

# BIOLOGY (BIO)

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## **BIO 1130. Functional Biology Laboratory.**

Fundamental techniques and instruments used in cellular biological research will be taught while emphasizing safety, measurements, and scientific methods. Students will design and implement controlled experiments, identify independent and dependent variables, analyze data, draw conclusions, and communicate results with appropriate tables and graphs in oral presentations and written papers.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1106

**Course Fee:** \$5; Fee - Lab BIO

## **BIO 1131. Organismal Biology Laboratory.**

This course introduces the students to the basics of experimental design, scientific method and inquiry, use of statistical analyses and writing research papers. Topics covered include Mendelian and population genetics, natural selection, population ecology, phylogeny, and behavioral ecology.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1107

**Course Fee:** \$5; Fee - Lab BIO

## **BIO 1320. Modern Biology I, Molecules, Cells, and Physiology.**

Provides students with basic scientific and biological principles. Current problems in biology and the ethics of science are presented with perspectives of public policy from a scientific viewpoint. This course is not recommended for majors in the natural sciences, including biology.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1308

## **BIO 1321. Ecology, Evolution and Society.**

This course provides the non-science major an overview of the ecological and evolutionary principles that govern relationships between living organisms, including humans, and their environment. Special attention is given to environmental issues of current concern, such as overpopulation, climate change, pollution, resource depletion, and conservation biology.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Life & Phys Sciences Core 030

**Grade Mode:** Standard Letter

## **BIO 1330. Functional Biology.**

This course provides the students with a strong foundation in cellular and molecular biology. Topics include biochemistry, energy metabolism, molecular bases of gene regulation and protein functions, cell division and control, and cell signaling. This course is required for all biology majors and is not recommended for non-science majors.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1306

## **BIO 1331. Organismal Biology.**

This course provides science majors with a foundation in organismal biology, Mendelian and population genetics, evolution and ecology. Topic include: patterns of inheritance, genetics, evolution, speciation, phylogenetics, and behavioral population, community, and ecosystem ecology. This course is required for all biology majors and is not recommended for non-science majors.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1307

## **BIO 2400. Microbiology.**

Principles of microbiology, morphology, anatomy, physiology and taxonomy of representative groups of non-pathogenic organisms. Laboratory methods stress studies of pure cultures, the use of laboratory apparatus in quantitative determinations and the detection and identification of microbial populations in the environment. Prerequisites: BIO 1330 and BIO 1130, and BIO 1331 and BIO 1131; and CHEM 1341 all with grades of "C" or higher.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2421

**Course Fee:** \$5; Fee - Lab BIO

## **BIO 2410. Intermediate General Botany.**

An introduction to the biology of plants and plant-like organisms, emphasizing their role in ecosystem processes, relationships between structure and function, and the evolutionary relationships among the major plant groups. Prerequisites: BIO 1330 and BIO 1130, and BIO 1331 and BIO 1131 with grades of "C" or higher.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$5; Fee - Lab BIO

## **BIO 2411. Intermediate Zoology.**

Provides biology majors a strong foundation in animal biology at the organismal level. The format will include details of animal form and function as well as concepts relating to classification, phylogeny, evolution, and ecology. Topics will include natural history, biogeography, adaptations to local environments, shared characters, and behavior. All material is presented in an accepted phylogenetic sequence. Prerequisites: BIO 1330/BIO 1130, and BIO 1331/BIO 1131 all with grades of "C" or higher.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$5; Fee - Lab BIO

**BIO 2430. Human Physiology and Anatomy.**

A course on human physiology covering the various organ systems. Principles of molecular biology, cell and tissue structure, anatomy and relationship of structure and function are stressed. May not be credited toward a Biology major or minor.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2404

**Course Fee:** \$5; Fee - Lab BIO

**BIO 2440. Principles of Microbiology.**

The Basic Principles of microbiology, morphology, physiology, immunology and the relationship of microorganisms to diseases. This course is designed primarily to meet the requirements for students in allied health sciences and other programs requiring only one semester of microbiology. This course may not be credited toward a biology major or minor. Prerequisites: BIO 1330 and CHEM 1341 with minimum grades of D.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2420

**Course Fee:** \$5; Fee - Lab BIO

**BIO 2450. Genetics.**

An introduction to basic principles of Genetics by studies of Mendelian, molecular, quantitative and population genetics. Topics include: classical transmission genetics, and gene mapping, DNA replication and repair, transcription, translation, control of gene expression, genetic engineering techniques, Hardy-Weinberg equilibrium, evolutionary change via natural selection, and genetic drift. Prerequisites: BIO 1330, BIO 1130, BIO 1331 and BIO 1131; CHEM 1141, CHEM 1341, CHEM 1142, and CHEM 1342 all with grades of "C" or higher.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2416

**Course Fee:** \$20; Fee - Lab BIO

**BIO 2451. Human Anatomy and Physiology I.**

Part I of a two semester course on the structure and function of the human body. Designed specifically to prepare students for nursing and other health professions. Prerequisites: BIO 1330 and CHEM 1341, all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2401

**BIO 2452. Human Anatomy and Physiology II.**

This course is the second part of a two semester course on the structure and function of the human body designed specifically to prepare students for nursing and other health professions. Prerequisites: BIO 1330 and CHEM 1341 and BIO 2451, all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2402

**BIO 3300. Cell and Molecular Biology.**

Fundamentals of structure and function of prokaryotic and eukaryotic cells. Course includes cell and organelle structure, basic biochemistry, principles of thermodynamics and energy transformation, nucleic acid and protein synthesis, enzyme kinetics, cell motility and cell signaling. Prerequisites: BIO 1330, BIO 1130, BIO 2450, and CHEM 1342 with grades of "C" or higher, or permission of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 3301. Biology of Sex and Reproduction.**

This course focuses on animals, especially vertebrates, and covers topics such as the evolution of sexual reproduction, genetic variation, sex differentiation during development, reproductive anatomy and physiology, reproductive endocrinology, gestation, disease transmission, and reproductive technologies. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 3308. Global Ecology.**

An interdisciplinary introduction to the science of global environmental change. Emphasis will be placed on understanding principles of earth system science, the scientific basis underlying the major components of global environmental change, the linkages between these components, and the central role of humanity in contributing to the observed changes. Prerequisites: BIO 1330, BIO 1130, BIO 1331 and BIO 1131 with grades of "C" or higher. (WI).

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**BIO 3341. Aquatic Toxicology.**

This course examines the basic concepts of aquatic toxicology, including uptake mechanisms, interactions, and elimination of different toxicants. Students will understand how toxic substances impact freshwater and marine organisms and identify potential health impacts to humans. Topics to be discussed include nutrients, metals, oil, pesticides, radionuclides, plastics, and emerging contaminants. Prerequisite: BIO 1331 and CHEM 1341, all with a grade of "C" better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 3351. Forensic and Human Genetics.**

This course introduces students to basic principles of Mendelian, molecular, and forensic genetics as it relates to the problems of human populations. This course is intended for non-science majors. May not be credited towards a biology major or minor. Prerequisites: BIO 1320 and BIO 1421, or BIO 1330/BIO 1130 and BIO 1331/BIO 1131.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 3371. Marine Resources.**

This course examines the exploitation and fragility of the marine environment and the economic importance of marine resources. Topics to be examined include ocean ownership, overfishing, aquaculture, shark finning, whaling, ocean mining, marine transportation, tourism, pollution, harvesting energy from the ocean, and the importance of creating marine reserves. Prerequisite: BIO 1331 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**BIO 3376. Introduction to Biotechnology.**

This course is an introduction to biotechnology. It provides an insight into how biotechnological applications can solve scientific and societal problems for the benefit of humankind. Prerequisite: BIO 1330 and BIO 1331.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**BIO 3406. Economic Botany.**

An introduction to the utilization of plants by humans and their economic and ecological significance. Laboratories will stress plant features beneficial to economic and societal needs. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter  
**Course Fee:** \$5; Fee - Lab BIO

**BIO 3410. Phycology.**

A study of algal organisms, comparative and culture techniques. Prerequisites: 8 hours from BIO 1410 or BIO 2410 or BIO 2450 or BIO 3400 or BIO 3450, with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter  
**Course Fee:** \$5; Fee - Lab BIO

**BIO 3421. Vertebrate Physiology.**

The study of the physiology of vertebrate organ systems, including the nervous system, musculoskeletal system, endocrine system, cardiovascular system, respiratory system, digestive system, reproductive system and urinary system. Mammalian systems will be emphasized. Prerequisites: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter  
**Course Fee:** \$5; Fee - Lab BIO

**BIO 3430. Mycology.**

A study of the fungal kingdom including slime molds and lichens. Laboratory studies will emphasize taxonomy, morphology and culture techniques. Prerequisites: BIO 2410 or BIO 2400 and BIO 2450, with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter

**BIO 3442. Virology.**

The structure, multiplication and genetics of bacterial, plant, and animal viruses. The role of viruses in human and plant disease. Prerequisites: BIO 2400 and BIO 2450 with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required|Writing Intensive  
**Grade Mode:** Standard Letter  
**Course Fee:** \$20; Fee - Lab BIO

**BIO 3460. Aquatic Biology.**

An introduction to plant and animal life in the fresh water habitats of the local area. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or better; and one year of Chemistry. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required|Writing Intensive  
**Grade Mode:** Standard Letter  
**Course Fee:** \$5; Fee - Lab BIO

**BIO 3461. Plant Taxonomy.**

Principles of identification and classification of plants; nomenclature and characteristics of various plant groups with emphasis on the higher plants. Prerequisites: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter  
**Course Fee:** \$20; Fee - Lab BIO

**BIO 3470. Invertebrate Zoology.**

A study of the comparative morphology, evolution, systematics and natural history of invertebrates. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter  
**Course Fee:** \$20; Fee - Lab BIO

**BIO 3480. Histology.**

A study of the structural and functional relationships between cells and tissues in organs. The laboratory includes the study of prepared slides and of microtechnique. This course is designed to meet the needs of pre-professional students. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter  
**Course Fee:** \$20; Fee - Lab BIO

**BIO 4126. Immunology Laboratory.**

This laboratory-based course will cover cells of the immune system and basic serological reactions, including bacterial and viral agglutination reactions, precipitation, immunoelectrophoresis, immunofluorescence, and enzyme-linked immunosorbent assays. Prerequisites: BIO 2400 and BIO 2450 with grades of "C" or better. Pre- or co-requisite: BIO 4326.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**  
**Grade Mode:** Standard Letter  
**Course Fee:** \$5; Fee - Lab BIO

**BIO 4166. Medical Microbiology Laboratory.**

This 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 grades of C or higher. Corequisite: BIO 4345. (WI).

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4176. Microbial Biotechnology Laboratory.**

This laboratory-based course will cover use of microbes for biotechnological applications and is designed to provide practical explorations into fields of biotechnology. Topics include laboratory techniques for recombinant protein purification, fermentation, identification of markers in genetically modified food and bioremediation of pollutants. Prerequisite: BIO 2400 and BIO 2450 with grades of "C" or higher. Corequisite: BIO 4376.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4299. Undergraduate Research.**

Supervised individual research projects in a mentor-student relationship with a biology professor. Available only to biology majors with junior standing and at least a "B" average. May be repeated once for credit. Prerequisites: BIO 2450 with a grade of "C" or better and consent of the supervising professor.

**2 Credit Hours. 0 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4300. Neurobiology.**

This course will give students an overview of neuroscience, particularly the areas of neuroanatomy, neurophysiology, and evolutionary and developmental neurobiology. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4301. Evolution.**

Basic genetic principles applied to natural selection, adaptation, populations, speciation and man's future. Consideration is given to the origin of life, nature of chromosomal variation, evolution of genetic systems and certain other selected topics. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4304. Wildlife and Recreation: Impact, Policy, and Management.**

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. Prerequisite: BIO 4416 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4305. Nature Study.**

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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4311. 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, oncogenes, 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. Prerequisite: BIO 2450 Genetics with a grade of "C" or better; or approval of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4319. Biological Resources: Conservation and Planning.**

This course is an introduction to the protection and sustainable use of populations, species, habitats, and ecosystems. Course also includes study of the methods used to analyze biodiversity and population regulation. Prerequisite: BIO 4416 with a grade of "D" or better, or concurrent enrollment.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4324. 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 4326. Immunology.**

This lecture-based course will cover the biology of the immune system and its relationship to disease, emphasizing B and T cell immunity, immune diseases, hypersensitivities, transplantation, and cancer. Prerequisites: BIO 2400 and BIO 2450 with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4327. Issues in Irish Biodiversity and Conservation.**

In this course, students will learn about Irish flora and fauna, ecosystems, conservation strategies in areas of high ecological concern, and public involvement. Emphasis will be placed on case studies and service-learning opportunities. Prerequisite: BIO 1331 and BIO 1131, student must be accepted into the Texas State in Ireland Study Abroad Program. Corequisite: BIO 4328.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4328. Field Biology of Ireland.**

In this course, students will use multiple techniques to explore biodiversity across multiple ecosystems in Ireland. Prerequisite: BIO 1331 and BIO 1131, student must be accepted into the Texas State in Ireland Study Abroad program. Corequisite: BIO 4327.

**3 Credit Hours. 0 Lecture Contact Hours. 12 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4329. Raptor Ecology.**

This course will examine the evolution, taxonomy, ecology, behavior, anatomy, physiology, and conservation of birds of prey of the world with emphasis on diurnal raptors, including those from Texas. Field trips will include at least two overnight visits to significant migration and overwintering areas.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4331. Human Dimensions of Wildlife and Fisheries Conservation.**

Humans play a role in nearly every aspect of wildlife and fisheries conservation. This course will provide students with principles, concepts, and case studies to understand how the human experience (e.g., culture, politics, economics) influences conservation outcomes. Students will also have an opportunity to integrate human dimensions into local decision-making. Prerequisite: BIO 4416.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4337. Biology and Conservation of Sharks.**

This course examines the biology and conservation of sharks and their relatives (skates, rays, chimaeras, and sawfish). Topics to be examined include evolutionary history, distribution, anatomy and physiology, daily movements and migration, diet, reproduction, relationship with humans, fisheries, conservation, and field methods used in shark research.

Prerequisite: BIO 1331 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4338. Tropical Ecology and Conservation.**

In this course students will obtain a first-hand knowledge of the ecology, biodiversity, conservation, and culture of tropical ecosystems. This is an immersive and intensive study abroad course combining traditional lecture, field-based instruction, and primary literature-based discussions while observing actual tropical ecosystems. Prerequisite: BIO 1330, BIO 1130, BIO 1331 and BIO 1131; all with grades of C or better; must have a minimum 2.5 overall GPA.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4343. Fish Physiology.**

This course examines the primary physiological functions in fish, including how fish sense and interact with the environment, maintain their energetic metabolism (respiration, digestion and excretion), reproduce and maintain water balance. Students will learn about the diverse adaptations fish use to cope with environmental and physiological challenges. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4350B. Biological Implications of Water Planning in Texas.**

Current topics in understanding the biological implications of water planning in Texas. This course will be of particular interest to students who have a background in aquatic biology and who intend to stay in Texas post-graduation. Prerequisites will be determined by topic and faculty offering the course. May be repeated once with different emphasis.

**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 4350D. 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):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4350E. Techniques in Aquatic Biology.**

This course will provide hands on experience with a suite of physical, chemical, and biological sampling techniques and gear used in applied river studies. Students will be exposed to the fundamentals of data quality objectives, accuracy, precision, detection limits, data visualization, exploratory analysis, univariate and multivariate statistics.

**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 4350I. Bird Conservation and Management.**

This course is an introduction to the conservation and management of bird populations in an ecological context. Course covers a variety of species and spatial scales from landscape to ecoregion. Laboratory portion will involve field trips, intensive computer-based labs, and class discussion. Prerequisites: BIO 4416 or concurrent enrollment.

**3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4350J. 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. Prerequisites: BIO 1330 and BIO 1331 and BIO 2450, all with grades of "C" or better.

**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 4350K. Genomics.**

The course is a lecture covering modern genomics, including principles of genome function, the human genome, comparative genomics, genome sequencing, evolution and genomic 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. Prerequisite: BIO 2450 with a grade of "C" or better.

**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 4350L. Bacterial Genetics.**

This course will cover concepts and mechanisms involved in the genetics of Archaea and Bacteria.

**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 4350M. Wildlife Policy and Law in North America.**

This course provides the student with a historical and cultural context within which wildlife policy and law have developed in North America, particularly in the United States. Federal treaties, statutes, case law, and regulations pertaining to wildlife will be presented. Wildlife law from representative states will be referenced as well. Corequisite: BIO 4423 or BIO 4435 with a grade of "C" or better.

**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 4350N. Aquatic Toxicology.**

This course examines the basic concepts of aquatic toxicology, including uptake mechanisms, interactions and elimination of different toxicants. Students will understand how toxic substances impact freshwater and marine environments and identify potential health impacts to humans. Topics to be discussed include nutrients, metals, petroleum, radionuclides, plastics and emerging contaminants. Restricted to Junior standing. Prerequisite: A minimum 2.5 Overall GPA.

**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 4350P. Tropical Ecology and Conservation Lab.**

This laboratory course complements the lecture course BIO 4350O, 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 in tropical ecosystems. Corequisite: BIO 4350O.

**3 Credit Hours. 0 Lecture Contact Hours. 9 Lab Contact Hours.**

**Co-requisite(s):** BIO 4350O

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4350Q. 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. Must be at least a Junior to enroll with a minimum 2.5 Overall GPA.

**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 4350R. Microbial Biotechnology.**

This course provides an overview of how microbes (e.g., bacteria, viruses and yeast) are manipulated to solve practical problems through biotechnology. It is designed on topics of applied microbiology recommended by American Society of Microbiology. Prerequisites: BIO 2400 and BIO 2450 (or equivalent), with a grade of "C" or higher.

**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 4350S. Marine Resources.**

This course examines the economic importance of marine resources and the exploitation and fragility of the marine environment. Topics to be examined include ocean ownership, overfishing, aquaculture, shark finning, whaling, ocean mining, marine transportation, tourism, pollution, harvesting energy from the ocean and the importance of creating marine reserves.

**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 4350T. Field Biology of Ireland.**

In this course, students will use multiple techniques to explore biodiversity across multiple ecosystems in Ireland. Must be accepted into the Texas State in Ireland Study Abroad program.

**3 Credit Hours. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4350U. Ecology of Rarity.**

This course will examine the ecology of rarity and its ability to inform public awareness and environmental policy. This course will explore how we define rarity, persistence and viability, is rarity more or less common than might be expected, and is there anything we can or should do about it? Prerequisite: BIO 4416.

**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 4350V. Fish Physiology.**

This course examines the primary physiological functions in fish, including how fish sense and interact with the environment, maintain their energetic metabolism (respiration, digestion and excretion), reproduce and maintain water balance. Students will learn about the diverse adaptations fish use to cope with environmental and physiological challenges. Prerequisite: BIO 2450 with a grade of "C" or better.

**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 4350W. Biology and Conservation of Sharks.**

This course examines the biology and conservation of sharks and their relatives (skates, rays and sawfish). Topics to be examined include evolutionary history, distribution, anatomy and physiology, daily movements and migration, diet, reproduction, relationship with humans, fisheries, conservation, and field methods used in shark research.

Prerequisite: BIO 2450 with a grade of "C" or better.

**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 4350X. Issues in Irish Biodiversity and Conservation.**

In this course, students will learn about Irish flora and fauna, ecosystems, conservation strategies in areas of high ecological concern, and public involvement. Emphasis will be placed on case studies and service-learning opportunities. Prerequisite: BIO 1331 & BIO 1131, Plus student must be accepted into the Texas State in Ireland Study Abroad Program. Corequisite: BIO 4350T.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4350Y. Introduction to Laboratory Research Methods.**

This course is for students interested in undergraduate research and introduces the fundamental methods and practices utilized in biological research labs. This hands on course covers keeping a lab notebook, following standard protocols, and collecting/analyzing data. Student will be introduced to current research programs offered in the Biology department. Prerequisite: BIO 1330 and BIO 1331 with grades of "C" or better.

**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 4350Z. Diversity and Cultural Impact of Geoparks.**

Students will explore biological differences in diversity across Geoparks in the United States and Ireland. Additionally, students will study the cultural impact that Geoparks have on the local community and national policy by focusing on differences between science communication strategies and community engagement practices conducted at the parks. Prerequisite: Accepted into the summer Texas State Study Abroad program in Ireland.

**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 4351A. Vertebrate Endocrinology.**

This course teaches function and organization of the endocrine system. It describes the major endocrine glands, the synthesis and release of their hormone products, and the interaction with target tissues. Endocrine control of digestion, growth, reproduction, and homeostasis will be compared between mammals and other vertebrate groups. Prerequisite: BIO 2450 and CHEM 2342, all with a grade of "C" or better.

**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 4351D. Ecology of Temporary Waters.**

Temporary waters (which regularly go dry) are often overlooked. This course explores their diversity, their ecological role and how these systems are impacted by humans. We will also look at the species that rely on temporary waters, their special adaptations, and their populations and community dynamics.

**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 4351G. Omics Approach to Microbiology.**

The course will discuss contemporary approaches, techniques and bioinformatic tools used to study function and ecology in microbial communities. Topics covered will include microbiome, next-generation sequencing, and metaproteomics. Prerequisite: BIO 2450.

**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 4351H. 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.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4366. Medical Microbiology.**

This lecture-based course will cover pathogenic bacteria and their relationship to disease, epidemiology and the biological basis for virulence. Prerequisites: BIO 2400 and BIO 2450 with grades of C or higher. Students may take only one of BIO 4345, BIO 4350G or BIO 4445 for credit.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4369. Biosystematics.**

Biological systematics is a multidisciplinary component of most biological disciplines. Course topics include: classification schemes, homology, homoplasy, the application of nomenclature, and phylogeny reconstruction. The course will also present relevant issues in conservation, biodiversity cataloguing, museum and collection management, and identification methods/dichotomous keys. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4376. 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 based on topics of applied microbiology as recommended by American Society of Microbiology. Prerequisite: BIO 2400 and BIO 2450, all with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4377. Genome Informatics.**

The course will cover basic knowledge on genomics and its bioinformatics tools. Students will learn current topics on genomics and bioinformatics, and will analyze genomic data using statistical software. All the analyses will be performed using a personal and a cluster computer. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4400. Plants Important for Wildlife.**

This course explores plant and plant part (specifically gall, fruit, seed, and twig) identification, phylogenetics, co-evolution of plant defenses, economic and ecological impacts of plant uses by wildlife. Prerequisite: BIO 2410 or BIO 2450 all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4402. Earth Science I.**

The description and interpretation of earth phenomena considered from the standpoint of meteorology and astroscience. Includes field observations, methods of measurement and interpretation of data related to the physical environment and space technology. May not be counted toward a major or minor in biology. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4403. 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. May not be counted toward a major or a minor in biology. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4408. 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. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4410. Field Biology of Plants.**

Ecological relationships and natural history of plants, including historical geology, geography, soils, vegetational regions and surface geology of central Texas. Emphasis is placed on plant-soil-water relationships to develop conservation concepts. Students will make a representative collection of plants. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4411. Morphology of the Vascular Plants.**

The structure, life-cycles and evolution of fossil and living vascular plants. Emphasis on such topics as the origin of land plants, evolution of the ovule, angiospermy, the flower and fruit. Prerequisites: BIO 2450 with a grade of "C" or better; one year of Chemistry.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4412. Plant Anatomy.**

The anatomy of vascular plants stressing descriptive, development and comparative aspects of seed plants and the anatomical adaptations of plants to environmental factors. Prerequisites: BIO 2450 with a grade of "C" or better; one year of Chemistry.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4413. Parasitology.**

The biology and biological significance of the common parasites of man and animals. Prerequisites: BIO 2411 and BIO 2450, all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4415. 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 analysis. Prerequisites: BIO 2411 and BIO 2450, all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO



**BIO 4416. General Ecology.**

The ecological relationships that exist between organisms and those relationships that exist between organism and environment. Laboratory sessions will be devoted to literature review and/or specific ecological problems. This course or BIO 4454 is required of all biology majors. Prerequisites: BIO 2450; BIO 2410 or BIO 2411 or BIO 2400, with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$5; Fee - Lab BIO

**BIO 4418. 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

**BIO 4420. Natural History of the Vertebrates.**

Environmental relationships and natural history of vertebrates. Emphasis is upon taxonomy, speciation and biotic provinces. The laboratory will include field trips for the study and collection of animals in their natural habitats. Students will assemble a representative collection of animals. Prerequisites: BIO 2411, BIO 2450 with a grade of "C" or higher and permission of instructor required for non-wildlife majors. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4421. Ornithology.**

Introduction to anatomy, behavior, ecology and identification of birds of Texas. Laboratory will emphasize field studies of birds and their habitat requirements. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4422. Mammalogy.**

The taxonomy, distribution, ecology, behavior and evolution of mammals with particular emphasis on wild animals of the southwest. Laboratory will emphasize anatomy, identification, preparation of specimens and field exercises in the methods of population analysis. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or higher. BIO 4416 is also recommended.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4423. Wildlife Management.**

Applications of the principles of ecology and natural history to the management of wildlife habitats and control of wildlife populations. Laboratory will involve demonstrations and practice exercises with wildlife management techniques and instrumentation and field trips to observe wildlife management projects. Prerequisites: BIO 2410 and BIO 2411 and and BIO 2450, all with a grade of "C" or better. BIO 4416 or BIO 4421 or BIO 4422 is also recommended. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4425. Biometry.**

Basic principles of statistical methods as applied to biological problems such as sampling techniques, analysis of data, experimental design and population dynamics. Emphasis will be on practical application. Prerequisites: BIO 2450 with a grade of "C" or higher; MATH 1315.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 4434. 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. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4435. 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. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or better and permission of instructor required for non-wildlife majors.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4436. Tropical Biology.**

This course entails an analysis and evaluation of the governing principles of tropical ecosystems, including wildlife ecologies, geological processes, and environmental-cultural interactions. In the laboratories, students will compare ecological relationships that influence tropical biology, discuss peer-reviewed literature and examine tropical flora and fauna during field trips to regional sub-tropical areas. Prerequisite: BIO 2410 and BIO 2411, and BIO 2450, all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4441. 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: BIO 2450 and CHEM 2330 or CHEM 2341 or CHEM 2342 all with a grade of "D" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 4442. Experimental Techniques.**

Use of methods and instruments applicable to biological investigations, including colorimetry; UV-spectrophotometry; fluorescence; flame and atomic absorption spectrophotometry; paper, gas, gel filtration and ion exchange chromatography; radioactive counting; and electrophoresis. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4446. Microbial Ecology.**

This course will illustrate the wide variety of bacteria in nature, their interactions with other organisms and the environments, and their roles in global cycling of elements such as carbon, nitrogen, and sulfur. The laboratories will feature enrichments for selected groups of microorganisms (sulfate reducers, nitrogen fixers) and analysis of these isolates by microscopy, gas chromatography and radiochemical substrate utilizations. Prerequisites: BIO 2400 and BIO 2450 with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$25; Fee - Lab BIO

**BIO 4447. Microbial Physiology and Genetics.**

This course will cover fundamental concepts in bacterial physiology and genetics, including central and specialized metabolism, and unique aspects of bacterial genetics. Prerequisites: BIO 2400 and BIO 2450; CHEM 2142 and CHEM 2342, all with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$30; Fee - Lab BIO

**BIO 4448. Bacterial Genetics.**

This course will cover concepts and mechanisms involved in the genetics of Archaea and Bacteria. Prerequisite: BIO 2400 and BIO 2450, all with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4450. Physiological Ecology of Animals.**

This course brings together the principal concepts of environmental physiology of animals inhabiting the major ecological realms of the earth (land, air, sea, and fresh water). The biological problem associated with living in the various ecological realms will be discussed, and the biochemical and physiological adaptations of animals to their diverse habitats will be studied. Prerequisites: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 4454. Plant Ecology.**

Physiological ecology and community structure and function in the organization of terrestrial plant ecosystems. Quantitative vegetational sampling and the use of field and laboratory physiological equipment are included in the laboratory. (WI) Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$25; Fee - Lab BIO

**BIO 4455. Plant Physiology.**

Basic principles of plant physiology are studied in lecture and laboratory. One semester of organic chemistry is strongly recommended. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 4464. Vertebrate Anatomy.**

This course is a comparative study of vertebrate anatomy. Fossil histories are evaluated to understand how vertebrate radiation occurred in the geological past, along with changes in structure of organs and organ systems. Lab includes dissection of representative members of each major vertebrate group. Prerequisite: BIO 2450 with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 4465. 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. Prerequisites: BIO 2411 and BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 4470. Limnology.**

The physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnological sampling methods, chemical, and biological analysis of samples and hydrographic surveying are included in the laboratory. Prerequisites: BIO 2450 with a grade of "C" or better; one year of chemistry. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$25; Fee - Lab BIO

**BIO 4472. 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: BIO 2450; and BIO 2400, BIO 2410, or BIO 2411 with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**Course Fee:** \$5; Fee - Lab BIO

**BIO 4480. Cytology and Microtechnique.**

A study of cellular structure and microscopic technique. The lecture portion of the course presents cytology of all cell types and theoretical aspects of microscopy including light and electron-based technologies. The laboratory portion of the course provides training in standard light and electron microscopy, laser scanning confocal microscopy, and digital microscopy. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 4481. 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 biology department adviser and chair. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 0 Lecture Contact Hours. 15 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 4490. Principles of Developmental Biology.**

This course will cover basic principles of developmental biology in both plant and animal systems. The course will mainly address cell, molecular and genetic mechanisms underlying the development of model organisms, mainly focusing on *Drosophila* (animal) and *Arabidopsis* (plant). Prerequisite: BIO 2450 with grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**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|Header

**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 all with a grade of "C" or better.

**1 Credit Hour. 0 Lecture Contact Hours. 1 Lab Contact Hour.**

**Grade Mode:** Standard Letter

**BIO 5176. Microbial Biotechnology Laboratory.**

This laboratory-based course will cover use of microbes for biotechnological applications and is designed to provide practical explorations into fields of biotechnology. Topics include laboratory techniques for recombinant protein purification, fermentation, identification of markers in genetically modified food and bio-remediation of pollutants. Corequisite: BIO 5376.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**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.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**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 5299B. 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.

**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

**BIO 5304. Wildlife and Recreation: Impact and Management.**

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 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, oncogenes, 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 5319C. Ecotoxicology.**

Topics to be covered include sources, types, and fates 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. 0 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 5319G. Omics Approach to Microbiology.**

The course will discuss contemporary approaches, techniques and bioinformatic tools used to study function and ecology in microbial communities. Topics covered will include microbiome, next-generation sequencing, metaproteomics, and their applications to clinical, agricultural, environmental and industrial needs.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Exclude from 3-peat Processing|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 5327. Issues in Irish Biodiversity and Conservation.**

In this course, students will learn about Irish flora and fauna, ecosystems, conservation strategies in areas of high ecological concern, and public involvement. Emphasis will be placed on case studies and service-learning opportunities. Prerequisite: Student must be accepted into the Texas State in Ireland Study Abroad Program.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5328. Field Biology of Ireland.**

In this course, students will use multiple techniques to explore biodiversity across multiple ecosystems in Ireland. Prerequisite: Must be accepted into the Texas State in Ireland Study Abroad Program.

**3 Credit Hours. 0 Lecture Contact Hours. 12 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5329. Raptor Ecology.**

This course will examine the evolution, taxonomy, ecology, behavior, anatomy, physiology, and conservation of birds of prey of the world with emphasis on diurnal raptors, including those from Texas. Field trips will include at least two overnight visits to significant migration and overwintering areas.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5331. Human Dimensions of Wildlife and Fisheries Conservation.**

Humans play a role in nearly every aspect of wildlife and fisheries conservation. This course will provide students with principles, concepts, and case studies to understand how the human experience (e.g., culture, politics, economics) influences conservation outcomes. Students will also have an opportunity to integrate human dimensions into local decision-making.

**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

**Course Fee:** \$20; Fee - Lab BIO

**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 pursuing 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, evolution and genomic 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



**BIO 5350O. Tropical Ecology and Conservation.**

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 in tropical ecosystems.

**3 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.**

**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 in tropical ecosystems. Corequisite: 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

**BIO 5350T. Field Biology of Ireland.**

In this course, students will use multiple techniques to explore biodiversity across multiple ecosystems in Ireland. Must be accepted into the Texas State in Ireland Study Abroad Program.

**3 Credit Hours. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 5350U. Ecology of Rarity.**

This course will examine the ecology of rarity and its ability to inform public awareness and environmental policy. This course will explore how we define rarity, persistence and viability. Is rarity more or less common than might be expected, and is there anything we can or should do about it?

**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 5350X. Issues in Irish Biodiversity and Conservation.**

In this course, students will learn about Irish flora and fauna, ecosystems, conservation strategies in areas of high ecological concern, and public involvement. Emphasis will be placed on case studies and service-learning opportunities. Prerequisite: Student must be accepted into the Texas State in Ireland Study Abroad Program. Corequisite: BIO 5350T.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 5350Z. Diversity and Cultural Impact of Geoparks.**

Students will explore biological differences in diversity across Geoparks in the United States and Ireland. Additionally, students will study the cultural impact that Geoparks have on the local community and national policy by focusing on differences between science communication strategies and community engagement practices conducted at the parks. Prerequisite: Accepted into the summer Texas State Study Abroad program in Ireland.

**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 5351G. Omics Approach to Microbiology.**

This course covers contemporary approaches, techniques and bioinformatic tools used to study function and ecology in microbial communities. Topics covered will include microbiome, next-generation sequencing, metaproteomics, and their applications to clinical, agricultural, environmental and industrial needs.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 5356. Plant Physiology.**

Basic principles of plant physiology are studied in lecture and laboratory. Previous courses in biochemistry and genetics are strongly recommended.

**4 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5362. Environmental Impact Analysis.**

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 all with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5376. 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 design is based on topics of applied microbiology as recommended by American society of Microbiology.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5377. Genome Informatics.**

The course will cover basic knowledge on genomics and its bioinformatics tools. Students will learn current topics on genomics and bioinformatics, and will analyze genomic data using statistical software. All the analyses will be performed using a personal and a cluster computer.

**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

**Course Fee:** \$20; Fee - Lab BIO

**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 used.

**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.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**BIO 5400. Plants Important for Wildlife.**

This course explores plant and plant part (specifically gall, fruit, seed, and twig) identification, phylogenetics, co-evolution of plant defenses, economic and ecological impacts of plant uses by wildlife.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**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

**Course Fee:** \$25; Fee - Lab BIO

**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

**Course Fee:** \$25; Fee - Lab BIO

**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

**Course Fee:** \$25; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5411. Morphology of the Vascular Plants.**

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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**BIO 5419. Stream Ecology.**

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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5424C. Fish Physiology.**

This course examines the primary physiological functions in fish including how fish sense and interact with the environment, maintain their energetic metabolism (respiration, digestion and excretion), reproduce and maintain water balance. Students will learn about the diverse adaptations fish use to cope with environmental and physiological challenges.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 5424D. Vertebrate Endocrinology.**

This course teaches function and organization of the endocrine system. It describes the major endocrine glands, the synthesis and release of their hormone products, and the interaction with target tissues. Endocrine control of digestion, growth, reproduction, and homeostasis will be compared between mammals and other vertebrate groups.

**4 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5436. Tropical Biology.**

This course entails an analysis and evaluation of the governing principles of tropical ecosystems, including wildlife ecologies, geological processes, and environmental-cultural interactions. In the laboratories, students will compare ecological relationships that influence tropical biology, discuss peer-reviewed literature and examine tropical flora and fauna during field trips to regional sub-tropical areas.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5442. Experimental Techniques.**

Use of methods and instruments applicable to biological investigations, including colorimetry, UV-spectrophotometry, fluorescence, 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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5443. Fish Physiology.**

This course examines the primary physiological functions in fish including how fish sense and interact with the environment, maintain their energetic metabolism (respiration, digestion and excretion), reproduce and maintain water balance. Students will learn about the diverse adaptations fish use to cope with environmental and physiological challenges.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5448. 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 post-transcriptional regulation involving small non-coding RNA. In addition graduate students will also write a critical review on a research article from relevant topic.

**4 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5465. 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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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

**Course Fee:** \$30; Fee - Lab BIO

**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

**Course Fee:** \$20; Fee - Lab BIO

**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.

**4 Credit Hours. 0 Lecture Contact Hours. 15 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 5485. Scanning Electron Microscopy.**

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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 5490. Principles of Developmental Biology.**

This course will cover basic principles of developmental biology in both plant and animal systems. The course will mainly address cell, molecular and genetic mechanisms underlying the development of model organisms, mainly focusing on *Drosophila* (animal) and *Arabidopsis* (plant).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**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.

**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.

**9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit



**BIO 7100. 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.

**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 7102. Seminar in Aquatic Resources.**

Interactive discussion of timely issues and problems, designed to introduce students to the range of scientific, socioeconomic and policy issues likely to be encountered within the field of aquatic resources. All students seeking a doctoral degree in Aquatic Resources must enroll in BIO 7102 at least twice.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing

**Grade Mode:** Standard Letter

**BIO 7103A. Ecology and Society.**

Interactive discussion on relationships between society and the life-supporting ecosystems on which humans depend. Topics include roles of natural systems in social systems; effects of social, economic and political institutions on ecological systems and services; and the means by which humans develop and sustain desired ecological and social states.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103B. Aquaculture.**

The course comprises a survey of aquaculture production throughout the world. It also examines and discusses the impacts of aquaculture on nutrition, fisheries and the economy.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103C. Marine Pollution.**

This course will be an interactive discussion of scientific literature on the bioaccumulation and trophic transfer of pollutants in the marine environment. Topics will include metals, oil, PCBs and emerging contaminants.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 7103D. Molecular Biology of the Cell.**

Interactive discussion of current literature on molecular biology of the cell. The course is designed to discuss concepts and their applications and methodology associated with the structure and function of the cell at cellular and molecular level.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103E. Contemporary Problems in Ecology.**

This course is an interactive discussion of the theoretical foundations and empirical basis for controversial topics in ecology, designed to develop critical thinking skills, and the ability to evaluate and integrate the biological, chemical and physical factors that affect the structure, functions, and interactions characterizing communities and ecosystems.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103F. Molecular Genetics of Plant Development.**

The study of plant development is rapidly changing as plant genome projects discover a multitude of new genes, and their expression and interaction patterns are understood. This course is designed to discuss concepts in plant development, and developmental processes as pathways of gene regulatory activities.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103G. Ecohydrology.**

A review of the concept of ecohydrology, its scientific foundation, and its ecological-hydrological linkages. Current topics in ecohydrology in the literature will be discussed, including manipulation of biota and hydrology interactions in a landscape, and the possibility of augmenting the resilience of ecosystems to anthropogenic changes.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103H. Integrated Waterbird Management.**

This course focuses on the ecology and management of waterbirds, with an emphasis on the inland and coastal waterbirds of Texas. The basic ecology of waterbirds, waterbird management techniques, and waterbird habitat management will be discussed.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7103I. Avian Ecology and Evolution.**

This course is an interactive discussion of avian ecology and evolution, providing students with a critical examination of theories, hypotheses, and lab and field-based data that support or refute these hypotheses. This course also discusses peer-reviewed literature that challenges some paradigms in avian ecology and evolution.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7114. Collaborative Research.**

This course (concurrent enrollment allowed) allows Ph.D. level graduate students to initiate, conduct, and participate in collaborative research with graduate faculty of the Department of Biology that is in addition to research conducted under BIO 7303, BIO 7399A, or BIO 7699A. This course recognizes the collaborative nature of scientific investigation.

**1 Credit Hour. 1 Lecture Contact Hour. 1 Lab Contact Hour.**

**Grade Mode:** Standard Letter

**BIO 7120. Population Biology Seminar.**

This course facilitates exploration of current topics in population and conservation biology through reading and discussion of contemporary primary and secondary literature.

**1 Credit Hour. 2 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7199A. Dissertation.**

Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**BIO 7214. Collaborative Research.**

This course (concurrent enrollment allowed) allows Ph.D. level graduate students to initiate, conduct, and participate in collaborative research with graduate faculty of the Department of Biology that is in addition to research conducted under BIO 7303, BIO 7399A, or BIO 7699A. This course recognizes the collaborative nature of scientific investigation.

**2 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7299A. Dissertation.**

Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

**2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**BIO 7300. Communicating Science.**

This course explores how to successfully disseminate science through visualizations, oral presentations, and written works to multiple audiences. Special emphasis will be placed on communicating with the general public, media, granting agencies, and science peers.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7301. College Science Teaching.**

This course is designed for graduate students in the sciences who are interested in improving their science teaching and/or are interested in pursuing careers in academia. This course focuses on the central question, "How do college students best learn science, and thus how do we best teach them?"

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7302. Problems in Aquatic Resources.**

Individual study on specific state, national, or international aquatic resources issues, under direct supervision of a doctoral or associate faculty member. Students may not enroll in BIO 7302 more than twice for doctoral credit without the approval of the Graduate Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7303. Research.**

Research course for students who have not yet passed their Candidacy Exam, typically under direction of research-dissertation supervisor. Pre-candidacy students must enroll in course every semester until admission to Candidacy, although it may not be taken more than three times for doctoral credit without the approval of Graduate Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7308. History of Vegetation and Climate.**

An overview of past vegetation and its relationship to changing climate. Topics include principles of paleovegetation analysis, paleoclimatology, the rise of flowering plants, vegetation during the age of dinosaurs, the rise of the grasslands, and the Quaternary Ice Age. Prerequisites: Consent of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Grade Mode:** Standard Letter

**Course Fee:** \$15; Fee - Lab BIO

**BIO 7310. Global Aquatic Resources.**

Introduction to global, national, and regional aquatic resource issues, including scientific, environmental policy and socioeconomic components and perspectives. Water quantity and quality issues and their root causes in different regions of the world are examined, with an emphasis on case studies.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7312. Government Policy and Aquatic Resources.**

Examination of aquatic resources issues in federal, state, or local governments, including examination of goals and relations of different governmental entities to each other. Relevant international treaties, and federal and state statutes in which these policies are embodied, are examined.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7314. Collaborative Research.**

This course (concurrent enrollment allowed) allows Ph.D. level graduate students to initiate, conduct, and participate in collaborative research with graduate faculty of the Department of Biology that is in addition to research conducted under BIO 7303, BIO 7399A, or BIO 7699A. 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 7322. Scientific Method and Aquatic Resources.**

Analysis of the scientific method applied to ecological research, focusing on aquatic ecosystems. Topics include methods of reasoning and statistical inferences in research, strategies of scientific research in aquatic ecology, and scientific research as a social process.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7324. 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 7325. Wildlife and Recreation: Impact, Policy, and Management.**

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. Prerequisite: BIO 4416.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7326. Immunobiology.**

This lecture-based course will cover the mechanisms and biology of the innate and adaptive immune system. Emphasis will include relationship to cancer, transplantation, hypersensitivity (allergy), and disease. Students will evaluate current research in immunology.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7328. Integrated Waterbird Management.**

This course examines the principles and practical methodology of integrated waterbird conservation and management, including overview of waterbird ecology, techniques in monitoring and data collection related to population dynamics, and habitat parameters of waterbird species. Field trips may be required.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7336. Evolutionary Ecology.**

This course will use an evolutionary perspective to explore questions provided by natural selection and sexual selection through assessment of current theory and research related to topics such as competition, coevolution, and phenotypic plasticity. Students will achieve comprehension and familiarity with the field through discussions and writing.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7342. Virology.**

This course examines the structure, multiplication and genetics of bacterial, plant, and animal viruses as well as the role of viruses in human and plant disease. Students are expected to become familiar with the research literature in virology.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7346. Conservation Biology.**

Examination of the alteration of habitats and associated biological changes threatening the continued existence of species and basic ecosystems. Topics include conservation ethics, working paradigms, levels and loss of global biodiversity, conservation at population and ecosystem levels, restoration ecology, endangered species biology and conservation laws. Recent Advances are stressed.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7348. Aquatic Resources Economics.**

Examination of economic and related social issues for facilitation of sustainable aquatic resources for competing beneficial human uses and ecosystem maintenance, including valuation of aquatic ecosystem services. Prerequisite: BIO 7312 or consent of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7350. Aquatic Resources Law.**

Examination of treaties, state and federal laws, and regional and local regulations, affecting freshwater and coastal aquatic resources. The focus is on aquatic ecosystems, water quantity and quality and environmental conditions, including the availability, storage, use, and protection of aquatic resources. Prerequisite: BIO 7312 with a grade of "C" or better, or consent of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7353. Biogeography.**

Examines historical and ecological explanations of the geographic distribution of organisms including the role of geologic, climatic, and biologic changes. Emphasizes the historical and philosophical development of the science and modern methods of analysis. Prerequisites: Undergraduate evolution and ecology courses, or consent of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Grade Mode:** Standard Letter

**BIO 7355. Plant-Water Relations.**

Examination of the physiology and ecology of water use in higher plants, including the uptake, utilization, and movement of water, transpiration and adaptation to variable water availability including drought, and the ecological role of water in structuring plant communities. Prerequisite: BIO 3465 or equivalent with a grade of "C" or better, or consent of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7356. Pollution of Aquatic Ecosystems.**

Overview of the water quality degradation of aquatic ecosystems (rivers, lakes, wetlands, groundwater aquifers) and their living resources from point and nonpoint pollutant sources. Topics will include aquatic ecosystem pollution and impacts attributable to nutrients, heavy metals, organic chemicals, sediment, salinization, and acid rain. Field trips may be required.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7360A. Industry and Sustainable Aquatic Resources.**

Examination of industrial water needs and uses, the types and quantities of water pollutants produced by different industries, problems faced by industry regarding process water for different manufacturing activities, and the possibilities for industry to contribute to the goal of sustainable aquatic resources.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360B. Environmental Linkages and Sustainable Aquatic Resources.**

Introduction to the environmental relationships between humans and other living beings and the ecological systems in which they exist. Emphasis will be on the potential for individual environmental problems to have serious impacts on other environmental components, as well as the nature of these impacts.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360C. Role of State and Federal Courts in Protection and Maintenance of Aquatic Resources.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360D. Evolutionary Ecology.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360E. Advances in Water Quality Investigations.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360F. Approaches to Aquatic Resource Modeling.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360G. Molecular Techniques in Microbial Ecology.**

Lectures on molecular techniques used to analyze structure and function of uncultured microbial communities in the environment with selected examples of applications. Prerequisites: None.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360H. Parasites and Diseases of Fishes and Other Aquatic Animals.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. Prerequisites: Ichthyology.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Topics

**Grade Mode:** Standard Letter

**BIO 7360I. Bayesian Statistics for Biology.**

This course examines the theory and mathematical foundations of Bayesian statistics and provides instruction and experience conducting Bayesian analyses using computer-based procedures. The course emphasizes practical applications for Bayesian statistical procedures for problems in biological sciences.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360K. Evolution.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360L. Landscape and Biogeography of Texas.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360M. Wetland Ecology.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360N. Behavioral Ecology.**

Examination of evolutionary implications of behavioral interactions through the assessment of current theory and research related to cooperation and conflict, mating and parental conflict and sexual selection. Class will consist of lectures, discussions of recent primary literature, and scientific writing.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360P. Regulation of Plant Growth and Development.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360Q. Spatial Ecology of Animals.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course maybe repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360R. Community and Ecosystem Ecology.**

Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360S. Soil Biology.**

An introduction to the biology of soil systems, including the roles of biota in forming and maintaining soils, and the interactions between biotic and abiotic components in soils.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360T. Karst Hydrogeology and Geomorphology.**

An introduction to, and advanced understanding of, karst hydrogeology, geology, and geomorphology, with emphasis on field and theoretical applications of this information to the study of karst systems, and recognition and understanding of karst landforms at the surface and their relationships with subsurface processes. Pre-requisite: Graduate status and instructor's approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360U. Sustainability in a Changing World.**

Understanding the ecological-social interface, including policies, product development and actions towards sustainability, with emphasis on integrating and implementing theories and methods across disciplines, and improving the knowledge and experience base for public policy and decision-making regarding human-environment linkages within the context of sustainable development. Prerequisite: Instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360V. Techniques in Aquatic Biology.**

The course will provide hands on experience with a suite of physical, chemical, and biological sampling techniques and gear used in applied river studies. Students will be exposed to the fundamentals of data quality objectives, accuracy, precision, detection limits, data visualization, exploratory analysis, univariate and multivariate statistics.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter

**BIO 7360X. Communicating Science.**

This course explores how to successfully disseminate science through visualizations, oral presentations, and written works to multiple audiences. Special emphasis will be placed on communicating with the general public, media and granting agencies.

**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 7360Y. Applied Bioinformatics.**

This course provides an introduction to scripting and other computational techniques used for visualizing and analyzing large biological datasets. Computational techniques include sequence and structural alignment, data mining, phylogenetic tree construction, and data clustering using UNIX, Python, and R. Students will gain a solid foundation in broadly applicable bioinformatics skills.

**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 7360Z. College Science Teaching.**

This course is designed for graduate students in the sciences who are interested in improving their science teaching and/or are interested in pursuing careers in academia. This course focuses on the central question, "How do college students best learn science, and thus how do we best teach them?"

**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 7361A. Discipline-Based Educational Research Methods.**

This course will expose science graduate students to educational research in a practical setting, supervised by a professor experienced in conducting discipline-based educational research, focusing primarily on qualitative methods.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Topics

**Grade Mode:** Standard Letter



**BIO 7361B. Ecology of Temporary Waters.**

The course explores the diversity of temporary bodies of water and of the species that rely on them, including their special adaptations, population and community dynamics, the ecological role of temporary waters, and how these systems are impacted by humans. Background coursework or independent study in ecology is recommended.

**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 7361C. Advanced Genomics and Bioinformatics.**

This course provides hands-on experience in processing and analyzing data produced from contemporary genomics tools for thesis students with basic bioinformatics training. Prerequisite: 'B' or better in BIO7360Y and instructor approval.

**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 7361D. Raptor Ecology.**

This course will examine the evolution, taxonomy, ecology, behavior, anatomy, physiology, and conservation of birds of prey of the world with emphasis on diurnal raptors, including those from Texas. Field trips will include at least two overnight visits to significant migration and overwintering areas.

**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 7362. Environmental Impact Analysis.**

Examination of government regulations regarding environmental impact, content of environmental impact statements, procedure for impact studies, application of ecological principles to impact studies, and the review process for environmental impact statements, focusing on aquatic resources.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7366. Integrated Water Resources Management.**

Study of principles for integrated management of aquatic ecosystems, including drainage basin, regional, and transboundary dimensions. Other global issues (climate change, biodiversity, etc.) also are discussed as components of integrative approach for multi-functional programs for sustainable use of aquatic ecosystems. Prerequisites: BIO 7310 and BIO 7412 or consent of instructor.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7367. Behavioral Ecology.**

Examination of the evolutionary implications of behavioral interactions through the assessment of current theory and research related to social behavior, sexual selection and sexual conflict, and mechanisms of behavior. Students will achieve comprehension and familiarity with the historical development of the field of behavioral ecology through discussions and writing.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7399A. Dissertation.**

Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours.

**3 Credit Hours. 3 Lecture Contact Hours. 5 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**BIO 7401. Assessment Techniques for Aquatic Resources.**

The rationale for designing and implementing monitoring and sampling programs for aquatic resources is examined. General field and laboratory methods for assessing water quantity, water quantity and the status of aquatic ecosystems and their living resources, will be introduced. Field trips will be required.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 7402. Molecular Field Techniques.**

The application of molecular tools for identifying, quantifying, and interpreting biological diversity assessments in aquatic systems. The course focuses on micro organismal identification and vertebrate model systems.

**4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$30; Fee - Lab BIO

**BIO 7405. Statistics and Experimental Design I.**

Introduction to inferential statistics, including exploratory and confirmatory data analysis, estimation and hypothesis testing, analysis of variance and regression, and non-parametric techniques, as applied to aquatic resource issues. Computer applications emphasized.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7406. Statistics and Experimental Design II.**

Introduction to the principles of experimental design, including randomization, replication, sample-size determination, completely randomized and randomized block design, factorial design, repeated measure design, and analysis of variance and covariance, as applied to aquatic resource issues. Computer applications emphasized. Prerequisite: BIO 7405 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 7407. Instrumentation for Water Quality Analysis.**

An introduction to the theory and application of laboratory and field instrumentation and techniques for analysis of water quality. Prerequisite: CHEM 3410 or consent of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$30; Fee - Lab BIO

**BIO 7408. Fish Ecology and Conservation.**

Examination of the linkages and interactions between fish assemblages and communities and their population ecology. Issues related to flowing and pooled water systems and fisheries conservation also are discussed. Field trips may be required.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 7410. Aquatic Microbial Ecology.**

Examination of microbial organisms, communities, and interactions affecting the form, structure, and functional aspects of aquatic ecosystems. Field trips may be required. Prerequisite: BIO 2400. BIO 3440 (Microbiology) or consent of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 7412. Environmental Hydrology.**

Overview of the properties, distribution, and movement of water over and under the land surface and its relation to sustainable aquatic ecosystems, including quantitative methods to assess cumulative impacts of human activities on such systems. Field trips may be required. Knowledge of calculus recommended.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7414. Ecology of Infectious Diseases of Wildlife.**

Concepts of the ecology of infectious diseases in wildlife are studied in depth with emphasis on their application to the management and conservation of wildlife species and for the control of zoonotic diseases. Requires consent from the instructor to enroll.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7415. 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

**Course Fee:** \$20; Fee - Lab BIO

**BIO 7419. Stream Ecology.**

Study of ecological theories, concepts, and processes occurring at the population, community, and ecosystem levels of organization in running water. Laboratory includes sampling methods, descriptive and comparative studies, experiments, and critical discussion of literature. Field trips may be required.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$15; Fee - Lab BIO

**BIO 7421. Landscape Dynamics.**

Study of processes influencing energy and material flows, interactions and cycling in aquatic ecosystems, including system and spatial analysis of landscapes, aquatic ecosystems, land use characteristics, and associated human impacts. Field trips may be required. Knowledge of calculus recommended. Prerequisite: BIO 7412 or consent of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$15; Fee - Lab BIO

**BIO 7422. Wetlands Ecology.**

Study of the characteristics, classification, conservation and management of marshes and other periodically-inundated ecosystems, emphasizing the interactions of physical, chemical and biological factors. Field trips may be required. Prerequisite: BIO 4416 or consent of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 7424. Phycology.**

Examination of algae (phytoplankton, periphyton) and their structure, taxonomy, ecology and distribution.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$20; Fee - Lab BIO

**BIO 7426. Ecology and Management of Aquatic Macrophytes.**

Examination of aquatic macrophytes and their ecology, taxonomy, distribution and management. Field trips may be required.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**Course Fee:** \$15; Fee - Lab BIO

**BIO 7427. Principles of Population Biology I.**

Provides a foundation in theory and mathematics of basic population biology. The course is divided into modular components including defining evolutionary significant units, ecology of populations, genetics of populations, and evolutionary genetics. Prerequisites: BIO 4416 and BIO 2450, or permission of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7428. Principles of Population Biology II.**

Provides a foundation in theory and mathematics of basic population biology. The course is divided into modular components which include: 1) Ecology of Communities, 2) Evolution of Behavior, 3) Phylogenetic Methods, and 4) Biological Diversity and Conservation Biology. Prerequisite: BIO 7427 or permission of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7430. Mycology.**

This course provides an introduction to the organisms in the Kingdom Fungi and to fungus-like organisms, their ecology and evolution, and their role in industry and disease. Special emphasis will be placed on morphology, culturing, and using laboratory techniques for identification.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7433. Population Genetics.**

This course examines the theoretical foundations of population genetics, including the description of population genetic structure and the forces creating it. The course emphasizes application of principles to a wide range of current problems in evolution, systematics and ecology. Molecular methods, data interpretation and computer-based data analysis are emphasized.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**BIO 7434. Herpetology.**

A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. While cosmopolitan in scope, 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 7440. Aquatic Toxicology.**

Introduction to principles for identifying and assessing the adverse effects of chemicals and other compounds and mixtures on aquatic organisms and ecosystems.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$30; Fee - Lab BIO

**BIO 7447. Microbial Physiology and Genetics.**

Prokaryotes, including bacteria and archaea, are the most diverse group of organisms on earth. Many prokaryotes live in environments which are inhospitable to other life forms. This course covers major aspects of prokaryotic physiology and genetics that permit them to be so successful. Prerequisites: BIO 2400 and BIO 2450 or equivalents.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$30; Fee - Lab BIO

**BIO 7466. Phylogenetics.**

Study of the use of phylogenetic methodologies in aquatic research, including practical data collection, management, and analysis in the reconstruction of phylogenies. Laboratory exercises will introduce phylogenetic and DNA analysis software. Prerequisite: BIO 2450, BIO 4369 and BIO 5466, or consent of instructor.

**4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$25; Fee - Lab BIO

**BIO 7468. Groundwater Resources.**

Study of the geological, physical, chemical and biological factors influencing sustainable groundwater resources, including hydrologic linkages and interactions with surface aquatic resources. Emphasis will be on the karst aquifer systems of Central Texas, and other groundwater aquifer systems of the United States.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 7469. Introduction to Ecological Modeling.**

Mathematical models range from simple conceptual models to complex mechanistic models for mimicking behavior of natural systems. This course provides a broad overview of modeling objectives, techniques and assumptions, as well as the practical skills needed to conduct modeling projects. Computer applications emphasized. Prerequisite: MATH 2471 or equivalent or consent of instructor.

**4 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**BIO 7470. 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

**Course Fee:** \$15; Fee - Lab BIO

**BIO 7471. Reservoir Ecology.**

Study of the physical, geological, chemical, and biological factors that influence and form structural and functional aspects of reservoir ecosystems. Lab focuses on field, laboratory, and mathematical approaches to quantifying and managing these important ecosystems. Field trips may be required. Prerequisite: BIO 4470 or BIO 5470 or consent of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$10; Fee - Lab BIO

**BIO 7475. Restoration of Polluted Aquatic Resources.**

Overview of methods for treating or restoring aquatic resources degraded by pollution and related anthropogenic impacts. Topics include point and nonpoint source pollution of surface waters and groundwater aquifers, pollution from storage and waste disposal sites, aquatic habitat rehabilitation, and on-site methods. Field trips may be required. Prerequisite: BIO 7356 or consent of instructor.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**Course Fee:** \$15; Fee - Lab BIO

**BIO 7599A. Dissertation.**

Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

**5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**BIO 7699A. Dissertation.**

Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours.

**6 Credit Hours. 6 Lecture Contact Hours. 10 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit

**BIO 7999A. Dissertation.**

Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

**9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Credit/No Credit