Master of Science (M.S.), Major in Aquatic Resources

Major Program
The master of science with a major in aquatic resources is a thesis-based degree that emphasizes research in aquatic ecosystems and the biological communities that they support.

Admission Policy
For information regarding admission application requirements and deadlines, please visit The Graduate College website at http://www.gradcollege.txstate.edu/aqrm.

Degree Requirements
Students in the aquatic biology concentration will focus on the biology and ecology of aquatic organisms and an understanding of the dynamics and management of aquatic ecosystems.

Students in the aquatic systems concentration will focus on an understanding of the structure and functioning of aquatic systems as integrated physical, biological, and socioeconomic entities and will emphasize practices aimed at protecting, maintaining, and restoring the health and sustainable use of these resources. This area of concentration encourages investigation of aquatic systems at the level of the watershed, as influenced by atmospheric and terrestrial processes.

All elective course work should be chosen in consultation with the thesis advisor, thesis committee, and program director to fulfill the requirements for the degree.

Course Work Requirements

Required Core Courses
BIO 5110 Seminar in Biology (Taken twice) 2
BIO 7406 Statistics and Experimental Design I 8
& BIO 7405 Statistics and Experimental Design II

Thesis Courses
Choose a minimum 6 hours 6
BIO 5199B Thesis
BIO 5299B Thesis
BIO 5399A Thesis
BIO 5399B Thesis
BIO 5599A Thesis
BIO 5599B Thesis

Concentration Courses
See tables below for course offerings 15

Total Hours 31

Aquatic Biology Concentration

Biology Electives
Choose 7 hours from the following: 7
BIO 5415 Ichthyology
BIO 5419 Stream Ecology

Aquatic Systems Concentration

Biology Electives
Choose 7 hours from the following: 7
BIO 5419 Stream Ecology
BIO 7312 Government Policy and Aquatic Resources
BIO 7412 Environmental Hydrology
BIO 7366 Integrated Water Resources Management
BIO 7421 Landscape Dynamics
BIO 7422 Wetlands Ecology
BIO 7468 Groundwater Resources
BIO 7471 Reservoir Ecology

Thesis Students
Students pursuing a master’s degree with thesis should have a thesis committee approved by the end of their first long term of enrollment in the graduate program. The thesis committee comprises three or more individuals and is chaired by the thesis advisor. Committee members should be selected by the student in consultation with the thesis advisor and should be chosen on the basis of what they can contribute to the student’s research and/or graduate studies. Committee members expect to be consulted about the research project and should contribute guidance and expertise to the project. A “Master’s Thesis Committee form” can be downloaded from the Department of Biology’s website and must be approved by the chair of the department’s graduate committee and the department chair prior to the submission of a thesis proposal.

Students working on a thesis are expected to enroll in a thesis course each term that they are actively involved in research. Students should enroll in BIO 5399A for their first term of thesis research and in BIO 5399B for all subsequent terms. While enrolled in BIO 5399A the student should prepare a detailed thesis proposal that introduces the project to be investigated, summarizes the relevant background literature, and explains the methodology to be used in carrying out the research. A “Master’s Thesis Proposal form” can be downloaded from The Graduate College website. Submission of an approved thesis proposal to the office of The Graduate College must be completed before the end of the student’s second term of enrollment in thesis. Students pursuing a thesis-based degree must be enrolled in at least one hour of thesis credit during the term in which they graduate.

All students completing a thesis are required to present the results of their research in an open seminar attended by the thesis committee members and other interested individuals. Following the public presentation of the thesis, the student must pass a comprehensive examination administered by the thesis committee.

Non-thesis Students
Students pursuing a non-thesis degree are required to have a major professor by the end of their first long term of enrollment in the graduate program. The major professor will normally be a faculty member.
specializing in an area of particular interest to the student and is often the individual who supervises the required independent study project. Prior to the final term of enrollment the non-thesis student must, in consultation with the major professor, select a committee that will administer the final comprehensive examination. A “Master’s Non-Thesis Committee form” can be downloaded from the Department of Biology’s website and must be approved by the chair of the department’s graduate committee and the department chair.

Comprehensive Examination
All candidates for master’s degrees in the Department of Biology must pass a comprehensive final examination administered by the student’s committee. The examination may be oral or written and must cover, at a minimum, the student’s field of concentration and the thesis, if one was written. The results of this exam should be reported on the “Master’s Comprehensive Examination Report form”, which can be downloaded from The Graduate College website and which must be filed in the office of The Graduate College at least 10 days prior to the date of expected graduation.

If a student elects to follow the thesis option for the degree, a committee to direct the written thesis will be established. The thesis must demonstrate the student’s capability for research and independent thought. Preparation of the thesis must be in conformity with the Graduate College Guide to Preparing and Submitting a Thesis or Dissertation. The thesis handbook may be accessed at http://www.gradcollege.txstate.edu/docs/Thesis_Diss_Guide.pdf.

Thesis Proposal
The student must submit an official Master’s Thesis Proposal form to their thesis committee. The required thesis proposal form may be obtained from The Graduate College at http://www.gradcollege.txstate.edu/gcforms.html. After signing the form and obtaining committee members’ signatures, graduate advisor’s signature (if required by the program), and the department chair’s signature, the student must submit the thesis proposal form with one copy of the proposal attached to the dean of The Graduate College for approval before proceeding with research on the thesis. If the thesis research involves human subjects, the student must obtain exemption or approval from the Texas State Institutional Review Board prior to submitting the proposal form to The Graduate College. If the thesis research involves vertebrate animals, the proposal form must include the Texas State IACUC approval code. It is recommended the thesis proposal form be submitted to the dean of The Graduate College by the end of the student’s enrollment in 5399A.

Thesis Committee
The thesis committee must be composed of a minimum of three approved graduate faculty members.

Thesis Enrollment and Credit
The completion of a minimum of six hours of thesis enrollment is required. Enrollment for the thesis will be in course number 5399A for a student’s initial thesis enrollment and a thesis B course for each subsequent thesis enrollment in the field in which the subject matter of the thesis falls, e.g., PS 5399A and PS 5399B. Preliminary discussions regarding the selection of a topic and assignment to a research supervisor will not require enrollment for the thesis course.

A student will be required to enroll in and pay the fee for at least one hour of the thesis course during any term in which the student will receive thesis supervision or guidance and/or in which the student is using university resources. Failure to register for the thesis course during a term in which supervision is received may result in postponement of graduation. After initial enrollment in 5399A, the student will continue to enroll in a thesis B course as long as it takes to complete the thesis. In the rare case when a student has not previously enrolled in thesis and plans to work on and complete the thesis in one term, the student will enroll in both 5399A and 5399B. The only grades assigned for thesis courses are PR (progress), CR (credit), W (withdrawn), and F (failing). If acceptable progress is not being made in a thesis course, the instructor may issue a grade of F. If the student is making acceptable progress, a grade of PR is assigned until the thesis is completed. The minimum number of hours of thesis credit (“CR”) will be awarded only after the thesis is filed in the Alkek Library and the librarian has electronically returned the thesis card to the office of The Graduate College.

A student who has selected the thesis option must be registered for the thesis course during the term or Summer I (during summer the thesis course runs ten weeks for both sessions) in which the degree will be conferred.

Fee Reduction
A master’s degree candidate for graduation may be eligible for a one-time fee reduction under V.T.C.A. Education Code, Section 54.054. Please refer to the section titled Fee Reduction in the Additional Fees and Expenses chapter of this catalog for more information.

Thesis Deadlines and Approval Process
Thesis deadlines are posted at the following web page: http://www.gradcollege.txstate.edu/Thes-Diss_Info/T-D_Deadlines.html. The completed thesis must be submitted to the chair of the thesis committee no later than 41 days before the date of the commencement at which the degree is to be conferred.

The following must be submitted to the office of The Graduate College no later than 24 days, not counting weekends or holidays, before the date of commencement at which the degree is to be conferred (see The Graduate College webpage for specific deadlines):

1. The Thesis/Dissertation Committee Approval form bearing original signatures of the student and all committee members.
2. One (1) copy of the thesis in final form, approved by all committee members, on standard paper (Hard-copy Submission Option) or PDF of the thesis in final form, approved by all committee members, uploaded in the on-line Vireo submission system (Vireo On-line Submission Option).

After the dean of The Graduate College approves the thesis, the process is as follows:

1. For the Vireo On-line Submission Option:
   a. No copies are required to be submitted to the Alkek Library. However, Alkek will bind copies submitted that the student wants bound for personal use. Personal copies are not required to be printed on archival quality paper. The student will take the personal copies to the Alkek Library and pay the binding fee for personal copies.

Master’s level courses in Biology: BIO
Courses Offered

Biology (BIO)

BIO 5100. Professional Development.
This course is seminar-based and covers topics related to teaching, research, and employment responsibilities. Completion of the course is required as a condition of employment for graduate assistants. This course does not earn graduate degree credit. Repeatable with different emphasis. Graded on a credit (CR), no-credit (F) basis
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

BIO 5110. Seminar in Biology.
Interactive discussion of timely issues and problems, designed to expose students to the current literature in their fields of interest and its critical analysis. This course is repeatable for credit
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

BIO 5114. Collaborative Research.
This course allows master’s level graduate students to initiate, conduct, and participate in research in collaboration with graduate faculty of the Department of Biology that is in addition to thesis research conducted under BIO 5399A or BIO 5399B. This course recognizes the collaborative nature of scientific investigation. See also BIO 5214 and BIO 5314
1 Credit Hour. 1 Lecture Contact Hour. 1 Lab Contact Hour.
Grade Mode: Standard Letter

BIO 5166. Medical Microbiology Laboratory.
This graduate laboratory-based course will cover pathogenic bacteria emphasizing identification of selected groups of pathogens and the biological basis for virulence. Prerequisites: BIO 2400 and BIO 2450 with minimum grades of C
1 Credit Hour. 0 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

BIO 5199B. Thesis.
This course represents a student’s continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding. Cannot be taken unless a Thesis Proposal has been submitted. Students working toward the M.A. or M.S. with a thesis are expected to enroll in thesis each semester in which faculty supervision is received or laboratory facilities are utilized. Graded on a credit (CR), progress (PR), no-credit (F) basis
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

BIO 5300. Neurobiology.
This course presents the biology of the nervous system with emphasis on the human nervous system. Topics presented in lecture include neuroanatomy, cellular neurobiology, neurophysiology, developmental neurobiology, and neuronal plasticity. Prerequisites: PHYS 1420 and PHYS 1430 or consent of instructor
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5301. Evolution.
Basic genetic principles applied to natural selection, adaptation, populations, and speciation. Consideration is given to the origin of life, nature of chromosomal variation, evolution of genetic systems, and certain other selected topics. Prerequisite: Undergraduate genetics course or its equivalent
3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

Students will be introduced to the impact human recreational activities have on wildlife habitats and populations. Management practices to enhance human-wildlife encounters or to minimize detrimental effects on wildlife populations will be presented. Prerequisites: BIO 1330/BIO 1130 and BIO 1331/BIO 1131 or BIO 1320 and BIO 1421
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5305. Methods of Nature Study for Teachers.
This course provides a comprehensive survey of natural events. It includes laboratory and field work emphasizing observation, collection and discovery of relationships. It is creditable only for those seeking elementary or middle school certification and is required for those seeking grade 4-8 Science or Science/Mathematics teaching certification. This course must be taken the semester immediately prior to student teaching
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5214. Collaborative Research.
This course allows master’s level graduate students to initiate, conduct, and participate in research in collaboration with graduate faculty of the Department of Biology that is in addition to thesis research conducted under BIO 5399A or BIO 5399B. This course recognizes the collaborative nature of scientific investigation. See also BIO 5314
2 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5295. Fundamentals of Research.
Designed to acquaint the beginning graduate student with materials and methods of research in the biological sciences. It is recommended that a graduate student take this course the first semester in residence
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
BIO 5311. Cancer Biology.
Cancer Biology provides a foundation for understanding the complex molecular, biochemical, and cellular processes associated with cancer development. Topics include the role of tumor suppressor genes, oncoproteins, DNA repair, apoptosis, ECM, cell cycle control, cell signaling pathways, immune function and cancer-causing viruses. Emerging diagnostics and/or therapeutics will also be discussed
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5314. Collaborative Research.
This course allows master's level graduate students to initiate, conduct, and participate in research in collaboration with graduate faculty of the Department of Biology that is in addition to thesis research conducted under BIO 5399A or BIO 5399B. This course recognizes the collaborative nature of scientific investigation
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5319A. Statistical Methods in Biology.
Selected topics in Biology
3 Credit Hours. 2.5 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

BIO 5319C. Ecotoxicology.
Topics to be covered include sources, types, and fate of toxicants, organism response to toxicants, toxicant effects at the population, community, and ecosystem levels, and monitoring and risk assessment. Examination of current literature will form the core of the course
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

BIO 5319F. Watershed Management Frameworks and Applications.
Introduction to integrated watershed assessment and management tools for identifying programmatic water quality and quantity issues and their root causes and solutions, and their practical application. The scientific and socio-economic elements are considered within the context of planning and developing watershed protection plans and programs. Prerequisite: Instructor approval
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

BIO 5324. Natural History and Conservation of Large Mammals.
This course will introduce students to advanced details of natural history, research, and conservation of large mammals. Topics considered will include natural history, range and population status (historic and current), importance to and interaction with humans, research design and analysis, and the development of conservation and management plans
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5335. Fisheries Management.
An introduction to principles and techniques in fisheries management. Includes the study of artificial reproduction, carrying capacity, productivity, sampling procedures, population estimates, mortality, survival growth rates, and commercial and sport fisheries. (Spring, even years).
Prerequisite: Ichthyology course or consent of instructor
3 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5350G. Medical Microbiology.
This lecture-based course will cover pathogenic bacteria and their ability to cause disease, emphasizing the biological basis for virulence, and research strategies for investigating infectious diseases. Prerequisite: BIO 2400 or equivalent. Students may take only one of BIO 5350G or BIO 5445 for credit
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

BIO 5350I. Emerging Infectious Diseases.
Current topics in the emergence of viral and bacterial diseases in humans. This course will include new diseases, diseases previously seen and increasing in incidence, and diseases not previously seen in this country. This course will be of interest to students who are pursing advanced degrees and courses in microbiology, biochemistry, and cell and molecular biology
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

BIO 5350J. Environmental Physiology of Animals.
This course is a study of how animals respond physiologically to changes in environmental temperature, moisture, salinity, partial pressure of gases, and toxins. Permission of instructor is required
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

BIO 5350K. Genomics.
The course is a lecture course in modern genomics, including principles of genome function, the human genome, comparative genomics, genome sequencing, variation and genetic change, databases and medicine, ethical, legal and social issues. The course also includes discussion of transcriptomics, proteomics, metabolomics, directed evolution, protein design, and systems biology
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

BIO 5350L. Graduate Bacterial Genetics.
This course will cover concepts and mechanisms involved in the genetics of Archaea and Bacteria. Graduate students will learn current strategies dealing with traditional molecular genetics including epigenetics and post-transcriptional regulation involving small non-coding RNA
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

BIO 5350M. Wildlife Policy and Law in North America.
This course provides the student with a historical and cultural context within which wildlife policy and law (federal treaties, statutes, case law, and regulations) have developed in North America, particularly in the United States. Graduate students will research the development of Wildlife law in representative states as well
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter
Students will obtain a first-hand knowledge of the ecology, biodiversity, conservation, and culture of tropical ecosystems. It is an immersive and intensive study abroad course combining traditional lecture and field-based laboratory instruction. All course work will be conducted during a ~1 month stay in the South American country of Ecuador. Co-requisite: BIO 5350P
3 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Co-requisite(s): BIO 5350P
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

BIO 5350P. Tropical Ecology and Conservation Lab.
This laboratory course complements the lecture course BIO 5350O, in which students will obtain a first-hand knowledge of the ecology, biodiversity, conservation, and culture of tropical ecosystems. It is an immersive and intensive study abroad course combining traditional lecture and field-based laboratory instruction. All course work will be conducted during a ~1 month stay in the South American country of Ecuador. Co-requisite: BIO 5350O
3 Credit Hours. 0 Lecture Contact Hours. 9 Lab Contact Hours.
Co-requisite(s): BIO 5350O
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

BIO 5350Q. Biological Oceanography.
Students will be introduced to the principles of oceanography and will understand anthropogenic impacts on the oceans. Topics to be investigated will include: ocean formation and destruction, sediments, ocean circulation, waves, tides, estuaries, life in the oceans, hydrothermal vents, coral reefs, fisheries, marine pollution, and climate change
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

BIO 5350R. Microbial Biotechnology.
This course provides an overview of how microbes (e.g., bacteria, viruses and yeast) are manipulated to solve practical problems through biotechnology. This course is designed on topics of applied microbiology recommended by American society of Microbiology
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

Current government regulations regarding environmental impact, content of environmental impact statements, how to proceed with an impact study, application of ecological principles to impact studies, and steps in the review process for environmental impact statements are considered. (Spring, odd years). Prerequisite: Consent of instructor
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5366. Medical Microbiology.
This lecture-based course will cover pathogenic bacteria and their relationship to disease, emphasizing critical evaluation of research literature, disease transmission and the biological basis for virulence. Prerequisites: BIO 2400 and BIO 2450 with minimum grades of C
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

BIO 5390. Problems in the Biological Sciences.
Open to graduate students on an individual basis by arrangement with the faculty member concerned
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5399A. Thesis.
This course represents a student’s initial thesis enrollment. No thesis credit is awarded until student has completed the thesis in BIO 5399B. Students working toward the M.A. or M.S. with a thesis are expected to enroll in thesis each semester in which faculty supervision is received or laboratory facilities are utilized. Graded on a credit (CR), progress (PR), no-credit (F) basis
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

BIO 5399B. Thesis.
This course represents a student’s continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding. Cannot be taken unless a Thesis Proposal has been submitted. Students working toward the M.A. or M.S. with a thesis are expected to enroll in thesis each semester in which faculty supervision is received or laboratory facilities are utilized. Graded on a credit (CR), progress (PR), no-credit (F) basis
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

BIO 5402. Earth Science I.
A study of astronomy and meteorology through observation, description, and interpretation of earth phenomena. Includes field observations, methods of measurement and interpretation of data related to the physical environment and space technology. Requires independent scientific and science education research and presentation of findings in a professional context
4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5403. Earth Science II.
The description and interpretation of earth phenomena considered from the standpoint of geology and oceanography. Includes field observations, methods of sampling and interpretation of data related to the physical environment. Requires independent scientific and science education research and presentation of findings in a professional context
4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5408. Science Processes and Research.
Students will analyze scientific research design, design research, interpret data, and communicate results. Stress will be placed on broad-field structure and integration of major science concepts and research-based science pedagogy. This course must be taken the semester prior to student teaching and is required for those seeking 7-12 Life Science or Science teacher certification. This course may not count as one of the four upper-level Biology courses required of general Biology majors, or one of the three upper-level Biology courses required of Biology minors
4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
BIO 5410. Field Biology of Plants.
Ecological relationships and natural history of plants, including historical geology, geography, soils, and vegetational regions of Central Texas.
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

A phylogenetic survey of living and fossil vascular plants that focuses on external morphology and reproductive biology. Topics include phylogenetic reconstruction, the origin of vascular plants, seed reproduction, and the origin of angiosperms. Emphasis is on broad-scale evolutionary patterns and origin of major taxonomic groups.
Prerequisites: Biology undergraduate botany course and General Chemistry I and II, or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5412. Plant Anatomy.
A descriptive and functional analysis of seed plants that focuses on internal structure. Topics include recognition and characterization of plant tissues, the structure of plant organs, and organ development. Emphasis is on pattern of tissue organization common to all seed plants and the functional basis for anatomical structure.
Prerequisites: Biology undergraduate botany course, and General Chemistry I and II, or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5413. Parasitology.
The biology and biological significance of the common parasites of man and animals. Prerequisite: Biology undergraduate zoology course or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5415. Ichthyology.
An introduction to the morphology, taxonomy, natural history, and evolution of fishes. Field trips will be made to collect specimens, and laboratory periods will be devoted to morphological and systematic analyses.
Prerequisite: Biology undergraduate zoology course or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5418. Field Ornithology.
This course is designed to introduce and provide an advanced knowledge of the application of various field, laboratory, and statistical methods and techniques in the study of avian species. The course will include topics related to survey methodology, sampling design, marking/banding, measurement/sample extraction, and aging/sexing of avian species.
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

Class covers ecological theories, concepts, and processes occurring at the population, community, and ecosystem levels of organization in running water. Lab includes sampling methods, description and comparative studies, experiments, critical discussion of literature and experience in writing manuscripts. Prerequisite: Consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5420. Natural History of the Vertebrates.
Environmental relationships and natural history of vertebrates. Emphasis is on evolution taxonomy, speciation, behavior, and morphology. Laboratory will include field trips for the study and collection of vertebrates in their natural habitats. Students will assemble a representative collection of vertebrates
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5421. Ornithology.
Introduction to anatomy, behavior, ecology, and identification of the birds of Texas. Laboratory will emphasize field studies of birds and their habitat requirements
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5422. Mammalogy.
The taxonomy, distribution, ecology, behavior, and evolution of mammals with particular emphasis on wild mammals of the Southwest. Laboratory will emphasize anatomy, identification, preparation of specimens, and field exercises in methods of population analysis. Students may assemble representative mammal collection
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5423. Wildlife Management.
Application of ecological principles and natural history concepts to the management of wildlife habitats and populations. Laboratory will involve demonstrations and practice exercises with wildlife management techniques and instrumentation, and field trips to observe wildlife management projects
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5426. Immunology.
A study of the immune response, antigen/antibody reactions, major histocompatibility complex, and immunopathology. Prerequisite: Biology undergraduate cellular biology course or BIO 3442 and organic chemistry, or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
BIO 5434. Herpetology.
A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. Emphasis will be placed on North American species and those groups inhabiting Texas
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5435. Techniques in Wildlife Management.
The basic methodology of practical wildlife management. This involves techniques in monitoring and data collection related to population dynamics and habitat parameters of wildlife species as well as field research
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5441. Cellular Physiology.
Advanced cellular biology, including membrane physiology, thermodynamics, energy transduction and distribution, and cellular movement in non-muscle and muscle cells. Laboratory includes discussion of current research and exercises in cellular physiology. Prerequisites: Cell biology, organic chemistry, or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5442. Experimental Techniques.
Use of methods and instruments applicable to biological investigations, including colorimetry, UV-spectrophotometry, fluorescein, flame and atomic absorption spectrophotometry, paper, gas, gel filtration and ion exchange chromatography, radioactive counting, and electrophoresis
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5450. Physiological Ecology of Animals.
Course brings together the principle concepts of environmental physiology of animals. The biological problems associated with living in various ecological realms will be discussed, and the biochemical and physiological adaptations of animals to their diverse habitats will be studied. Prerequisites: Organic chemistry or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5454. Plant Ecology.
Functional ecology of terrestrial plants, plant populations, and communities. Laboratory emphasizes quantitative and experimental approaches to plant ecology and the use of field and laboratory physiology equipment. Prerequisites: Undergraduate ecology course, undergraduate plant physiology course, and an undergraduate cellular biology course, or consent of the instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5455. General Entomology.
Principles of morphology, physiology, and taxonomy of insects. Laboratory time will be devoted to a taxonomic study of the common orders and families of insects. Prerequisite: Biology undergraduate zoology course or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5466. Phylogenetic Methods.
Reconstructing phylogenies is important in most fields of biology. Course emphasis is on practical data collection, management, and analysis. Laboratory exercises will introduce phylogenetic and DNA analysis software, and WWW resources. Students will learn how to address questions in their own research using phylogenetic methodologies. Prerequisite: Genetics course or consent of instructor
4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5470. Limnology.
Physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnology sampling methods, chemical and biological analysis of samples, and hydrographic surveying are included in the laboratory. Prerequisite: One year of chemistry, or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5471. Reservoir Ecology.
Study of the physical, geological, chemical, and biological factors that influence and make up reservoir ecosystems. Prerequisites: Limnology course or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5472. Animal Behavior.
This course presents all the major facets of the study of animal behavior, giving special attention to its evolution and ecological significance. We will discuss major conceptual models guiding past and present research in the field. Laboratories will emphasize experimental techniques and statistical analysis. Prerequisites: One course in statistics, or consent of instructor
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5480. Cytology and Micro-technique.
Study of cellular ultra-structure and electron micro technique. Lecture portion of course will cover cytology of all cell types and theoretical aspects of light microscopy and electron microscopy. Laboratory portion will train students to proficiency in microscopy
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
BIO 5481. Internship in Biological Laboratory Technologies.
The student will participate in the work of a selected biology unit (private, commercial, or governmental). A research paper reporting the internship experience conducted at the biological unit under the supervision of a faculty member will be required. This course may be credited toward a biology major with prior approval of the graduate advisor and department chair. Graded on a credit (CR), no credit (F) basis.
4 Credit Hours. 0 Lecture Contact Hours. 15 Lab Contact Hours.
Grade Mode: Standard Letter

A course on theory of operation and practical use of the scanning electron microscope as applied to biological materials. The course includes aspects of specimen preparation, photomicroscopy, micrograph interpretation, and microscope maintenance procedures. The course will provide the student training necessary to independently do scanning electron microscopy.
4 Credit Hours. 2 Lecture Contact Hours. 6 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

BIO 5599B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding. Cannot be taken unless a Thesis Proposal has been submitted. Students working toward the M.A. or M.S. with a thesis are expected to enroll in thesis each semester in which faculty supervision is received or laboratory facilities are utilized. Graded on a credit (CR), progress (PR), no-credit (F) basis.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

BIO 5999B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding. Cannot be taken unless a Thesis Proposal has been submitted. Students working toward the M.A. or M.S. with a thesis are expected to enroll in thesis each semester in which faculty supervision is received or laboratory facilities are utilized. Graded on a credit (CR), progress (PR), no-credit (F) basis.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit