TTU Undergraduate Courses

***Indicates it as a sustainability course. Otherwise it just includes sustainability.**

Agribusiness Economics

1. AGBE 2010 - World Food and Society

Lec. 3. Credit 3.
Food production and distribution for the advancement of societies in developed and developing countries.

2. AGBE 2100 - Economics of Agriculture

Lec. 3. Credit 3.
Economic principles as they relate to agriculture, and the place of agriculture and agribusiness in the national economy.

3. AGBE 3110 - Agricultural Marketing and Futures

Lec. 3. Credit 3.
Prerequisite: AGBE 2100. Institutions involved in marketing agricultural products and the use of futures and hedging.

4. AGBE 4030 - Agribusiness Management

Lec. 3. Credit 3.
Prerequisite: AGBE 2100 and AGBE 3400. Economics and business principles applied to farm management, resources allocation, budgeting, and records. Students who have not had prerequisites can request permission from the instructor.

5. AGBE 4120 (5120) - Natural Resource Economics

Fall. Lec. 3. Credit 3.
Prerequisite: AGBE 2100 or ECON 2010. Static and dynamic models of renewable and non-renewable resource allocation. Application of principles of economics will identify the causes, consequences, and ways of dealing with natural resource problems, including problems associated with fisheries, forests, water problems and land.

6. AGBE 4130 - Agricultural Policy

Lec. 3. Credit 3.
Prerequisite: AGBE 2100. Rural and urban values, farm problems, relationship of agriculture to public policy, policy vs. programs, and appraisal of program results

Agricultural Engineering Technology

7. AGET 2110 - Agricultural Engineering Technology

Fall. (E). Lec. 2. Credit 2.

Corequisite: AGET 2115. Application of engineering principles to agriculture through a selection of independent but related topics while also advancing the student's problem solving skills.

8. AGET 2115 - Agricultural Engineering Technology Laboratory
Fall. Lab. 2. Credit 1.
Corequisite: AGET 2110. Application of engineering principles to agriculture through a selection of independent but related topics.

9. AGET 3110 - Natural Resource Systems
Spring. Lec. 2. Credit 2.
Corequisite: AGET 3115. Application of engineering principles to surveying, soil and water conservation, and animal waste management.

10. AGET 3115 - Natural Resource Systems Laboratory
Spring. Lab. 2. Credit 1.
Corequisite: AGET 3110. Application of engineering principles to surveying, soil and water conservation, and animal waste management.

11. AGET 3560 - Turf Systems Irrigation Design
Summer and Fall (E). Lec. 2. Credit 2.
Corequisite: AGET 3565. Irrigation system design for turf-based systems including residential lawns, commercial properties, athletic fields, and golf courses. Irrigation scheduling and water demand are presented to provide management capabilities.

12. AGET 3565 - Turf Systems Irrigation Design Laboratory
Summer and Fall (E). Lab. 2. Credit 1.
Corequisite: AGET 3560. Residential, commercial, and athletic irrigation system assembly, installation, maintenance, and troubleshooting.

13. AGET 4610 (5610) - Greenhouse Structures and Landscaping Equipment
Fall. Lec. 3. Credit 3.
Selection, design, construction and operation of greenhouse structures and related nursery and landscaping equipment.

14. AGET 4620 (5620) - Agricultural Structures
Spring. (E). Lec. 3. Credit 3.
Planning; drawing; materials; principles of construction with respect to arrangement, location, and environmental control; and plan reading.

Horticulture

15. AGHT 3030 - Integrated Pest Management
Spring. (O). Lec. 2. Lab. 2. Credit 3.

Prerequisite: BIOL 1114. Introduction to the aspects of integrated pest management. Identification of plant disease and insect pest problems. Fundamentals of control: biological, cultural and chemical. Plant disease concepts including etiology, ecology and physiology.

16. AGHT 3250 - Arborist Services

Lec. 1. Lab 4. Credit 3.
Basic training and experience in professional tree care and aerial tree work. Climbing equipment provided, students provide personal protective equipment after instruction.

17. AGHT 3400 - Landscape Horticulture

Fall. Lec. 2. Lab. 2. Credit 3.
Prerequisite: AGRN 1100, AGRN 1110 or consent of instructor. Basic theory and principles of design for landscaping modern homes and businesses. Use of ornamental plants and special features. Installation, maintenance, and discussion of the effect of management on plant growth and health. Topics include pruning, fertilizer application, pest control, etc.

18. AGHT 3410 - Plant Propagation

Fall. Lec. 2. Lab. 2. Credit 3.
Prerequisite: AGRN 1100, AGRN 1110, BIOL 1114, or consent of instructor. Asexual and sexual propagation of plants by cuttings, layers, division, special structures, grafting, budding, seeds and tissue culture.

19. AGHT 3440 - Floral Arrangement

Fall. Lec. 1. Lab. 4. Credit 3.
Fundamentals and theory of floral design with emphasis on arrangements for the home and special occasions.

20. AGHT 3450 – Dendrology

Fall Lec. 2. Lab. 3. Credit 3.
Prerequisite: BIOL 2110 or consent of instructor. The study of trees and the identification of native and urban species commonly found in the mid-South. Adaptability of the species to various ecological conditions of forest ecosystems and landscape environments will be discussed.

21. AGHT 3460 - Interior Plantscaping

Spring. (E). Lec. 2. Lab. 2. Credit 3.
Identification, culture, production, and use of foliage plants in interior design; principles of design; and practices of maintenance.

22. AGHT 3470 - Landscape Plant Materials

Spring. (E). Lec. 2. Lab. 3. Credit 3.
Uses and the identification of tree, shrub, and herbaceous plant species for landscapes. Ornamental characteristics and the adaptability of the species to various landscape conditions will be discussed.

23. AGHT 4420 - Greenhouse Management and Crop Production
Spring. (E). Lec. 2. Lab. 3. Credit 3.
Prerequisite: AGHT 3410, AGET 4610 (5610), or request by advisor. Principles of greenhouse management and environmental controls; production, timing, harvesting, and marketing of commercial floricultural crops; pest control strategies; and nutrient film technique. Development of commercial production schedule required.

Agritourism

24. ATOU 4200 - Sustainable Tourism as Economic and Community Development*
Lec. 3. Credit 3.
Prerequisite: ATOU 2100 or consent of instructor. Sustainable tourism is a strategy for economic and community development in rural areas around the world. This course will trace the inception of these concepts from the United Nations World Tourism Organization and follow their application in various locations, both internationally and within the US. Focus will be given to various types of niche tourism to achieve economic and community development goals.

Agronomy

25. AGRN 1100 - Plant Science
Fall, Spring. Lec. 3. Credit 3.
Introduction to the fundamentals of plant science as related to the ecological principles of agronomic and horticultural crops.

26. AGRN 1110 - Plant Science Laboratory
Lab. 2. Credit 1.
Corequisite: AGRN 1100 unless credit for AGRN 1100 has previously been earned.

27. AGRN 2240 - Introduction to Soil Evaluation
Fall. Lab. 2. Credit 1.
For students interested in becoming members of the intercollegiate soil judging team.

28. AGRN 3020 - Crops in Sustainable Systems*
Lec. 2. Lab. 2. Credit 3.
Prerequisite: AGRN 1100 and AGRN 1110. Botany and classification, importance, cultural practices (including tillage systems), pest control, crop improvement, harvesting, and uses of the principal crops of Tennessee and the United States. Agroecosystem concepts will be emphasized.

29. AGRN 3210 – Soils
Lec. 2. Lab. 2. Credit 3.
An introduction to soil physical and biological properties and their relationship to plant growth, land use and environmental quality.

30. AGRN 3230 - Environmental Soil Science
Spring. Lec. 3. Lab. 2. Credit 4.
Prerequisite: AGRN 3210, AGRN 3220. Soil and water conservation as related to land use, land use planning, and impact of agriculture on the environment.

31. AGRN 3300 - Organic Farming
Lec. 2. Lab. 2. Credit 3.
An examination of organic crop production methods including improving the structure of soil and fertility, pest management, irrigation, season extension, vegetable and fruit crop production, harvesting, postharvest handling and marketing techniques.

32. AGRN 4110 (5110) - Forage Crops Production and Management
Spring. Lec. 3. Lab. 2. Credit 4.
Prerequisite: AGRN 1100, AGRN 1110 and AGRN 3210, AGRN 3220. Botany and classification, soil and climatic requirements, species adaptation, establishment and management of grasses and legumes for silage, hay, and temporary, permanent, and rotational pastures for ruminants, swine, and horses.

33. AGRN 4220 (5220) - Environmental Soil Chemistry
Lec. 3. Credit 3.
Prerequisite: AGRN 3210, AGRN 3220 or consent of instructor. Study of chemical composition of natural and anthropogenic material in soil and their reactions and movement in the soil environment.

Anthropology

34. ANTH 2002 - Non-Western Cultures
Lec. 3. Credit 3.
An introduction to the study of non-Western cultures and societies through their ideologies, language systems, ecologies, family structures, social stratification, religions and economic structures. A comparative approach will be emphasized.

35. ANTH 2100 - Cultural Ecology
Lec. 3. Credit 3.
Prerequisite: SOC 1010 or SOC 1100 or consent of instructor. Interaction between human cultural systems and the physical environment in prehistoric through modern times.

Biology

36. BIOL 1000 - Introduction to Biological Methods
Lec. 0. Lab. 2. Credit 1.
An introduction and orientation to the literature, research and computing skills utilized in the life sciences.

37. BIOL 1010 - Introduction to Biology I
Lec. 3. Lab. 2. Credit 4.
Introduction to concepts of biology and their relationships to current and future social problems. Non-biology majors only. Credit will not be given for both BIOL 1010 and BIOL 1105.

38. BIOL 1020 - Introduction to Biology II
Lec. 3. Lab. 2. Credit 4.
Note: BIOL 1010 is not a prerequisite. Survey of plant and animal diversity, introductory ecology, and man's impact on the environment. Non-biology majors only.

39. BIOL 1105 - Foundations of Biology
Lec. 3. Lab. 2. Credit 4.
A basic foundation in biological principles common to all organisms with an emphasis on molecules, cells and organelles, respiration, photosynthesis, metabolism and enzymatic function, genetics and inheritance, cellular reproduction, evolution, and speciation. Credit will not be given for both BIOL 1105 and BIOL 1010.

40. BIOL 1114 - General Zoology
Lec. 3. Lab. 2. Credit 4.
Prerequisite: BIOL 1105 is highly recommended. Introduction to the principles of Zoology.

41. BIOL 1310 - Concepts of Biology and Environment*
Lec. 2. Lab. 2. Credit 3.
Basic concepts of biology including botany, zoology, and environmental applications. This course will not count as a part of a biology sequence.

42. BIOL 2110 - General Botany
Lec. 3. Lab. 2. Credit 4.
Prerequisite: It is highly recommended that students wait until their Sophomore year to take this course. This course addresses the life cycles, morphology, and pylogeny of major clades of organisms, with an emphasis on fungi, protists, and plants.

43. BIOL 3120 - General Ecology
Lec. 3. Credit 3.
The relationship between plants and animals and their environment. This course cannot be taken as part of the university science requirement and credit will not be given for both BIOL 3120 and BIOL/WFS 3130.

44. BIOL 3130 - General Ecology
Lec. 3. Lab. 3. Credit 4.
The relationship between plants and animals and their environment. The laboratory provides examples of concepts discussed in lecture and analytical procedures used in interpreting data.

45. BIOL 3240 - Field Botany

Lec. 2. Lab. 3. Credit 3.
Prerequisite: BIOL 2110 and Junior Standing. Survey of regional flora (herbs, shrubs, & trees) focusing on gymnosperms and angiosperms. Emphasis on nomenclature, structural characteristics, identification of species using a dichotomous key, and characteristics of plant families.

46. BIOL 3330 – Entomology
Lec. 2. Lab. 2. Credit 3.
Common harmful and beneficial insects of this region and their control.

47. BIOL 3550 - Ecology (TN eCampus Course)
Credit 3.
Prerequisite: BIOL 1114 and BIOL 2110. Introduction to the basic concepts of ecology, and the study of organisms and their interactions with the environment delivered primarily via PowerPoint presentations. Note: This course is for teachers seeking a Biology Add-on Endorsement; it will not substitute for required ecology courses in Biological Sciences or related majors.

48. BIOL 4000 (5000) - General Parasitology
Lec. 3. Lab. 2. Credit 4.
Prerequisite: BIOL 1114, BIOL 3120 or BIOL 3130 or WFS 3130. Biology of animal agents and vectors of diseases with emphasis placed on medical parasitology and organisms that parasitize fish and wildlife species.

49. BIOL 4100 (5100) - Evolutionary Biology
Lec. 3. Credit 3.
Prerequisite: BIOL 3810 and BIOL 3130 or WFS 3130. Theories, evidences, principles, and examples of organic evolution. Emphasis on anatomical, chemical, ecological, geological, anthropological, and genetic factors.

50. BIOL 4130 (5130) - Environmental Microbiology*
Lec. 2. Lab. 2. Credit 3.
Prerequisite: BIOL 3200 or BIOL 3230. The function of microorganisms in the environment.

51. BIOL 4230 (5230) - Animal Behavior
Lec. 3. Credit 3.
Prerequisite: Junior Standing. Introduction to basic principles underlying the behavior of animals.

52. BIOL 4240 (5240) - Systematic Botany*
Lec. 2. Lab. 3. Credit 3.
Prerequisite: BIOL 3240. Principles of evolutionary relationships among major plan groups, with an emphasis on the phylogeny of gymnosperms and flowering plant families.

53. BIOL 4250 (5250) - Economic Botany

Lec. 3. Credit 3.
Prerequisite: BIOL 2110. Interrelationships between plants and people. Topics include a survey of the past, present, and future uses of plants and the role of conservation biology in the preservation of plant resources.

54. BIOL 4300 (5300) - Plant Speciation and Evolution
Lec. 3. Credit 3.
Prerequisite: BIOL 1114. Principles of the evolution of plants at the micro- and macroevolution levels, including a survey of relevant primary and secondary literature.

55. BIOL 4610 (5610) - Invertebrate Zoology
Lec. 2. Lab. 2. Credit 3.
Prerequisite: BIOL 3130 or WFS 3130. Biology of invertebrates with emphasis on morphology, systematics and ecology.

56. BIOL 4630 (5630) – Ornithology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior Standing. General survey of the class Aves with emphasis on morphology, identification and ecology of local birds.

57. BIOL 4650 (5650) - Marine Biology
Lec. 3. Lab. 2. Credit 4.
Prerequisite: BIOL 3130 or WFS 3130. An introduction to the study of the marine environment and marine organisms.

58. BIOL 4750 (5750) - Medical Microbiology
Lec. 2. Lab. 4. Credit 4.
Prerequisite: BIOL 3200 or BIOL 3230. A survey of microorganisms of medical importance with emphasis on the bacteria and viruses. Principles of infectious disease, including diagnostic methods and treatments. Laboratory exercises demonstrating methods of isolating and identifying pathogenic microorganisms.

59. BIOL 4780 (5780) – Phycology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior Standing. Introduction to freshwater algae.

60. BIOL 4810 (5810) – Ichthyology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior Standing. Identification, classification, anatomy, physiology, ecology and adaptations of fishes; emphasis on North American freshwater species.

61. BIOL 4820 (5820) – Mammalogy
Lec. 2. Lab. 3. Credit 3.

Prerequisite: Junior Standing. Classification, structure and function, phylogeny, and geographical distribution of mammals; emphasis on Tennessee mammals.

62. BIOL 4830 (5830) – Herpetology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior Standing. Classification, adaptations, habits, life histories, and geographical distribution of amphibians and reptiles; emphasis on North American species.

63. BIOL 4840 (5840) – Limnology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior Standing. Physiochemical and biological dynamics of inland water.

Gulf Coast Research Laboratory Program

64. MBIO 3000 - Oceanography I: Physical, Chemical and Geological
Summer. Credit 5.
Prerequisite: College Algebra and two semesters of Chemistry. Integration of chemical, geological. and physical oceanography to provide a multidisciplinary approach to the fundamentals of oceanography. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

65. MBIO 3010 - Oceanography II: Marine Biology
Summer. Credit 5.
Prerequisite: Eight semester hours of Biology. General introduction to marine biology with emphasis on local fauna and flora. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

66. MBIO 4030 (5030) - Marine Invertebrate Zoology
Summer. Credit 6.
Prerequisite: 16 semester hours of Biology. Structure, classification, phylogeny, and function in Protozoa through the Lophophorata. Observation of their ecology and behavior. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

67. MBIO 4040 (5040) - Parasites of Marine Animals
Summer. Credit 6.
Prerequisite: BIOL 3200 or BIOL 3230 or consent of instructor. Morphology, taxonomy, life histories, and host-parasite relationships. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

68. MBIO 4050 (5050) - Marine Ecology
Summer. Credit 5.
Prerequisite: 16 semester hours of Biology, including General Zoology, General Botany, and Invertebrate Zoology. Relationship of marine organisms to their environment. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

69. MBIO 4060 (5060) - Fauna and Faunistic Ecology of Tidal Marshes
Summer. Credit 4.
Prerequisite: 16 semester hours of Biology and Junior Standing or consent of instructor. Taxonomy, distribution, trophic relationships, reproductive strategies, and adaptations. Emphasis on northern Gulf marshes. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

70. MBIO 4070 (5070) - Marine Aquaculture
Summer. Credit 6.
Prerequisite: 16 semester hours of Zoology, including Invertebrate and Vertebrate Zoology of Ichthyology. Technology, principles, and problems of aquaculture. Emphasis on marine species. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

71. MBIO 4080 (5080) - Marine Ichthyology
Summer. Credit 6.
Prerequisite: 12 semester hours of Biology and Junior Standing. Marine Chordata, including lower groups and the mammals and birds. Emphasis on fishes. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

72. MBIO 4090 (5090) - Marine Microbiology
Summer. Credit 5.
Prerequisite: BIOL 3200 or BIOL 3230 or consent of instructor. Sampling procedures, taxonomy of marine bacteria, mineralization, microbial, fouling, pollution, and diseases of marine animals. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

73. MBIO 4200 (5200) - Marine PhycolSummer.
Credit 4.
Prerequisite: Eight semester hours of Biology, including introductory Botany or consent of instructor. Survey of the principal groups of marine algae and maritime flowering plants. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.ogy

74. MBIO 4210 (5210) - Coastal Vegetation
Summer. Credit 3.
Prerequisite: 10 semester hours of Biology, including General Biology. Aspects of coastal vegetation. Emphasis on local examples. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

75. MBIO 4220 (5220) - Salt Marsh Plant Ecology
Summer. Credit 4.
Prerequisite: General Botany, Plant Taxonomy, Plant Physiology, General Ecology or consent of instructor. Identification, composition, structure, distribution, primary productivity, ecology,

and development. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

76. MBIO 4410 (5410) - Marine Chemistry
Summer. Credit 6.
Prerequisite: 16 semester hours of Chemistry, three to six semester hours of Biology and Geology or consent of instructor. Chemical aspects of oceans and interactions of chemistry, biology, and geology in marine environments. This course is offered at the Gulf Coast Research Laboratory, Ocean Springs, MS.

Chemical Engineering

77. CHE 4300 (5300) - Introduction to Air Pollution
Lec. 3. Credit 3.
Prerequisite: CHE 4131 (5131). Problems of air pollution and their solutions. Analysis and design of devices for the control of air pollutants from chemical processes.

78. CHE 4660 (5660) - Biochemical Engineering
Lec. 3. Credit 3.
Prerequisite: CHE 4210 (5210) and Senior Standing or consent of instructor. Applications of Chemical Engineering principles to the study of biochemical systems.

79. CHE 4661 (5661) - Transport in Biochemical and Biological Processes
Lec. 2. Lab. 2. Credit 3.
Prerequisite: CHE 4210 (5210) or consent of instructor. Applications of chemical engineering principles to the study of biochemical and biological systems. Lab is centered around various techniques used in the biochemical and biological field.

Chemistry

80. CHEM 3005 - Elementary Organic Chemistry
Fall, Spring. Lec. 3. Lab. 3. Credit 4.
Prerequisite: CHEM 1020 or CHEM 1120. Aliphatic and Aromatic Organic Chemistry for students in Agriculture, Human Ecology, and Pre-Medical Technology. Not for Chemistry majors.

81. CHEM 3010 - Organic Chemistry I
Fall, Spring. Lec. 3. Lab. 3. Credit 4.
Prerequisite: CHEM 1120 with a grade of C or better or a minimum grade of B in CHEM 1010 and CHEM 1020. Study of carbon-containing compounds using the functional group approach and an emphasis in simple mechanisms of aliphatic and aromatic compounds.

82. CHEM 3020 - Organic Chemistry II
Fall, Spring. Lec. 3. Lab. 3. Credit 4.

Prerequisite: CHEM 3010 with a grade of C or better. Study of carbon-containing compounds using the functional group approach and an emphasis in simple mechanisms of aliphatic and aromatic compounds.

83. CHEM 3420 - Analytical Applications
Spring. Lec. 2. Lab. 3. Credit 3.
Prerequisite: CHEM 3410. The application of wet chemical and instrumental methods of analysis to real problems in chemistry, biochemistry and the environment.

84. CHEM 4610 (5610) - General Biochemistry
Fall. Lec. 3. Credit 3.
Prerequisite: CHEM 3005 or CHEM 3010. Chemistry of proteins, lipids, carbohydrates and nucleic acids. Includes study of pH, buffer system, and biological separation methods.

85. CHEM 4620 (5620) - General Biochemistry
Spring. Lec. 3. Credit 3.
Prerequisite: CHEM 4610 (5610). Intermediary metabolism, bioenergetics, and biosynthesis.

86. CHEM 4650 (5650) - General Biochemistry Laboratory
Spring. Lab. 6. Credit 2.
Prerequisite: CHEM 4610 (5610) or CHEM 4300. Laboratory techniques associated with contemporary general biochemistry to include buffer preparation, pKa determination, amino acid analysis, protein expression, separation and purification techniques, protein determination, enzymology, equilibrium and binding constant determinations, and carbohydrate analysis. The CHEM 5650 student will engage in additional procedures in some of the experiments.

87. CHEM 4710 (5710) - Environmental Chemistry
Fall. Lec. 3. Credit 3.
Prerequisite: CHEM 3005 or CHEM 3010, and CHEM 3410 or CHEM 3500 or CHEM 3510 (courses from the latter group may be taken concurrently.) Basic concepts of environmental chemistry.

88. CHEM 4720 (5720) - Advanced Environmental Chemistry
Spring. Lec. 2. Lab. 3. Credit 3.
Prerequisite: CHEM 4710 (5710). Advanced topics within environmental chemistry including emphasis on organic, inorganic, and analytical environmental chemistry. Case studies and contemporary literature in the field will be discussed.

Civil and Environmental Engineering

89. CEE 1020 - Connections to Civil and Environmental Engineering
Rec. 2. Credit 1.
Prerequisite: Freshman Standing. Engages the student in meaningful academic and non-academic activities introducing students to the CEE department and the civil engineering

profession. Emphasizes time management and study skills, department and university resources, faculty interaction, professional and student organizations, and the civil engineering profession.

90. CEE 3040 - Geotechnical Engineering Lab
Lab. 2. Credit 1.
Prerequisite: CEE 3030. Measurement of basic engineering properties of soils.

91. CEE 3413 - Environmental Engineering
Lec. 3. Credit 3.
Prerequisite: CHEM 1110 and MATH 2110. Fundamentals of environmental engineering with applications in water quality, water and wastewater treatment, solid waste management, air pollution, and hazardous waste management.

92. CEE 3420 – Hydraulics
Lec. 3. Credit 3.
Prerequisite: ME 3720. Fundamental principles and design of water and wastewater supply, stormwater and sanitary sewer systems and their components, including pipes, pumps, storage facilities, detention basins, open-channels, and culverts.

93. CEE 3430 - Environmental Engineering Lab
Lab. 2. Credit 1.
Prerequisite or corequisite: CEE 3413. Laboratory experiments to illustrate the application of engineering fundamentals to environmental systems.

94. CEE 4410 (5410) - Solid and Hazardous Waste Management
Lec. 3. Credit 3.
Prerequisite: CEE 3413 or consent of instructor. The collection and disposal of solid wastes. Treatment and disposal technologies of hazardous wastes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

95. CEE 4420 (5420) - Engineering Hydrology
Lec. 3. Credit 3.
Prerequisite: CEE 3420 or consent of instructor. Fundamental processes in the hydrologic cycle including precipitation, infiltration, and runoff. Quantitative approaches for engineering hydrology to estimate flows for a variety of design problems.

96. CEE 4430 (5430) - Water and Wastewater Engineering
Lec. 3. Credit 3.
Prerequisite: CHEM 1120 and CEE 3413 or consent of instructor. Analytical methods for use in water quality management of streams, lakes, reservoirs, and groundwater systems. Project design of water and wastewater treatment plants. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

97. CEE 4440 (5440) - Water Resources Engineering

Lec. 3. Credit 3.

Prerequisite: CEE 3420 or consent of instructor. Problems related to the planning and design of systems to manage water resources for flood-damage reduction, hydropower, and river navigation.

98. CEE 4450 (5450) - Water Quality Modeling

Lec. 3. Credit 3.

Prerequisite: CHEM 1120 and CEE 3413 or consent of instructor. Mathematical modeling of chemical and biological processes occurring in streams, lakes, and estuaries, emphasizing oxygen demand and nutrient processes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

99. CEE 4800 - Geotechnical Engineering

Lec. 3. Credit 3.

Prerequisite: CEE 3030 and GEOL 3210. (CEE 3020 and GEOL 3210 may be taken concurrently.) Soil physical properties, classification, permeability and seepage, consolidation, design, and analysis of foundations.

Criminal Justice

100. CJ 3500 - Wildlife Law Enforcement

Lec. 3. Credit 3.

State wildlife laws and practices used in their enforcement. Enrollment primarily restricted to WFS majors.

Economics

101. ECON 4120 - Natural Resource Economics

Lec. 3. Credit 3.

Prerequisite: AGBE 2100 or ECON 2010. Static and dynamic models of renewable and non-renewable resource allocation. Application of principles of economics will identify the causes, consequences, and ways of dealing with natural resource problems, including problems associated with fisheries, forests, water problems, and land.

102. ECON 4200 - Environmental Economics

Lec. 3. Credit 3.

Prerequisite: AGBE 2100 or ECON 2010. A detailed study of the economic foundations of Environmental Policy and common tools used by environmental economists to measure and analyze benefits and costs of environmental regulation and consider the characteristics of efficient regulation.

Environmental and Sustainable Studies

103. ESS 1020 - Connections to Environmental and Sustainability Studies*

Lec. 1. Rec. 2. Credit 1.
The course is designed to strengthen the student's connection to TTU by engaging the student in meaningful academic and nonacademic activities both in and out of the classroom. It emphasizes critical thinking in the formation of academic and social goals and support groups, and in self-management and development of study skills.

104. ESS 1100 - Introduction to Environmental Studies*
Lec. 3. Credit 3.
This course is an introductory course to the field of environmental studies. Environmental problems are complex, involving interconnections between people, ecosystems and the biosphere. The solution to these problems requires an understanding of diverse areas of study, including chemistry, biology, ecology, toxicology, hydrology, psychology, sociology, anthropology, economics, ethics, history, law, politics, literature and communication.

105. ESS 3000 - Introduction to Environmental Law*
Lec. 3. Credit 3.
Prerequisite: Junior standing or consent of instructor. The course presents the basics of environmental laws from local governments to international agreements emphasizing U.S. laws and the roles of federal and state agencies in our domestic legal. The interaction of law with policy formulation, implementation and enforcement, and opportunities for citizen involvement are reviewed.

106. ESS 3710 - Chemistry and the Environment*
Lec. 3. Credit 3.
Prerequisite: CHEM 1010. Concepts of environmental chemistry that include organic chemistry, polymer chemistry, the chemistry of the earth, water and air, biochemistry, and energy. A grade in ESS 3710 may be accepted as a replacement for a previous grade in CHEM 3710.

107. ESS 4001 - Society and the Environment: Capstone Experience Part 1.*
Lec. 3. Credit 3.
Prerequisite: Senior standing. The course is the first semester of a two semester sequence that will be a case study to learn about the environmental issues and possible solutions. The first semester course will address interdisciplinary approaches to environmental issues, research methods and grantsmanship.

108. ESS 4002 - Society and the Environment: Capstone Experience Part 2.*
Lec. 3. Credit 3.
Prerequisite: ESS 4001. The course topic will focus on a specific environmental issue facing society. The course will be conducted as a case study to learn about the environmental issues and possible solutions.

109. ESS 4300 - Environmental Management System*
Lec. 3. Credit 3.

The course is a case study that presents the student with the techniques, technologies, regulations and strategies that define industrial pollution prevention.

Exercise Science, Physical Education and Wellness

110. EXPW 3600 - Wilderness and Environmental Ethics
Lec. 3. Credit 3.
The purpose of this course is to introduce students to environmental problems and to explore the moral questions raised by these problems.

111. EXPW 4100 - Experiential Nature-based Outdoor Education and Recreation
Lec. 2. Lab. 2. Credit 3.
This course explores the relationship between outdoor recreation behavior and the natural environment and how the relationship benefits people and society.

Geography

112. GEOG 1010 - Weather and Climate*
Lec. 3. Credit 3.
Introduction to weather and climate, landforms, soils, vegetation, and water.

113. GEOG 1100 - Global Climate Change*
Lec. 3. Credit 3.
This is an introduction to the Earth's global climate from an Earth-systems perspective. We will investigate prehistoric and historic fluctuations in Earth's climate, the current climate system, and projections for future climate and climate impacts.

114. GEOG 1110 - World Geography*
Lec. 3. Credit 3.
This course examines the political, economic, demographic and environmental shifts happening in the world today. Throughout this course, students will be exposed to the following concepts: globalization, development of world regions, issues of people and land, diversity of cultures and regions, global changes and local responses, cultural and political landscapes, global economics, and environmental issues.

115. GEOG 1120 - Human Geography*
Lec. 3. Credit 3.
Distribution of people and their activities as they are related to the earth.

116. GEOG 1130 - Geography of Natural Hazards*
Lec. 3. Credit 3.
The societal and economic impact of natural hazards including flooding, hurricanes, tornadoes, volcanoes, earthquakes, landslides, disease, wildfire, drought, famine, and climate change. The response of governments, cultures, and individuals to natural hazards.

117. GEOG 2100 - Introduction to Meteorology

Lec. 3. Lab. 2. Credit 4.

An introduction to atmospheric science and elements controlling daily weather. Global and local scale atmospheric processes, atmospheric hazards, weather monitoring and technology, forecasting, global climates, and climate change.

118. GEOG 3010 - Geography of the United States

Lec. 3. Credit 3.

Prerequisite: GEOG 1010. The United States and its physical environment, resources and cultural development.

119. GEOG 3200 - Water Resources*

Lec. 3. Credit 3.

This course deals with water as a resource basic for life on Earth. Topics to be covered include: dams and reservoirs, irrigation, inter-basin transfers, river channel modification, flood control, water quality, and water law.

120. GEOG 3330 – Meteorology*

Lec. 3. Lab. 2. Credit 4.

Earth's atmosphere and the mechanics and causes of day to day weather changes.

121. GEOG 4150 (5150) – Geomorphology*

Lec. 2. Lab. 4. Credit 4.

Prerequisite: GEOL 2500. Analysis of landforms and processes that shape them.

122. GEOG 4650 (5650) - Environmental Applications of GIS*

Lec. 3. Credit 3.

Prerequisite: GEOG 4510 (5510). Applications of GIS in environmental sciences and engineering. Main emphasis is on approaches, scripting, and modeling exercises. Covers the scope of ecosystems, forestry, drainage basins, pollution modeling, and spatial analysis of contaminants in various environments using GIS as the main tool of analysis. Completion of a real-world GIS project is required.

123. GEOG 4711 (5711) – Hydrogeology*

Lec. 3. Lab. 2. Credit 4.

Prerequisite: GEOL 1040 and GEOL 1045. Occurrence and movement of ground water, well hydraulics, water quality, and pollution.

Geology

124. GEOL 1020 - Field Experiences in the Geosciences

Lec. 2. Credit 1.

This course will introduce students interested in science to the practice of scientific research in the field and the laboratory, with emphasis on the geosciences. Field trips and in-class activities will stimulate critical thinking and real-world problem-solving skills unique to the sciences. Current geosciences-related issues will be discussed in class (e.g. Sumatra tsunami, Himalayan earthquakes).

125. GEOL 1040 - The Dynamic Earth

Lec. 3. Lab. 2. Credit 4.

Origin and classification of minerals and rocks; geologic processes and landform development. Credit will not be given for both: 1)GEOL 1040 and GEOL 1310, 2)GEOL 1040 and GEOL 3210, and 3)GEOL 1310 and GEOL 3210.

126. GEOL 1045 - Earth Environment, Resources, and Society

Lec. 3. Lab. 2. Credit 4.

Application of physical geology principles to geologic hazards, environmental pollution, and land/resource use.

127. GEOL 1046 - Earth Environment, Resources and Society

Lec. 3. Credit 3.

Application of physical geology principles to geologic hazards, environmental pollution, and land/resource use. This course cannot be taken as part of the university natural sciences requirement and credit will not be given for both GEOL 1046 and GEOL 1045.

128. GEOL 1310 - Concepts of Geology

Lec. 2. Lab. 3. Credit 3.

Introduction to the earth sciences: minerals and rocks, resources, geologic processes, water, earthquakes, maps, folds and faults, geologic time, continental drift, weather, and climate. This course will not count as part of a geology sequence. Credit will not be given for both: 1)GEOL 1040 and GEOL 1310, 2)GEOL 1040 and GEOL 3210, and 3)GEOL 1310 and GEOL 3210.

129. GEOL 2000 - Earth Evolution and Life History

Lec. 3. Credit 3.

Prerequisite: GEOL 1040. Illustrate how biological and geological interactions have influenced life patterns and Earth history and how these processes continue to shape human history today. Also, the impact of human population upon these Earth systems.

130. GEOL 2010 - Topical Minicourse in Geology

Credit 1.

Independent study including library and outdoor projects. No formal classwork is required. Not intended for geosciences majors.

131. GEOL 2500 - Geological Fundamentals

Lec. 2. Lab. 2. Credit 3.

Prerequisite or corequisite: GEOL 1040. Basic geologic field techniques and map reading. Detailed study of rocks and minerals.

132. GEOL 2510 - Oceanography 1. Physical, Chemical and Geological

Summer. Credit 5.
Prerequisite: College algebra, eight semester hours of chemistry. Fundamentals of oceanography integrating chemical, geological, and physical oceanography. The following course is offered at the Gulf Coast Research Laboratories.

133. GEOL 3110 - Principles of Mineralogy and Petrology

Lec. 2. Lab. 4. Credit 4.
Prerequisite: GEOL 1040 and CHEM 1110. Physical properties of minerals; identification of basic rock-forming minerals, elements of rock classification, and megascopic properties of common rocks.

134. GEOL 3120 – Mineralogy

Lec. 2. Lab. 4. Credit 4.
Prerequisite: CHEM 1120, GEOL 3110 and MATH 1720. Geometrical crystallography; determination of silicate and nonsilicate minerals by physical properties, chemical tests, and Xray diffraction.

135. GEOL 3200 - Water Resources

Lec. 3. Credit 3.
This course deals with water as a resource basic for life on Earth. Topics to be covered include: dams and reservoirs, irrigation, inter-basin transfers, river channel modification, flood control, water quality, and water law.

136. GEOL 3210 - Geology for Engineers

Lec. 2. Lab. 2. Credit 3.
Introduction to principles of geology and practical application of geology to engineering problems. Credit will not be given for both: 1)GEOL 1040 and GEOL 1310, 2)GEOL 1040 and GEOL 3210, and 3)GEOL 1310 and GEOL 3210.

137. GEOL 3230 - Structural Geology and Tectonics

Lec. 3. Lab. 2. Credit 4.
Prerequisite: GEOL 1040 or GEOL 3210. The mechanisms of plate tectonics and the geologic structures that result from rock deformation; application of methods for structural analysis in the field and the lab.

138. GEOL 3350 – Paleobiology

Lec. 3. Credit 3.
Prerequisite: Junior standing and one of the following courses: GEOL 1040, GEOL 2000, BIOL 1010, BIOL 1020, BIOL 1105, or BIOL 1114. Survey of biologic and geologic principles related

to preservation, variation, classification, speciation, evolution, paleoecology, and biogeography or fossil invertebrates.

139. GEOL 3410 – Paleontology

Lec. 2. Lab. 4. Credit 4.
Prerequisite: GEOL 1040 or GEOL 1045 or BIOL 1105. Systematics, morphology, stratigraphic distribution, and evolutionary significance of all major taxa of invertebrate macrofossils and selected microfossils.

140. GEOL 3830 - Field Geology

Credit 4.
Prerequisite: GEOL 1040 and GEOL 2500. Introduction to field methods involving the identification and tracing of geologic formations, aerial mapping and structure contouring. Eight hours field work per week.

141. GEOL 4040 - Summer Field Geology

Credit 4-9.
Field course in geological mapping.

142. GEOL 4100 - Environmental Sedimentology

Lec. 2. Lab. 4. Credit 4.
Prerequisite: GEOL 1040. Basic sampling and analytic techniques to determine compositions and textures of non-lithified sediments and the use of grain-sized distributions to interpret depositional process. Field trips will be taken to examine modern river and coastal deposits.

143. GEOL 4110 - Sedimentation and Stratigraphy\

Lec. 3. Lab. 2. Credit 4.
Prerequisite: GEOL 1040 and GEOL 2500. Fundamental depositional processes, sedimentary structures, and facies models of siliciclastic and carbonate sedimentary rocks. Basic stratigraphy concepts, methods of correlation, and introduction to sequence stratigraphy.

144. GEOL 4150 (5150) – Geomorphology

Lec. 2. Lab. 4. Credit 4.
Prerequisite: GEOL 1040 and GEOL 2500 or consent of instructor. Analysis of landforms and processes that shape them.

145. GEOL 4200 - Geological Exploration Techniques

Lec. 3. Lab 2. Credit 4.
Prerequisite: GEOL 1040, GEOL 1045, and GEOL 2500. Practical techniques for geological exploration, with emphasis on environmental, mining, and petroleum industry applications. Surface and subsurface methods include geological mapping, drilling, core extraction, wireline logging and 2D/3D seismic.

146. GEOL 4210 - Advanced Historical Geology

Lec. 3. Credit 3.

Prerequisite: Completion of core curriculum in geology and GEOL 3410. Advanced treatment of the Earth's history concentrating on plate tectonics, evolution of the biosphere and chemical changes from the Archaean to the Holocene.

147. GEOL 4610 - Optical Mineralogy and Petrography

Lec. 2. Lab. 4. Credit 4.

Prerequisite: GEOL 3120. Theory and use of the petrographic microscope in mineral optics, and study of rocks in thin sections using the petrographic microscope.

148. GEOL 4650 (5650) - Applied Geochemistry

Lec. 3. Credit 3.

Prerequisite: GEOL 1040 and CHEM 1110. Application of geochemistry to mineral exploration, environmental pollution, public health, and geologic hazards. Three field trips required.

149. GEOL 4711 (5711) – Hydrogeology

Lec. 3. Lab. 2. Credit 4.

Prerequisite: GEOL 1040 and GEOL 1045; CHEM 1120; MATH 1830 or MATH 1730 (MATH 1910 is recommended); or consent of instructor. Occurrence and movement of ground water, well hydraulics, water quality, and pollution.

History

150. HIST 3900 - Environmental History

Lec. 3. Credit 3.

The history of human impact on the North American environment and the resulting effects on society.

Human Ecology, Food, Nutrition and Dietetics

151. HEC 3620 - Food Safety in Agritourism - Growing and Harvesting

Lec. 2. Lab. 1. Credit 3.

Prerequisite: HEC 3610. Further application of food and farm principles and regulations, with emphasis on planning, production, and processing of warm season crops. Students participate in dissemination of raw and processed products in various Agritourism settings.

152. HEC 4993 - Field Experience–Environmental Health Science

Credit 6

Prerequisite: HEC 4242, HEC major, senior standing. Supervised work experience with an Environmental Health Science professional for application of sanitation, inspection, disease control, and quality control skills. Course may be repeated one time.

Sociology

153. SOC 2100 - Cultural Ecology

Lec. 3. Credit 3.

Prerequisite: SOC 1010 or SOC 1100 or consent of instructor. Interaction between human cultural systems and the physical environment in prehistoric through modern times.

154. SOC 3600 - Environmental Sociology

Lec. 3. Credit 3.

Prerequisite: SOC 1010 or SOC 1100 or consent of instructor. Explores the relationship between society and the physical environment with emphasis on environmental usage patterns, environmental justice issues, and the causes and consequences of environmental pollution and over-population problems, with an orientation toward possible solutions of these problems.

Wildlife and Fisheries Science

155. WFS 3130 - General Ecology

Lec. 3. Lab. 3. Credit 4.

The relationship between plants and animals and their environment. The laboratory provides examples of concepts discussed in lecture and analytical procedures used in interpreting data.

156. WFS 3500 - Wildlife Law Enforcement

Lec. 3. Credit 3.

State wildlife laws and practices used in their enforcement.

157. WFS 4230 (5230) - Animal Behavior

Lec. 3. Credit 3.

Prerequisite: Junior standing. Introduction to basic principles underlying the behavior of animals.

158. WFS 4500 (5500) - National Wildlife Policy

Lec. 3. Credit 3.

Prerequisite: Eight semester hours of biology. Policies, agencies and laws that influence wildlife management on a national level.

159. WFS 4630 (5630) – Ornithology

Lec. 2. Lab. 3. Credit 3.

Prerequisite: Junior standing. General survey of the class Aves with emphasis on morphology, identification and ecology of local birds.

160. WFS 4640 (5640) - Waterfowl Ecology and Management

Lec. 2. Lab. 3. Credit 3.

Prerequisite: BIOL 3130 or WFS 3130. Advanced ecological principles as illustrated by ducks, geese, and swans, including habitat selection, morphological and behavioral adaptations,

intraspecific and interspecific interactions, and reproductive ecology. Field techniques for identifying species and management approaches are emphasized in the laboratory.

161. WFS 4650 (5650) - Marine Biology
Lec. 3. Lab. 2. Credit 4.
Prerequisite: BIOL 3130 or WFS 3130. An introduction to the study of the marine environment and marine organisms.

162. WFS 4660 (5660) - Wild Bird Ecology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: BIOL 3130 or WFS 3130 or concurrent enrollment. The ecology and natural history of selected avian species, emphasizing game species, endangered species, predators, and pests. Anatomy and procedures for identification are the focus of laboratories.

163. WFS 4670 (5670) - Wild Mammal Ecology
Lec. 2. Lab. 2. Credit 3.
Prerequisite: BIOL 3130 or WFS 3130 or concurrent enrollment. The natural history and ecology of selected mammal species, emphasizing game species, furbearers, endangered species, predators, and pests. Anatomy and procedures for identification are the focus of the laboratories.

164. WFS 4700 (5700) - Habitat Management
Lec. 2. Lab. 3. Credit 3.
Prerequisite: BIOL 3240. Description, principles and techniques of quantitative characterization of wildlife habitat types.

165. WFS 4710 (5710) - Fisheries Management
Lec. 3. Lab. 3. Credit 4.
Prerequisite: BIOL 3130 or WFS 3130. Theory, methods, and techniques of freshwater fisheries management. Field and laboratory.

166. WFS 4711 (5711) - Fisheries Management
Lec. 3. Credit 3.
Prerequisite: BIOL 3130 or WFS 3130. Classroom-based overview of theory, methods, and techniques of freshwater fisheries management.

167. WFS 4730 (5730) - Conservation Biology
Lec. 3. Credit 3.
Prerequisite: BIOL 3130 or WFS 3130. Advanced concepts of plant and animal conservation, including biodiversity, population genetics, habitat fragmentation, endangered and threatened species, and ecosystem management.

168. WFS 4740 (5740) - Wildlife Principles
Lec. 2. Credit 2.

Prerequisite: BIOL 3130 or WFS 3130. Classroom-based theory and principles of wildlife management.

169. WFS 4760 (5760) - Fish Culture
Lec. 2. Lab. 4. Credit 4.
Prerequisite: BIOL 3130 or WFS 3130. Cultural practices; hatchery operation, care of brood fish, transport and stocking; and the ecological requirements of hatchery species.

170. WFS 4770 (5770) - Nongame Species Management
Lec. 3. Credit 3.
Prerequisite: Junior standing. Advanced concepts of managing non-game species. Topics include urban wildlife, funding mechanisms, monitoring and inventory techniques, habitat management, rare species, and state wildlife action plans.

171. WFS 4790 - Wildlife Techniques
Summer. Lec. 2. Lab. 12. Credit 6.
Prerequisite: WFS 4740 (5740). Field-based techniques for studying and managing wildlife populations.

172. WFS 4810 (5810) – Ichthyology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior standing. Identification, classification, anatomy, physiology, ecology and adaptations of fishes; emphasis on North American freshwater species.

173. WFS 4820 (5820) – Mammalogy
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior standing. Classification, structure and function, phylogeny and geographical distribution of mammals; emphasis on Tennessee mammals.

174. WFS 4830 (5830) – Herpetology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior standing. Classification, adaptions, habits, life histories and geographical distribution of amphibians and reptiles; emphasis on North American species.

175. WFS 4840 (5840) – Limnology
Lec. 2. Lab. 3. Credit 3.
Prerequisite: Junior standing. Physiochemical and biological dynamics of inland waters.

http://catalog.tntech.edu/content.php?catoid=21&navoid=4013

TTU Graduate Courses
**Indicates it as a sustainability course. Otherwise it just includes sustainability.*
Agribusiness Economics
1. AGBE 4120 (5120) - Environmental and Natural Resource Economics
Fall. Lec. 3. Cr. 3.
Prerequisite: AGBE 2100 and/or ECON 2110, or consent of instructor. Issues and policies involving pollution, depletable and renewable resources, and sustainable development. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
Agronomy
2. AGRN 4110 (5110) - Forage Crops Production and Management
Lec. 3. Lab. 2. Cr. 4.
Prerequisite: AGRN 1010 and 2210. Botany and classification, soil and climatic requirements, species adaptation, establishment, and management of grasses and legumes for silage, hay, and temporary, permanent, and rotational pastures for ruminants, swine, and horses. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
3. AGRN 4120 (5120) - Crop Improvement
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: AGRN 1010 or consent of instructor. Objectives, genetic principles, and methods of crop improvement by conventional and genetic engineering methods. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
4. AGRN 4210 (5210) - Soil Fertility and Fertilizers
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: AGRN 2210 or consent of instructor. Properties of soils in relation to plant nutrition; fertilizer materials and their relationship to soil fertility. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
5. AGRN 4220 (5220) - Environmental Soil Chemistry
Lec. 3. Cr. 3.
Prerequisite: AGRN 2210 or consent of instructor. Study of chemical composition of natural and anthropogenic material in soil and their reactions and movement in the soil environment. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
6. AGRN 4230 (5230) - Soil Classification
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: AGRN 2210 or consent of instructor. Soil formation, morphology, and classification; methods of soil survey, and detailed mapping of an assigned area. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
7. BIOL 4120 (5120) - Protozoology
Lec. 3. Lab. 2. Cr. 4.
Prerequisite: BIOL 3200 or BIOL 3230. Diversity, ecology, and taxonomy of protozoa, and the importance of protozoa as agents of human disease and as model organisms for studying

eukaryotic cell biology. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

8. BIOL 4130 (5130) - Environmental Microbiology
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: BIOL 3200 or 3230. The function of microorganisms in the environment. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

9. BIOL 4330 (5330) - Plant Ecology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: BIOL 3130 or WFS 3130 Biotic and abiotic factors affecting the distribution and abundance of plant species, and the role of plants in ecosystem structure and function. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

10. BIOL 4610 (5610) - Invertebrate Zoology
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: 8 hours of BIOL/WFS courses, plus BIOL/WFS 3130, or consent of the instructor. Biology of invertebrates with emphasis on morphology, systematics, and ecology. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

11. BIOL 4650 (5650) - Marine Biology
Lec. 3. Lab. 2. Cr. 4.
Prerequisite: BIOL 3130 or WFS 3130. An introduction to the study of the marine environment and marine organisms. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

12. BIOL 6120 - Fishery Science
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: WFS 4710 (5710). Current concepts and practices of fishery science, especially those environmentally related.

13. BIOL 4750 (5750) - Medical Microbiology
Lec. 2. Lab. 4. Cr. 4.
Prerequisite: BIOL 3200 or 3230. A survey of microorganisms of medical importance, with emphasis on the bacteria and viruses. Principles of infectious diseases, including diagnostic methods and treatments. Laboratory exercises demonstrating methods of isolating and identifying pathogenic microorganisms. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

14. BIOL 4780 (5780) - Phycology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. Introduction to freshwater algae. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

15. BIOL 4810 (5810) - Ichthyology

Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. Identification, classification, anatomy, physiology, ecology, and adaptations of fishes; emphasis on North American freshwater species. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

16. BIOL 4820 (5820) - Mammalogy
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. Classification, structure and function, phylogeny, and geographical distribution of mammals; emphasis on Tennessee mammals. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

17. BIOL 4830 (5830) - Herpetology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. Classification, adaptations, habits, life histories, and geographical distribution of amphibians and reptiles; emphasis on North American species. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

18. BIOL 4840 (5840) - Limnology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing or consent of instructor. Physiochemical and biological dynamics of inland waters. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

19. BIOL 6140 - Fish and Wildlife Biometrics
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: WFS 4710 (5710) and BIOL 4220 (5220) or equivalents. Study and application of quantitative methods used to assess fish and wildlife populations. Estimation of parameters, hypothesis testing, and use of classical fisheries and wildlife statistical techniques.

20. BIOL 6350 - Management of Wetland Wildlife
Lec. 3. Lab. 3. Cr. 4.
Prerequisite: WFS 4700 (5700). Ecology and management of wildlife species occurring in wetland habitats, emphasis on waterfowl and southeastern fauna.

21. BIOL 6360 - Wetland Identification and Assessment
Lec. 3. Lab.3. Cr. 4.
Prerequisite: BIOL 6350. Advanced concepts of the physical, chemical, and biological properties of wetlands and how hydrology and geomorphology interact to create wetland ecosystems. field techniques for distinguishing wetlands from nonwetlands and for assessing functional capacity of wetland ecosystems will be covered.

22. BIOL 6370 - Management of Upland Wildlife
Lec. 3. Lab.3. Cr. 4.
Ecology and management of wildlife species occurring in upland habitats, emphasis on southeastern fauna.

23. BIOL 6600 - Microbial Ecology
Lec. 2. Lab. 4. Cr. 4.
Prerequisite: BIOL 3200 or 3230 or BIOL 4130 (5130). Topics will include role of microorganisms in nutrient cycling, techniques in sampling, enumeration, and activity measurements, distribution of microorganisms, diversity and adaptation, and microbial interactions including competition, symbioses, and predation.

24. BIOL 6630 - Animal Ecology
Lec. 2. Lab. 2. Cr. 3.
The relationship between animals and their environment; the structure, processes, and distribution of animal communities.

25. BIOL 6660 - Fish Ecology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: WFS 4710 (5710). Principles of the evolutionary ecology of fishes, including reproductive guilds, morphological and behavioral polymorphism, foraging, habitat selection, intraspecific and interspecific interactions, and stability of fish assemblages.

26. BIOL 6670 - Stream Ecology
Lec. 2. Lab. 4. Cr. 4.
Concepts in water chemistry and physics, hydrology, and sediments of lotic systems and their influences on ecological relationships. Stream production, metabolism, and energy flux relative to river continuum concepts will be emphasized through field studies and report preparation.

27. BIOL 6680 - Malacology
Lec. 1. Lab. 6. Cr. 3.
Prerequisite: Consent of instructor. Identification, classification, and ecology of freshwater bivalves. Emphasis on ecology of Ohio River basin species.

Chemical Engineering
28. CHE 4300 (5300) - Introduction to Air Pollution
Lec. 3. Cr. 3.
Prerequisite: CHE 3110. Problems of air pollution and their solutions. Analysis and design of devices for the control of air pollutants from chemical processes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

Chemistry
29. CHEM 4610 (5610) - General Biochemistry

Fall. Lec. 3. Cr. 3.
Prerequisite: CHEM 3010 or 3110. Chemistry of proteins, lipids, carbohydrates, and nucleic acids. Includes study of pH, buffer system and biological separation methods. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

30. CHEM 4620 (5620) - General Biochemistry
Spring. Lec. 3. Cr. 3.
Prerequisite: CHEM 4610 (5610). Intermediary metabolism, bioenergetics, biosynthesis. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

31. CHEM 4710 (5710) - Environmental Chemistry
Fall. Lec. 3. Cr. 3.
Prerequisite: CHEM 3005 or 3010 CHEM 3410, 3500 or 3510 Basic concepts of environmental chemistry. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

32. CHEM 4720 (5720) - Advanced Environmental Chemistry
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: CHEM 4710 (5710). Advanced topics within environmental chemistry, including emphasis on organic, inorganic and analytical environmental chemistry. Case studies and contemporary literature in the field will be discussed. CHEM 5720 students will be required to carry out a more extensive field project and present a paper on an advanced topic in environmental chemistry. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

33. CHEM 6210 - Advanced Organic Chemistry
Spring. Lec. 3 Cr. 3.
Prerequisite: CHEM 3120. Application of physical principles to the understanding of the structure and dynamics of organic compounds.

34. CHEM 6610 - Advanced Biochemistry
Fall. Lec. 3. Cr. 3.
Prerequisite: CHEM 4610 (5610). Current advanced topics in Biochemistry selected from recent peer reviewed literary journals. Instruction, with practical exercises, in the step-by-step stages of grant planning, locating funding sources, and writing successful grant proposals.

Civil and Environmental Engineering
35. CEE 4430 (5430) - Water and Wastewater Engineering
Lec. 3. Cr. 3.
Prerequisite: CEE 3413 or consent of instructor. Analytical methods for use in water quality management of streams, lakes, reservoirs, and groundwater systems. Project design of water and

wastewater treatment plants. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

36. CEE 4440 (5440) - Water Resources Engineering
Lec. 3. Cr. 3.
Prerequisite: CEE 3420 or consent of instructor. Problems related to the planning and design of systems to manage water resources for flood-damage reduction, hydropower, and river navigation. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

37. CEE 4450 (5450) - Water Quality Modeling
Lec. 3. Cr. 3.
Prerequisite: CEE 3413 or consent of instructor. Mathematical modeling of chemical and biological processes occurring in streams, lakes, and estuaries, emphasizing oxygen demand and nutrient processes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

38. CEE 6440 - Hydrometeorology
Lec. 3. Cr. 3.
Prerequisite: CEE 4420 (5420), Engineering Hydrology, or consent of instructor. Theory and observations of hydrological processes in land surface and atmosphere. Exchanges of mass, heat and momentum between soil, vegetation, or water surface and overlying atmosphere. Precipitation processes, radiation and clouds, atmospheric boundary layer dynamics, coupled balance of moisture and energy, soil moisture and climate feedbacks, hydroclimatology, monsoonal flow and thunderstorms. Emphasis on recent research and modern methods for data analysis and modeling.

39. CEE 6520 - Open-Channel Hydraulics
Lec. 3. Cr. 3.
Prerequisite: CEE 3420 or consent of instructor. Advanced topics in open-channel hydraulics, including design of hydraulic structures, gradually varied flow, unsteady flow, and flood routing techniques.

40. CEE 6610 - Applied Environmental Chemistry
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Consent of instructor. Theoretical concepts from inorganic, organic, physical, and biological chemistry as applied to the analysis of environmental engineering problems.

41. CEE 6620 - Applied Environmental Chemistry
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Consent of instructor. Theoretical concepts from inorganic, organic, physical, and biological chemistry as applied to the analysis of environmental engineering problems.

42. CEE 6710 - Environmental Engineering Unit Operations and Processes
Lec. 3. Cr. 3.
Prerequisite: Consent of instructor. An advanced study of the physical, chemical and biological unit operations processes for water and wastewater treatment.

43. CEE 6720 - Environmental Engineering Unit Operations and Processes
Lec. 3. Cr. 3.
Prerequisite: Consent of instructor. An advanced study of the physical, chemical and biological unit operations processes for water and wastewater treatment.

44. CEE 6750 - Environmental Modeling
Lec. 3. Cr. 3.
Prerequisite: CEE 4430 (5430) or consent of instructor. Mathematical modeling of chemical and biological processees occurring in streams, lakes, and estuaries, emphasizing oxygen demand and nutrient processes.

45. CEE 6760 - Environmental Microbiology
Lec. 2. Cr. 2.
Prerequisite: Consent of instructor. Study of the microorganisms of importance in connection with environmental engineering processes.

46. CEE 6770 - Environmental Engineering Laboratory
Lab. 3. Cr. 1.
Corequisite: CEE 6710 and CEE 6720. Environmental engineering laboratory experience related to unit operations and processes and environmental microbiology.

47. CEE 6780 - Environmental Engineering Laboratory
Lab. 3. Cr. 1.
Corequisite: CEE 6710 and CEE 6720. Environmental engineering laboratory experience related to unit operations and processes and environmental microbiology.

48. CEE 6840 - Environmental Applications of Remote Sensing
Lec. 3. Cr. 3.
Prerequisite: CEE 4420 (5420) or consent of instructor. Theory and techniques of remote sensing and their application to environmental analysis. Microwave, infrared, passive and active techniques on orbiting and geostationary platforms. Multi-sensor analysis, current and planned satellite missions, radar altimetry, estimation of precipitation, soil moisture, discharge, land use and land cover. Scale and uncertainty issues.

49. CEE 7210 - Water Quality Aspects of Impoundment
Lec. 3. Cr. 3.
Prerequisite: Consent of instructor. Water quality changes and their causative mechanisms that occur in water stored and released from impoundments. Study of reservoir water quality models.

50. CEE 7300 - Natural Systems Engineering
Lec. 3. Cr. 3.
Prerequisite: CEE 6720 or consent of instructor. A study of treatment of wastes through engineered natural systems. Wetlands, lagoons, and land application.

51. CEE 7320 - Degradation of Waste Organics
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: CEE 6760, CEE 6620, or consent of instructor. A study of physical, chemical, and biologically mediated degradation of waste organics. Emphasis is placed upon the catabolism of naturally occurring organic substrates in natural and engineered environments.
52. CEE 7310 - Hazardous Waste Remediation in Groundwater and Soil
Lec. 3. Cr. 3.
Prerequisite: CEE 6720 or consent of instructor. A study of processes for the remediation of hazardous waste contamination in groundwater and in soil. Water-soil interactions and transport of pollutants.

Economics
53. Econ 4200 (5200) - Environmental Economics
Lec. 3 Cr. 3
Prerequisite: AGBE2100 or ECON2010. A detailed study of the economic foundations of Environmental Policy and common tools used by environmental economists to measure and analyze benefits and costs of environmental regulation and consider the characteristics of efficient regulation.

Environmental and Sustainable Studies
*54. ESS 4300 (5300) - Environmental Management System**
Cr. 3.
The course is a case study that presents the student with the techniques, technologies, regulations, and strategies that define industrial pollution prevention. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

*55. ESS 6510 - Programming GIS**
Lec. 3. Cr. 3.
Python is a free and easy to learn language, tightly integrated into ArcGIS 10. This course introduces students to Python scripting to increase productivity and management of GIS data and adding more function to the projects.

*56. ESS 6520 - GIS Project Development and Management**
Lec. 3. Cr. 3.
Prerequisite: Senior Standing. Knowledge and skills for developing GIS projects will be introduced in the course. Students will be exposed to organizational management and design of GIS projects. STudents will be introduced to various projects and use the real-world projects as the template to approach GIS project development.

Environmental Sciences Agriculture
*57. EVSA 6010 - Environmental Agriculture**
Lec. 3. Cr. 3.
Provides a summary of the actual and/or relative environmental impacts of existing and emerging agricultural production technologies.

Environmental Sciences Biology
*58. EVSB 6010 - Environmental Biology**
Lec. 3. Cr. 3.
Biological concepts, community and ecosystem structure and function, population biology, water pollution, land and wildlife resources, endangered and threatened species, resource management, human impact, and environmental economics. This course cannot be taken for credit toward graduation by students with a degree or concentration in biology or wildlife and fisheries sciences.

59. EVSB 7050 - Environmental Risk Assessment
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: BIOL 6060 and EVSC 6010. Assessment of ecological risk associated with new chemicals and effluents, existing chemicals and mixtures of chemicals, and human actions.

60. EVSB 7060 - Ecological Toxicology
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: BIOL 6060 and EVSC 6010. A study of the mechanisms of toxicity in terrestrial and aquatic ecosystems, including the measurement of response, learning and teaching devices. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus. uptake, metabolism, and excretion of toxicants; design and interpretation of toxicity tests, hazard evaluation, risk assessment, and toxics reduction plans; fate and transport processes and advanced approaches in automated computer-assisted monitoring will be evaluated.

61. EVSB 7110 - Environmental Approaches to Fisheries Management
Lec. 3. Lab. 2. Cr. 4.
Prerequisite: WFS 4710 (5710) or BIOL 6630. An in-depth analysis of current fisheries management practices assessed from the ecosystem perspective.

62. EVSB 7120 - Endangered Species Biology
Lec. 3. Lab. 3. Cr. 3.
The biology, ecology, management, and recovery of threatened and endangered species.

63. EVSB 7130 - Wetlands Ecology
Lec. 3. Lab. 3. Cr. 4.
Ecology and legal issues concerning the management of wetland habitats and species.

64. EVSB 7140 - Wildlife and Fisheries Nutrition
Lec. 3. Cr. 3.
The nutritional and foraging ecology of wild fish, amphibians, reptiles, birds, and mammals.

65. EVSB 7150 - Population and Community Ecology
Lec. 3. Cr. 3.
Prerequisite: BIOL 3130 or WFS 3130. Empirical and theoretical concepts in ecology at the population and community levels, including population growth and regulation, species interactions, community assembly and dynamics, metapopulation ecology, and landscape ecology.

66. EVSB 7210 - New and Re-emerging Environmental Human Pathogens
Lec. 3. Cr. 3.
Prerequisite: 7 hours of microbiology courses or equivalent. Aspects of emerging human pathogens, including case histories of outbreaks, methods of detection in food and water, and techniques for enumeration and identification.

67. EVSB 7220 - Molecular Ecology and Evolution Seminar
Lec. 1. Cr. 1.
Prerequisite: BIOL 3130 and BIOL 4150 (5150). Review of current literature concerning application of modern molecular techniques to solve ecological and evolutionary questions. Course may be taken up to 3 times for credit.

68. EVSB 7230 - Molecular Ecology and Evolution
Lec. 3. Lab. 3. Cr. 4.
Role of molecular techniques in the study of ecology and evolution, including techniques used to study phylogeny, microorganism detection, population structure, gene flow, and kinship.

69. EVSB 7310 - Plant Ecology
Lec. 3. Lab. 3. Cr. 4.
Interrelationships between plants and their environment and evaluation of community structure.

70. EVSB 7320 - Aquatic Botany
Lec. 3. Lab. 3. Cr. 4.
Anatomy, ecology, morphology, physiology, reproductive biology, evolution, and taxonomy/systematics of aquatic plants.

71. EVSB 7970 - Topics in Environmental Biology
Lab. 2-8. Cr. 1-4.
Prerequisite: Consent of instructor. Special study in an approved field under the supervision of a member of the graduate faculty. Course may be taken for credit more than once for a maximum of six (6) hours of credit.

Environmental Sciences Chemistry

72. EVSC 6010 - Environmental Chemistry

Lec. 3. Cr. 3.

Prerequisite: Graduate standing in environmental sciences; one (1) year of chemistry. This is a broad based course applying the fundamentals of chemistry to the environment. This course cannot be taken for credit toward graduation by students with a concentration in chemistry.

73. EVSC 7110 - Water, Soil, and Air Chemistry—Part I

Lec. 3. Cr. 3.

Prerequisite: CHEM 4520 (5520), CHEM 4710 (5710), or consent of instructor. Composition of waters and soils; kinetics and thermodynamics of environmental chemical and physical processes in waters and soils. Equilibrium modeling exercises are employed to prepare students for professional activities, and to reinforce course material.

74. EVSC 7120 - Water, Soil, and Air Chemistry—Part II

Lec. 3. Cr. 3.

Prerequisite: EVSC 7110 or consent of instructor. Electrochemistry and solubility of soil minerals. Kinetics, reaction dynamics, photochemistry, and heterogeneous phase chemistry of the troposphere and stratosphere. Students will become familiar with watershed modeling and the use of geographical information systems in environmental chemistry.

75. EVSC 7210 - Organic Chemistry in the Environment

Lec. 3. Cr. 3.

Prerequisite: CHEM 3520 and CHEM 6210 or consent of instructor. Introduction to specific organic compounds, their physical and chemical properties, chemical and photochemical transformation reactions and mechanisms in the environment, and literature case studies effectively used in their decontamination.

Environmental Geology

76. EVSG 6010 - Environmental Geology

Lec. 3. Cr. 3.

Prerequisite: Consent of instructor. Introduction to geology and the application of geologic knowledge to issues and potential solutions of problems arising from the interaction of human activities and natural earth processes.

Environmental Sciences Social

77. EVSS 6010 - Environmental Social Policy

Lec. 3. Cr. 3.

Prerequisite: Consent of instructor. Social, political, legal and scientific issues that influence environmental policy decisions.

Geography

78. GEOG 4711 (5711) - Hydrogeology
Lec. 3. Lab. 2. Cr. 4.
Prerequisite: GEOL 1040 and GEOL 1045. Occurrence and movement of ground water, well hydraulics, water quality, and pollution. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.
Geography
79. GEOL 4300 (5300) - Environmental Aqueous Geochemistry
Lec. 3. Cr. 3.
Prerequisite: GEOL 1040, CHEM 1010 or CHEM 1110, or consent of instructor.

80. GEOL 4320 (5320) - Petroleum Geology
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: GEOL 3230 and 4110. Origin and accumulation of petroleum and natural gas. Subsurface exploration techniques involving geophysical well-logs and seismic stratigraphy. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

81. GEOL 4330 (5330) - Environmental Geology
Lec. 2. Lab. 2. Cr. 3.
Application of geologic knowledge to the solution of problems arising from the interaction of human activities and natural earth processes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus

82. GEOL 4650 (5650) - Applied Geochemistry
Lec. 3. Cr. 3.
Prerequisite: GEOL 1040 and CHEM 1110. Application of geochemistry to mineral exploration, environmental pollution, public health and geologic hazards. Three (3) field trips required. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

83. GEOL 4720 (5720) - Advanced Hydrogeology
Lec. 3. Cr. 3.
Prerequisite: GEOL 4710 (5710) and MATH 1810 (MATH 1820 is recommended) or consent of instructor. Methods of aquifer remediation and groundwater modeling, case studies of groundwater contamination. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

Horticulture
84. AGHT 4510 (5510) - Fruit and Vegetable Production
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: AGHT 3400 or 3410, AGRN 4210 (5210), or consent of instructor. Fundamental principles of tree fruit and small fruit, and field and greenhouse vegetable production. Cultural

and environmental management; systems of harvesting, storing, marketing. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

85. AGHT 4530 (5530) - Greenhouse Crop Production
Lec. 2. Lab. 2. Cr. 3.
Prerequisite: AGHT 4420 or consent of instructor. Production, timing, harvesting, and marketing of bedding plants and floricultural crops grown in commercial greenhouses; nutrient film technique. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

Marine Biology
86. MBIO 4030 (5030) - Marine Invertebrate Zoology
Summer. Cr. 6.
Prerequisite: 16 semester hours of biology. Structure, classification, phylogeny, and function in Protozoa through the Lophophorata. Observation of their ecology and behavior. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

87. MBIO 4040 (5040) - Parasites of Marine Animals
Summer. Cr. 6.
Prerequisite: BIOL 3110, or 3130, or consent of instructor. Morphology, taxonomy, life histories, and host-parasite relationships. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

88. MBIO 4050 (5050) - Marine Ecology
Summer. Cr. 5.
Prerequisite: 16 semester hours of biology, including General Zoology, General Botany, and Invertebrate Zoology. Relationship of marine organisms to their environment. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

89. MBIO 4060 (5060) - Fauna and Faunistic Ecology of Tidal Marshes
Summer. Cr. 4.
Prerequisite: 16 semester hours of biology and Junior standing, or consent of instructor. Taxonomy, distribution, trophic relationships, reproductive strategies and adaptations. emphasis on northern Gulf marshes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

90. MBIO 4070 (5070) - Marine Aquaculture
Summer. Cr. 6.
Prerequisite: 16 semester hours of zoology, including invertebrate and vertebrate zoology of ichthyology. Technology, principles, and problems of aquaculture. Emphasis of marine species. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

91. MBIO 4080 (5080) - Marine Ichthyology
Summer. Cr. 6.
Prerequisite: 12 semester hours of biology and junior standing. Marine Chordata, including lower groups and the mammals and birds. Emphasis on fishes. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

92. MBIO 4090 (5090) - Marine Microbiology
Summer. Cr. 5.
Prerequisite: BIOL 3110 or consent of instructor. Sampling procedures, taxonomy of marine bacteria, mineralization, microbial, fouling, pollution, and diseases of marine animals. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

93. MBIO 4100 (5100) - Marine Fisheries Management
Summer. Cr. 4.
Prerequisite: Consent of instructor. Overview of practical marine fishery management program. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

94. MBIO 4200 (5200) - Marine Phycology
Summer. Cr. 4.
Prerequisite: 8 semester hours of biology, including introductory botany, or consent of instructor. Survey of the principal groups of marine algae and maritime flowering plants. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

95. MBIO 4210 (5210) - Coastal Vegetation
Summer. Cr. 3.
Prerequisite: 10 semester hours of biology, including general biology. Aspects of coastal vegetation. Emphasis on local examples. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

96. MBIO 4220 (5220) - Salt Marsh Plant Ecology
Summer. Cr. 4.
Prerequisite: General botany, plant taxonomy, plant physiology, general ecology, or consent of instructor. Identification, composition, structure, distribution, primary productivity, ecology, and development. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

97. MBIO 4410 (5410) - Marine Chemistry
Summer. Cr. 6.

Prerequisite: 16 semester hours of chemistry, 3-6 semester hours of biology and geology or consent of instructor. Chemical aspects of oceans and interactions of chemistry, biology, and geology in marine environments. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

98. MBIO 4440 (5440) - Behavior and Neurobiology of Marine Animals
Summer. Cr. 4.
Prerequisite: 16 semester hours of zoology and/or psychology, or consent of instructor. Behavior, neuroanatomy, and neurophysiology. Emphasis on neural mechanisms underlying behavior. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

Wildlife and Fisheries Science
99. WFS 4220 (5220) - Biostatistics
Lec. 3. Cr. 3.
Probability and frequency distribution; statistical populations and samples; and tests of hypotheses used in biological research. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

100. WFS 4230 (5230) - Animal Behavior
Lec. 3. Cr. 3.
Prerequisite: Junior standing. Introduction to basic principles underlying the behavior of animals. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

101. WFS 4500 (5500) - National Wildlife Policy
Lec. 3. Cr. 3.
Prerequisite: 8 semester hours of biology. Policies, agencies, and laws that influence wildlife management on a national level. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

102. WFS 4630 (5630) - Ornithology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. General survey of the class Aves with emphasis on morphology, identification, and ecology of local birds. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

103. WFS 4640 (5640) - Waterfowl Ecology and Management
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: WFS 3130 and WFS 4740 (5740) or consent of instructor. Advanced ecological principles as illustrated by ducks, geese, and swans, including habitat selection, morphological and behavioral adaptations, intraspecific and interspecific interactions, and reproductive ecology. Field techniques for identifying species and management approaches are emphasized in

the laboratory. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

104. WFS 4650 (5650) - Marine Biology
Lec. 3. Lab. 2. Cr. 4.
Prerequisite: BIOL 3130 or WFS 3130. An introduction to the study of the marine environment and marine organisms. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

105. WFS 4660 (5660) - Wild Bird Ecology
Lec. 2. Lab.3. Cr. 3.
Prerequisite: BIOL 3130 or WFS 3130. The ecology and natural history of selected avian species, emphasizing game species, endangered species, predators, and pests. Anatomy and procedures for identification are the focus of laboratories. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

106. WFS 4670 (5670) - Wild Mammal Ecology
Lec. 2. Lab. 2. Cr. 3.
Prerequisite or Corequisite: BIOL 3130 or WFS 3130. The natural history and ecology of selected mammal species, emphasizing game species, furbearers, endangered species, predators, and pests. Anatomy and identification are the focus of the laboratories. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

107. WFS 4700 (5700) - Habitat Management
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: AGHT 3450, BIOL 3240, WFS 4740 (5740), or equivalent. Description, principles, and techniques of quantitative characterization of wildlife habitat types. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

108. WFS 4710 (5710) - Fisheries Management
Lec. 3. Lab. 3. Cr. 4.
Prerequisite: WFS 4810 (5810) and WFS 4840 (5840) or equivalent, and consent of instructor. Theory, methods, and techniques of freshwater fisheries management. Field and laboratory. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

109. WFS 4711 (4711) - Fisheries Management

Lec. 3. Cr. 3.
Prerequisite: BIOL 3130 or WFS 3130. Classroom based overview of theory, methods, and techniques of freshwater fisheries management. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

110. WFS 4730 (5730) - Conservation Biology
Lec. 3. Cr. 3.
Prerequisite: BIOL 3130 or WFS 3130. Advanced concepts of plant and animal conservation, including biodiversity, population genetics, habitat fragmentation, endangered and threatened species, and ecosystem management. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

111. WFS 4740 (5740) - Wildlife Principles
Lec. 2. Cr. 2.
Prerequisite: WFS 3130 and Junior standing or consent of instructor. Classroom-based theory and principles of wildlife management. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

112. WFS 4760 (5760) - Fish Culture
Lec. 2. Lab. 4. Cr. 4.
Prerequisite: BIOL 3130 or WFS 3130. Cultural practices; hatchery operation, care of brood fish, transport, and stocking; the ecological requirements of hatchery species. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

113. WFS 4770 (5770) - Nongame Species Management
Spring (E). Lec. 3 Cr. 3
Prerequisite: Junior standing. Advanced concepts of managing nongame species. Topics include urban wildlife, funding mechanisms, monitoring and inventory techniques, habitat management, rare species, and state wildlife action plans.

114. WFS 4810 (5810) - Ichthyology
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. Identification, classification, anatomy, physiology, ecology, and adaptations of fishes; emphasis on North American freshwater species. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

115. WFS 4820 (5820) - Mammalogy
Lec. 2. Lab. 3. Cr. 3.
Prerequisite: Junior standing. Classification, structure and function, phylogeny, and geographical distribution of mammals; emphasis on Tennessee mammals. Students enrolled in the 5000-level course will be required to complete additional work as stated in the syllabus.

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