allows a student to demonstrate particular ability with some part of the Curriculum Content. The project will be an original work supported by a mathematical literature review.

Student Learning Outcomes
Upon completion of their MS degree, Mathematics majors will be able to:

• Demonstrate a command of principles of general mathematics at the graduate level.
• Recognize mathematics outside the realm of the classroom, and apply graduate level mathematical content as a matter of professional practice.
• Communicate mathematics effectively at the graduate level, in oral and written form, with appropriate use of technology.

Admission Requirements
1. In addition to meeting all University requirements for admission to graduate study in degree-seeking status, applicants for the MS degree in mathematics should also submit the following to the University’s Office of Graduate Studies:
   • Two letters of recommendation specifically addressing the applicant’s potential for graduate work in the chosen option.
   • A personal essay, of 300-500 words in length, discussing the applicant’s educational and professional goals, pertinent work and undergraduate experience, and other factors relating to the chosen option for graduate study. If the applicant has a GPA below 3.0 in undergraduate mathematics courses, the essay should specifically address any factors that might have hampered the applicant’s undergraduate study.
2. Applicants are expected to enter the program with adequate academic preparation for their chosen option, as detailed in #3 below. If the graduate committee determines that an applicant’s preparation is deficient, the individual will be required to complete course work to remedy these deficiencies. Such course work will be regarded as leveling work, and will not count as credit towards the total required for completion of the MS degree in mathematics.

   a. Applicants for the Applied and Computational Mathematics option should have the equivalent of an undergraduate mathematics major, or an undergraduate mathematics minor and a minor in science. Specific leveling course work is MATH 3315, Differential Equations; MATH 3311, Linear Algebra; MATH 3470, Calculus III and MATH 4342, Introduction to Mathematical Statistics. Students with no computer programming experience may find themselves at a disadvantage in certain courses without an introductory programming course.

   b. Applicants for the Curriculum Content option should have teaching certification, teaching experience, or both. Applicants seeking initial certification should consult the SMTE Coordinator or College of Education to make plans for certification as leveling work. Specific leveling course work within Mathematics is MATH 2305, Discrete Mathematics, MATH 2413, Calculus I and MATH 3311, Linear Algebra.

**Degree Requirements**

The course of study for the MS program in mathematics consists of the components listed below. Graduation requirements are slightly different for the Applied and Computational Mathematics and Curriculum Content options.

**Applied and Computational Mathematics Option**

<table>
<thead>
<tr>
<th>Sem. Hrs.</th>
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</thead>
<tbody>
<tr>
<td>36</td>
</tr>
</tbody>
</table>

| 1. Core courses | 21 |
|-----------------|
| MATH 5333 Numerical Linear Algebra 3 |
| MATH 5336 Advanced Differential Equations 3 |
| MATH 5339 Numerical Analysis 3 |
| MATH 5342 Linear Statistical Models 3 |
| MATH 5348 Optimization 3 |
| MATH 5351 Real Analysis 3 |
| MATH 5378 Mathematical Modeling 3 |

2. Elective courses may be chosen from the following list of MATH courses. Prior approval from the student’s Committee Chair(s) or Department Chair is required for MATH 5390 and MATH 5396.

| MATH 4342 Mathematical Statistics |
| MATH 5344 Spatial Statistics |
| MATH 5360 Combinatorics and Graph Theory |
| MATH 5375 Applied Analysis |
| MATH 5390 Special Topics in Mathematics |
| MATH 5396 Directed Independent Studies |

Also, with prior approval from Committee Chair(s) or Department Chair, a student may select graduate courses from outside the Department as electives.
3. Thesis. Each student in the Applied and Computational Mathematics option will take MATH 5394 as a co-requisite to the core courses for one to three semesters, for a total of three semester hours. The final time MATH 5394 is taken, the student will prepare a thesis proposal. When a student is within 18 semester hours of graduation, he or she may submit the proposal for the thesis. (Guidelines for writing the thesis, including the required format and style, are available in the Mathematics Department office.) Immediately upon approval of the thesis proposal, the student forms a graduate committee and registers for MATH 5995, Thesis. The student continues to register for MATH 5995 each successive semester (Fall, Spring, Summer I) until the thesis is completed. A student who does not complete a thesis in the semester for which he or she has registered will receive a grade of IP (In Progress). Failure to register for an incomplete thesis in the next semester will terminate the thesis and will require that the entire thesis process be repeated starting with the submission of a new thesis proposal.

Each student in the Applied and Computational Mathematics option must defend his or her thesis, ordinarily during his or her final semester. The student’s graduate committee will administer the defense. For more information, see the Department’s Thesis Guidelines.

Curriculum Content Option

<table>
<thead>
<tr>
<th>1. Core Courses</th>
<th>Sem. Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 5321</td>
<td>3</td>
</tr>
<tr>
<td>MATH 5322</td>
<td>3</td>
</tr>
<tr>
<td>MATH 5325</td>
<td>3</td>
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<tr>
<td>MATH 5326</td>
<td>3</td>
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<td>MATH 5327</td>
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<tr>
<td>MATH 5370</td>
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<table>
<thead>
<tr>
<th>2. Electives</th>
<th>Sem. Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 5323</td>
<td>3</td>
</tr>
<tr>
<td>MATH 5331</td>
<td>3</td>
</tr>
<tr>
<td>MATH 5332</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Thesis/Project</th>
<th>Sem. Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 5330</td>
<td>3</td>
</tr>
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<td></td>
<td>6</td>
</tr>
</tbody>
</table>

1. The Core Courses

2. Any of the courses MATH 5323, 5331 or 5332 may be used as an elective. With prior approval of the Department Chair or student’s Graduate Committee, any course with significant and appropriate mathematical content may be taken as an elective.

3. All students in the Curriculum Content option will take MATH 5393, Literature Review and Research Methodology, as an introduction to relevant literature, research methods and project design. This course serves as the capstone to the graduate program.

(a) Thesis. Students writing a thesis will prepare a thesis proposal in MATH 5393. When a student is within 18 semester hours of graduation, he or she may submit the proposal for the thesis. (Guidelines for writing the thesis, including the required format and style, are available on the Mathematics Department website.) Immediately upon approval of the thesis proposal, the student forms a graduate committee and registers for MATH 5995, Thesis. The student continues to register for MATH 5995 each successive semester (Fall, Spring, Summer...
I) until the thesis is completed. A student who does not complete a thesis in the semester for which he or she has registered will receive a grade of IP (In Progress). Failure to register for an incomplete thesis in the next semester will terminate the thesis and will require that the entire thesis process be repeated starting with the submission of a new thesis proposal.

(b) Students choosing to complete a project in lieu of a thesis will produce a project in MATH 5997 Directed Research, based on topics from MATH 5393, demonstrating their ability to undertake a significant curriculum development, perform the appropriate research needed to implement the development, and communicate orally and in writing their understanding of that process. (Guidelines for writing the research project, including the required format and style, are available on the Mathematics Department website, http://math.tamucc.edu/.) MATH 5997 must be passed with a grade of B or better.

(c) Each student in the Curriculum Content Option must defend his or her Thesis or Project, ordinarily during his or her final semester. The student’s graduate committee will administer the defense. For more information, see the Department’s Thesis & Project Guidelines (http://sci.tamucc.edu/~eyoung/Thesis_project_guidelines.pdf).

For Additional Information
Website: http://math.tamucc.edu
Campus Address: Center for Instruction, Room 301; Phone (361) 825-2459
Mailing Address: Department of Mathematics and Statistics, Unit 5825
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5825

GRADUATE COURSES
MATH 5310. 3 sem. hrs. (3:0)
TOPICS IN MATHEMATICS
May not be used for graduate credit towards the MS in mathematics. Course included to provide a suitable vehicle for anticipated future service courses. Grade assigned will be “credit” (CR) or “no credit” (NC). Prerequisite: Dependent on topics course offered.

MATH 5315. 3 sem. hrs. (2.2)
STATISTICAL METHODS IN RESEARCH I
This course is for graduate students in other disciplines and is designed to prepare them to use statistical methods in their research. This is a non-calculus exposition of the concepts, methods and usage of statistical data collection and analysis. Topics include descriptive statistics, the t-test, the one and two-way analysis of variance, multiple comparison tests, and multiple regression. Students also learn how to conduct these analyses using computer software and how to properly report their findings. Prerequisite: MATH 1442, MATH 2342, or the equivalent. Fall, Spring.

MATH 5316. 3 sem. hrs. (2.2)
STATISTICAL METHODS IN RESEARCH II
This course is a continuation of MATH 5315. Topics include: statistical experimental design, randomized blocks and factorial analysis, multiple regression, chi-squared tests, analysis of covariance, non-parametric methods and sample surveys. Emphasis will be placed on the computer analysis of research data and how to properly report statistical findings. Prerequisite: MATH 5315. Spring.

MATH 5321. 3 sem. hrs. (3:0)
PROBLEM SOLVING AND MATHEMATICAL REASONING FOR TEACHERS
An investigation of problems that span a variety of domains with a focus on making and evaluating mathematical arguments, using tools such as manipulatives and technology, identifying and analyzing the connections within and outside of mathematics, and using symbols and representations to communicate mathematical ideas.

MATH 5322. 3 sem. hrs. (3:0)
MATHEMATICS ASSESSMENT
A historical overview of assessment of mathematics, statistical description of norm- and criterion-reference tests, scaling of standardized exams, varieties of assessment and rubrics, the mathematical analysis of error patterns, and equity.

MATH 5323. 3 sem. hrs. (3:0)
MATHEMATICS INSTRUCTION AND MENTORING
A study of how the use of appropriate mathematical content can create and support a mathematics classroom environment in which students are engaged in mathematical problem solving and how to use these understandings to be effective in supporting teacher development.
MATH 5325. 3 sem. hrs. (3:0)
STRUCTURE OF NUMBER CONCEPTS
An in-depth investigation of real and complex number systems, base ten and other number bases, operations and algorithms, divisibility, Euclidean algorithm, congruence, modular arithmetic, and the Fundamental Theorem of Arithmetic, with an emphasis on quantitative and qualitative reasoning.

MATH 5326. 3 sem. hrs. (3:0)
STRUCTURE OF PATTERNS AND ALGEBRA
Algebraic reasoning incorporating the use of technology. This course includes investigations of patterns, relations, functions, and analysis, with a focus on representations and the relationships among them.

MATH 5327. 3 sem. hrs. (3:0)
STRUCTURE OF GEOMETRY AND MEASUREMENT
An investigation of concepts and principles in geometry and measurement with emphases on deductive reasoning and on inductive reasoning with the use of dynamic geometry software.

MATH 5328. 3 sem. hrs. (3:0)
STRUCTURE OF PROBABILITY AND STATISTICS
An investigation of the principles and applications of probability and descriptive and inferential statistics.

MATH 5329. 3 sem. hrs. (3:0)
STRUCTURE OF MODELING WITH RATES OF CHANGE
A study of rates of change through modeling. Direct applications of rates of change to number concepts, algebra, geometry, probability, and statistics.

MATH 5331. 3 sem. hrs. (3:0)
EVOLUTION OF MATHEMATICAL SYSTEMS
Covers the evolution of mathematical concepts and thought from ancient to modern times, including women and men who played key roles, from original and secondary sources. Provides a better understanding of the historical development of larger context for topics studied in other courses, and deepens understanding and appreciation of these topics. This course is intended to benefit current and future mathematics teachers. Prerequisite: MATH 5321 or consent of the instructor. Fall.

MATH 5332. 3 sem. hrs. (3:0)
INTEGRATING TECHNOLOGY IN MATHEMATICS EDUCATION
An introduction to technology appropriate for the mathematics classroom, including calculators, CAS systems, handhelds, computer software and multimedia. This course is intended for in-service mathematics teachers at the middle/high school level. Prerequisite: MATH 5321 or consent of the instructor. Fall.

MATH 5333. 3 sem. hrs. (3:0)
NUMERICAL LINEAR ALGEBRA

MATH 5336. 3 sem. hrs. (3:0)
ADVANCED DIFFERENTIAL EQUATIONS
A continuation of MATH 3315, Differential Equations. Relying heavily on linear algebra concepts, this course covers linear systems of differential equations; introductory operator theory; existence, uniqueness and continuity of solutions; stability of equilibria; planar nonlinear systems; and the Poincaré-Bendixson Theorem. Several applications are covered to illustrate the mathematical concepts. Prerequisites: MATH 3311 and MATH 3315. As needed.

MATH 5339. 3 sem. hrs. (3:0)
NUMERICAL ANALYSIS
Error estimation. Solution of non-linear equations. Interpolation. Numerical differentiation and integration. Finite differences and finite elements. Numerical methods for ODE’s and PDE’s. Prerequisites: MATH 3311, MATH 3470, MATH 3315, MATH 4315; also COSC 1435 or COSC 5311 or equivalent. As needed.

MATH 5342. 3 sem. hrs. (3:0)
LINEAR STATISTICAL MODELS
Review of basic concepts in probability theory. Principles of estimation and model building. Linear models, especially ANOVA and regression. Non-parametric alternatives. Prerequisites: MATH 3311, 3342, and 3470. As needed.

MATH 5344. 3 sem. hrs. (3:0)
SPATIAL STATISTICS
An introduction to methods of spatial statistics commonly used in scientific settings. Topics include the nature of geospatial sampling, analysis and modeling of spatial point patterns, and development and analysis of common continuous spatial models such as kriging. Additional topics to be covered, as time and student interest permit, include Bayesian modeling, hierarchical environmental modeling, and spatiotemporal modeling. Use of appropriate software is emphasized. Prerequisite: MATH 3342 or MATH 5315.

MATH 5348. 3 sem. hrs (3:0)
OPTIMIZATION
Unconstrained optimization, necessary and sufficient conditions for solutions, basic algorithms. Constrained optimization, KKT conditions, linear programming, convex programming, algorithms. Prerequisites: MATH 4301.

MATH 5351. 3 sem. hrs. (3:0)
REAL ANALYSIS
This course includes such topics as sequences and series of constants and functions, the Riemann integral, Fourier Series, and an introduction to Lebesgue measure and integration. Prerequisites: MATH 4301. As needed.

MATH 5354. 3 sem. hrs. (3:0)
ABSTRACT ALGEBRA
Basic structure theorems for groups, rings, and fields. Additional topics selected from Sylow’s theorem, symmetry groups, algebraic coding theory, and Galois theory. Prerequisite: MATH 4306. As needed.
MATH 5360. 3 sem. hrs. (3:0)
COMBINATORICS AND GRAPH THEORY
Topics to include basic counting rules, connectivity, graph coloring and applications, chromatic polynomials, trees and their applications to searching and sorting, generating functions, recurrence relations, the Pigeonhole Principle, Eulerian and Hamiltonian chains and paths, and applications. Prerequisites: MATH 2305 and MATH 3313 or the equivalent. As needed.

MATH 5370. 3 sem. hrs. (3:0)
MODELING OF NATURAL SYSTEMS
This course is designed to expose science and technology majors to models of real problems arising in the environment and ecology. Students will learn how to create solvable models of the real world situations and how to find answers on the posted questions by using tools of mathematics and computing. There will be modeling and simulations of tides in the Gulf of Mexico, multi-species models of the food chains, circulation of carbon, water, and oxygen. Students will learn new tools based on calculus and elementary statistics such as numerical algorithms, Monte-Carlo methods, Markov Processes, multivariate analysis, evaluation of stability, methods of extrapolation (predictions) and interpolations. Prerequisite: MATH 2413 or MATH 5329, and MATH 1442 or MATH 2342, or equivalent.

MATH 5375. 3 sem. hrs. (3:0)
APPLIED ANALYSIS
Topics to include basic theory of Euclidean, Banach and Hilbert spaces, calculus of variations and optimal control, elements of system analysis, and elements of complex analysis. All theoretical topics will be illustrated by real application. Prerequisite: MATH 5351 or MATH 4301.

MATH 5378. 3 sem. hrs. (3:0)
MATHEMATICAL MODELING
Modeling of applied problems using analytical, stochastic, and dynamical methods. Prerequisite: Completion of 24 semester hours towards the Applied Computational option of the M.S. in Mathematics degree.

MATH 5390. 3 sem. hrs. (3:0)
SPECIAL TOPICS IN MATHEMATICS
Prerequisite: Varies.

MATH 5393. 3 sem. hrs. (3:0)
LITERATURE REVIEW AND RESEARCH METHODOLOGY
Reading, analyzing, and synthesizing mathematics education research literature for the purpose of informing teaching practice. Includes a study of qualitative research with a focus on the components of a research study (research question(s), literature review, conceptual framework, methods, analysis, findings) and the relationships among them.

MATH 5394. 1-3 sem. hrs. (1:0)
RESEARCH METHODS IN MATHEMATICS
This course develops an ability to independently investigate a technical topic of interest, and the skills necessary to successfully communicate on that topic. The student learns how to find, organize, assimilate, and report on technical information derived from published sources. Specific areas of study include literature searches, technical word processing, technical writing style, and oral presentation techniques. The instructor and selected additional faculty members review and critique oral and written reports submitted throughout the semester. A final paper and a formal presentation are submitted in lieu of a final exam in the final semester. This course is a co-requisite for all other courses (except thesis) taken by students in the Applied Computational Mathematics option.

MATH 5396. 3 sem. hrs. (3:0)
DIRECTED INDEPENDENT STUDY
Study in areas of current interest. See College description for further details. Prerequisite: Permission of the instructor. May not be substituted for regularly scheduled offerings.

MATH 5995. 3-9 sem. hrs. (9:0)
THESIS
Students may register for 3 to 9 semester hours of thesis per semester. Only 3 hours total will count toward the MS degree in mathematics. Prerequisite: MATH 5394 and a Thesis Proposal signed by the student’s committee. Fall, Spring, Summer.

MATH 5997. 3-9 sem. hrs. (9:0)
DIRECTED RESEARCH
Students work with an advisor to complete and present their proposed research project from MATH 5393. Students may register for 3 to 9 semester hours of directed research per semester. Only 3 hours total will count toward the MS degree in mathematics. Prerequisite: MATH 5393 and a Project Proposal signed by the student’s committee. Fall, Spring, Summer.
Physical Science
Graduate courses in physical science are offered in support of graduate degree programs in computer science, education, environmental science, and mathematics. For details concerning these degree programs, consult the appropriate section of the catalog.

For Additional Information
Website:  http://www.sci.tamu.edu/~physweb/physicalscience/PSCICourses.html
Campus address:  Science and Technology Building, Room 319
Phone (361) 825-2754
Mailing address:  Physical Science Program, Unit 5800
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5800

GRADUATE COURSES
PSCI 5302.  3 sem. hrs. (3:0)
SEMINAR: CURRENT TRENDS IN PHYSICAL SCIENCE
Study and discussion of current activities and research in physical sciences in a seminar setting. This course is intended to provide teachers with the background and understanding that will enrich their classroom presentations in the physical science curriculum. May be repeated for credit when the topics vary. Offered on sufficient demand.

PSCI 5490.  1-4 sem. hrs. (1:0-3:2)
ADVANCED TOPICS
Subject varies. Advanced topics including literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Permission of instructor.

PSCI 5596.  1-5 sem. hrs.
DIRECTED INDEPENDENT STUDY
Study in areas of current interest.

Physics
Graduate courses in physics are offered in support of graduate degree programs in computer science, education, environmental science, and mathematics. For details concerning these degree programs, consult the appropriate section of the catalog.

For Additional Information
Website:  http://www.sci.tamu.edu/~physweb/physics/physics-homepage.html
Campus address:  Science and Technology Building, Room 319; phone (361) 825-2681
Mailing address:  Physics Program, Unit 5800
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5800

GRADUATE COURSES
PHYS 5490.  1-4 sem. hrs. (1:0-3:2)
ADVANCED TOPICS
Subject material variable. Advanced topics including literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Permission of instructor.
Science, Mathematics and Technology Education

Graduate courses in Science, Mathematics and Technology Education are offered in support of graduate degree programs in computer science, education, the sciences, and mathematics. For details concerning these degree programs, consult the appropriate section of the catalog.

For Additional Information
Website: http://www.sci.tamucc.edu/wiki/SMTE/SciMathTechEducationWiki
Campus address: Center for Instruction, Room 312; Phone (361) 825-2459
Mailing address: Science, Mathematics and Technology Education Program, Unit 5825
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Corpus Christi, Texas 78412-5825

GRADUATE COURSES

SMTE 5104. 1 sem. hr. (1:0)
SEMINAR FOR TEACHING ASSISTANTS.
Examination of contemporary theories of science teaching and learning. Basic lesson design, teaching skills, assessment, multicultural education, teaching “special needs” students. Course content will be linked to participants’ experiences as teaching assistants, and will include discussions of their day-to-day experiences. Course is taken as credit/no credit and may not be applied towards an M.S. degree in The College of Science and Technology.

SMTE 5490. 1-4 sem. hrs. (1:0-3:2)
ADVANCED TOPICS
Subject varies. Advanced topics including literature research. May be repeated for credit when topics are sufficiently different. Prerequisite: Permission of instructor.

SMTE 5396. 1-3 sem. hrs. (1:0 – 3:0)
DIRECTED INDEPENDENT STUDY
Study in areas of current interest. May be repeated for a total of 6 SCH as topics vary.