

# College of Agriculture

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PAUL M. PATTERSON, *Dean*

AMY N. WRIGHT, *Associate Dean*

THE COLLEGE OF AGRICULTURE prepares students for a variety of opportunities throughout a global food, agricultural and natural resource system by emphasizing living sciences and providing challenging science-based curricula. Graduates are prepared to become productive global citizens and to address the challenges of providing a safe, affordable food, fiber and renewable bio-energy system while protecting environmental and water resources. Many of the basic science courses taken in the freshman and sophomore years serve as a foundation for additional basic and applied coursework in a specific major during the junior and senior year. The college's student-focused atmosphere fosters strong academic, engaged learning environments and student development around life-skills and international issues.

Curricula are offered in agricultural business and economics, agricultural communications, agricultural science, animal sciences, applied biotechnology, biological and agricultural technology management, crop and soil science, environmental science, fisheries, aquaculture & aquatic sciences, horticulture, and poultry science. The College of Agriculture also furnishes the subject matter training in agriculture for the curricula of biosystems engineering and agriscience education.

Employment opportunities for graduates with expertise gained in these majors are forecast to remain strong. Possible careers include: agricultural economists, agricultural engineers, crop scientists, animal nutritionists, aquaculturalists, biochemists, biological engineers, biometricians, botanists, business managers, cell biologists, climatologists, educators, extension specialists, entomologists, environmental scientists, farm services, fisheries scientists, florists, food systems and safety workers, geneticists, golf course managers, poultry scientists, molecular biologists, plant pathologists, plant physiologists, quality assurance workers, rural sociologists, science writers, soil scientists, toxicologists, turf scientist/specialists, as well as the foundation for entrance to graduate school, law, and health-related professional schools.

## Transfer Credits

Transfer credits for agricultural subjects not considered equivalent to those required in the chosen curriculum may be substituted for elective credit; however, duplication of credit will not be allowed. Equivalence of agricultural subjects will be determined by the dean's office; however, students may also obtain transfer credit on the basis of validating examinations. Arrangements for validating examinations must be made with the academic dean of Agriculture in the first term of enrollment in the College of Agriculture at Auburn and the examinations must be completed before the middle of the second term. Transfer credit for courses which are upper-division courses at AU will not be accepted from two-year colleges.

## Pre-Veterinary Medicine and Pre-Professional

Curricula within the college enable students to complete requirements for admission to health related professional schools. It is possible to gain admission to colleges of veterinary medicine or other health-related professional schools after a student's third year of undergraduate studies. If students are admitted to a college of veterinary medicine or other professional program after the completion of their third year, they may obtain a Bachelor of Science degree in their selected degree program after successful completion of their first year in a college of veterinary medicine or other professional degree program and completion of all major (bolded) courses. The specific graduation requirements may be obtained from a program advisor or academic advisor for the college. The minimum requirements for admission to most colleges of veterinary medicine and other professional programs are incorporated in the first three years of the options listed under the following curricula: animal sciences, fisheries and allied aquacultures and poultry science. (See also the curriculum in Pre-Veterinary Medicine in the College of Science and Mathematics and College of Forestry, Wildlife and Environment).

## Majors

- Agricultural Business & Economics ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agricultureeconomicsandruralsociology/agriculturalbusinessandeconomics\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agricultureeconomicsandruralsociology/agriculturalbusinessandeconomics_major/))
- Agricultural Communications ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/generalagriculture/agcommunications\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/generalagriculture/agcommunications_major/))
- Agricultural Science ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/agriculturalscience\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/agriculturalscience_major/))
- Animal Sciences — Animal and Allied Industries Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences\\_productionoption\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences_productionoption_major/))
- Animal Sciences — Equine Science Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences\\_equinescienceoption\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences_equinescienceoption_major/))

- Animal Sciences — Meat Science Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences\\_musclefoodsoption\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences_musclefoodsoption_major/))
- Animal Sciences Pre-Vet — Pre-Professional Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences\\_pre-veterinarymedicine\\_professionalsoption\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences_pre-veterinarymedicine_professionalsoption_major/))
- Applied Biotechnology ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/entomologyandplantpathology/appliedbiotechnology\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/entomologyandplantpathology/appliedbiotechnology_major/))
- Biological and Agricultural Technology Management ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/biosystemsengineeringbsen/BioTech\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/biosystemsengineeringbsen/BioTech_major/))
- Biosystems Engineering ([http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/biosystemsengineering\\_major/](http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/biosystemsengineering_major/))
- Biosystems Engineering — Bioprocess Engineering Option ([http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/biosystemsengineeringbioprocessengr\\_obtion/](http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/biosystemsengineeringbioprocessengr_obtion/))
- Biosystems Engineering — Ecological Engineering Option ([http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/ecologicalengineeringoption\\_major/](http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/ecologicalengineeringoption_major/))
- Biosystems Engineering — Forest Engineering Option ([http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/forestengineering\\_major/](http://bulletin.auburn.edu/undergraduate/samuelginncollegeofengineering/departmentofbiosystemsengineering/forestengineering_major/))
- Crop and Soil Sciences — Production Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils\\_production\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils_production_major/))
- Crop and Soil Sciences — Science Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils\\_science\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils_science_major/))
- Crop and Soil Sciences — Soil, Water and Land Use Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils\\_soilwaterland\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils_soilwaterland_major/))
- Crop and Soil Sciences — Turfgrass Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils\\_turfgrass\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomysoils_turfgrass_major/))
- Environmental Science ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/environmentalscience\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/environmentalscience_major/))
- Fisheries, Aquaculture, and Aquatic Sciences — Fisheries and Aquaculture Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/fisheriesandaquaculture\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/fisheriesandaquaculture_major/))
- Fisheries, Aquaculture, and Aquatic Sciences — Marine Resources Management Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/marineresources\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/marineresources_major/))
- Fisheries, Aquaculture, and Aquatic Sciences — Pre-Professional Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/fisheries\\_preprofessional\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/fisheries_preprofessional_major/))
- Horticulture — Fruit and Vegetable Production Track ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/fruitandvegetableproductionemphasis\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/fruitandvegetableproductionemphasis_major/))
- Horticulture — Landscape Horticulture Track ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/horticulture\\_landscapehorticultureemphasis\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/horticulture_landscapehorticultureemphasis_major/))
- Horticulture — Nursery and Greenhouse Science Track ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/horticulture\\_nurseryandgreenhouseemphasis\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/horticulture_nurseryandgreenhouseemphasis_major/))
- Horticulture — Pre-Landscape Architecture Track ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/prelandscape\\_architecture\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/prelandscape_architecture_major/))
- Poultry Science — Production Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/poultrysciencepoul/poultryscience\\_poultryproductionoption\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/poultrysciencepoul/poultryscience_poultryproductionoption_major/))
- Poultry Science — Pre-Veterinary Medicine Option ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/poultrysciencepoul/poultryscience\\_pre-veterinarymedicineoption\\_major/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/poultrysciencepoul/poultryscience_pre-veterinarymedicineoption_major/))

## Minors

- Agribusiness ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agriculturealeconomicsandruralsociology/agribusiness\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agriculturealeconomicsandruralsociology/agribusiness_minor/))
- Agricultural Leadership Studies ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/minors/agri\\_leadership\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/minors/agri_leadership_minor/))
- Animal Sciences ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/animalsciencesansc/animalsciences_minor/))
- Crop and Soil Sciences ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomyandsoils\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/agronomyandsoils_minor/))

- Entomology ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/entomologyandplantpathology/entomolgy\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/entomologyandplantpathology/entomolgy_minor/))
- Fisheries, Aquaculture, and Aquatic Science ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/fisheriesandalliedaquacultures\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/fisheriesandalliedaquaculturesfish/fisheriesandalliedaquacultures_minor/))
- Horticulture ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/hort\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/horticulturehort/hort_minor/))
- Natural Resources Economics and Environmental Policy ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agricultureeconomicsandruralsociology/naturalresrenvironmentpolicy\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agricultureeconomicsandruralsociology/naturalresrenvironmentpolicy_minor/))
- Plant Pathology ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/entomologyandplantpathology/plantpathology\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/entomologyandplantpathology/plantpathology_minor/))
- Poultry Science ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/poultrysciencepoul/poultryscience\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/poultrysciencepoul/poultryscience_minor/))
- Rural and Community Development ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agricultureeconomicsandruralsociology/rural\\_communitydev\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agricultureeconomicsandruralsociology/rural_communitydev_minor/))
- Stewardship-based Agriculture ([http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/stewardship-basedagriculture\\_minor/](http://bulletin.auburn.edu/undergraduate/collegeofagriculture/agronomyandsoilsagrn/stewardship-basedagriculture_minor/))

## Graduate Programs

- Agricultural Economics — MS, MAg ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/agricultureeconomicsandruralsociologymsmag\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/agricultureeconomicsandruralsociologymsmag_major/))
- Animal Sciences — MS, MAg, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/animalsciencesmsmagphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/animalsciencesmsmagphd_major/))
- Applied Economics — PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/agricultureeconomicsandruralsociologymsmag\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/agricultureeconomicsandruralsociologymsmag_major/))
- Bioproducts and Bioprocessing — Graduate Certificate ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/biop\\_gcrt/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/biop_gcrt/))
- Biosystems Engineering — MS, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/biosystemsengineeringmsphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/biosystemsengineeringmsphd_major/))
- Crop, Soil, and Environmental Sciences — Graduate Certificate, MS, MAg, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/agronomyandsoilsmmagphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/agronomyandsoilsmmagphd_major/))
- Earth System Science — Interdisciplinary PhD Program ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/interdisciplinaryprograminearthsystm\\_phd/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/interdisciplinaryprograminearthsystm_phd/))
- Entomology — MS, MAg, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/entomologymsmagphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/entomologymsmagphd_major/))
- Fisheries, Aquaculture, and Aquatic Sciences — MAq, MS, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/fisheriesandalliedaquaculturesmagmsphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/fisheriesandalliedaquaculturesmagmsphd_major/))
- Food Science — MAg, MS, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/foodsciencemagmsphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/foodsciencemagmsphd_major/))
- Horticulture — Graduate Certificate, MS, MAg, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/horticulturemsmagphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/horticulturemsmagphd_major/))
- One Health — Graduate Certificate ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/onehealth\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/onehealth_major/))
- Plant Pathology — MAg, MS, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/plantpathologymagmsphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/plantpathologymagmsphd_major/))
- Poultry Science — MAg, MS, PhD ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/poultrysciencemagmsphd\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/poultrysciencemagmsphd_major/))
- Rural Sociology — MS ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/ruralsociologymsmag\\_major/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/ruralsociologymsmag_major/))
- Rural Studies — Graduate Certificate ([http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/ruralstudies\\_gcrt/](http://bulletin.auburn.edu/thegraduateschool/graduatedegreesoffered/ruralstudies_gcrt/))

## Agric Economics Courses

**AGEC 1000 GLOBAL ISSUES IN FOOD, AGRICULTURE, DEVELOPMENT, AND ENVIRONMENT (3) LEC.** 3. To expose students to global issues in food, agriculture, development, and natural resource/environmental economics and to learn about career opportunities in the field.

**AGEC 3010 AGRIBUSINESS MARKETING (3) LEC.** 3. Pr. (ECON 2020 or ECON 2023 or ECON 2027). Principles and problems of marketing farm and agribusiness products including marketing methods, channels, structures, and institutions. May count either AGECE 3010 or AGECE 3013.

**AGEC 3050 FARM APPRAISAL (2)** LEC. 2. Theory of land values; terminology, processes and procedures for alternative appraisal purposes; factors affecting value; and evaluation of appraisal methods.

**AGEC 3080 FUTURES AND OPTIONS MARKETING (2)** LEC. 2. Pr. (ECON 2020 or ECON 2023 or ECON 2027). Functions, institutions, economic performance, and practices and procedures involved in utilizing futures and options markets to manage market price risks.

**AGEC 3100 COMPUTER APPLICATIONS IN AGRICULTURAL ECONOMICS (3)** LEC. 3. Pr. P/C STAT 2010 or P/C STAT 2017 or P/C STAT 2510 or P/C STAT 2513 or P/C STAT 2610 or P/C BUAL 2600. Analytical methods for agricultural economics: spreadsheet applications, optimization, regression, budgeting, and risk management.

**AGEC 3200 QUANTITATIVE METHODS IN AGRICULTURAL ECONOMICS (3)** LEC. 3. Pr. (MATH 1680 or MATH 1610) and AGEC 3100. The course covers mathematical and econometric models for the quantitative analysis of problems in food, agricultural, development and resource/environmental economics.

**AGEC 3300 AGRICULTURAL POLICIES AND TRADE (3)** LEC. 3. Pr. ECON 2020 or ECON 2027 or ECON 2023. Public policies affecting agriculture. Theory and significance of international trade, distribution of production and trade, issues and policies, and influence of exchange rates.

**AGEC 3920 AGRICULTURAL BUSINESS AND ECONOMICS INTERNSHIP (1-3)** INT. SU. Departmental approval. Practical experience with agricultural business firms and agencies including finance, farm supply, production, marketing and sales and government. Course may be repeated for a maximum of 6 credit hours.

**AGEC 3950 CAREERS IN AGRICULTURAL BUSINESS AND ECONOMICS (1)** LEC. 1. SU. To develop skills to find a job and learn about career opportunities in agricultural business and economics.

**AGEC 4000 PRINCIPLES OF AGRIBUSINESS MANAGEMENT (3)** LEC. 3. Pr. (ECON 2020 or ECON 2027 or ECON 2023). Economics and business principles applied to agriculture: business formation, composing and analyzing financial statements, financial analysis and decision-making functions of management, capital budgeting and investment decisions. (Credit will not be given to majors in AGEC, ECON, or business).

**AGEC 4040 AGRIBUSINESS FINANCE (3)** LEC. 3. Pr. (ECON 2020 or ECON 2023 or ECON 2027) and (ACCT 2110 or ACCT 2117 or ACCT 2810) and (STAT 2010 or STAT 2017 or STAT 2510 or STAT 2513 or STAT 2610 or BUAL 2600). ECON 2020 or ECON 2023 or ECON 2027 with minimum grade of C. Economic problems and policies in financing agriculture.

**AGEC 4047 HONORS AGRIBUSINESS FINANCE (3)** LEC. 3. Pr. (ECON 2020 or ECON 2023 or ECON 2027) and (ACCT 2110 or ACCT 2117 or ACCT 2810) and (STAT 2010 or STAT 2017 or STAT 2510 or STAT 2513 or STAT 2610 or BUAL 2600). ECON 2020 or ECON 2023 or ECON 2027 with minimum grade of C. Economic problems and policies in financing agriculture.

**AGEC 4070 AGRICULTURAL LAW (3)** LEC. 3. Recognition of legal problems associated with property ownership, contracts, torts, financing, estate planning and environmental controls and restrictions.

**AGEC 4100 AGRICULTURAL COOPERATIVES (2)** LEC. 2. Principles and problems of organizing and operating farmers' cooperative buying and selling associations.

**AGEC 4120 ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS (3)** LEC. 3. Economic principles related to common property, public goods, property rights, externalities and resource scarcity and allocation applied to current issues.

**AGEC 4960 SPECIAL PROBLEMS IN AGRICULTURAL ECONOMICS (1-2)** IND. Departmental approval. Individual or group projects with a faculty member in agricultural economics or agribusiness. May include research, data analysis or a combination of these. Course may be repeated for a maximum of 4 credit hours.

**AGEC 4967 HONORS SPECIAL PROBLEMS (1-3)** IND. Pr. Honors College. Membership in the Honors College required; Topics in agricultural economics. Course may be repeated for a maximum of 3 credit hours.

**AGEC 4970 SPECIAL TOPICS IN AGRICULTURAL ECONOMICS (1-3)** LEC. 1-3. Departmental approval. Topics of special interest in agricultural economics. May be repeated with change of topic. Course may be repeated for a maximum of 6 credit hours.

**AGEC 4980 UNDERGRADUATE RESEARCH (2-4)** IND. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**AGEC 4997 HONORS THESIS (1-3)** LEC. 3. Pr. Honors College. Directed research and writing of honors thesis. Course may be repeated for a maximum of 3 credit hours.

**AGEC 5010 FARM MANAGEMENT (3)** LEC. 3. Pr. (MATH 1680 or MATH 1683 or MATH 1610 or MATH 1613) and (ECON 2020 or ECON 2023 or ECON 2027) and (STAT 2010 or STAT 2017 or STAT 2510 or STAT 2513 or STAT 2610 or BUAL 2600) and (ACCT 2110 or ACCT 2117 or ACCT 2810) and AGEC 3100. ECON 2020 or 2023 or 2027 minimum grade of C. Principles of economics applied to agriculture; uses of farm records to improve management of the farm; developing enterprise budgets and use in preparing a profit-maximizing farm plan.

**AGEC 5030 AGRICULTURAL PRICES (3)** LEC. 3. Pr. (STAT 2010 or STAT 2510 or STAT 2610 or BUAL 2600) and (MATH 1680 or MATH 1610) and ECON 3020. Functions of prices and principles of supply and demand in price determination for agricultural products and markets. Statistical estimation of price and demand relationships. Spring. May count either AGEC 5030 or AGEC 6030.

**AGEC 5090 ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS I (3)** LEC. 3. Pr. ECON 3020. Supply, demand, future requirements and availability of environmental and natural resources plus institutional framework affecting and conditioning such use through property rights, zoning, taxation, etc. May count either AGEC 5090 or AGEC 6090.

**AGEC 5100 AGRICULTURAL BUSINESS MANAGEMENT (3)** LEC. 3. Pr. (ECON 2020 or ECON 2023 or ECON 2027) and AGEC 3100 and ACCT 2210 or ACCT 2217 or ACCT 2810 and P/C AGEC 4040. Principles and problems in acquiring or starting, organizing, and operating successful agribusiness; financial and operational efficiency; human resource and public relations; decision-making tools. May count either AGEC 5100 or AGEC 6100.

**AGEC 5210 ADVANCED AGRIBUSINESS MANAGEMENT (3)** LEC. 3. Pr. AGEC 5100 and ECON 3020 and MATH 1690 and (STAT 2010 or STAT 2510 or STAT 2610). Case studies, managerial economics. May count either AGEC 5210 or AGEC 6210.

**AGEC 5250 BIG DATA FOR AGRIBUSINESS MANAGEMENT (3)** LEC. 3. Pr. AGEC 3200. To expose students to essential tools for acquiring, managing, and visualizing large datasets in agribusiness.

**AGEC 6010 FARM MANAGEMENT (3)** LEC. 3. Pr. (MATH 1680 or MATH 1683 or MATH 1610 or MATH 1613 or MATH 1617) and (ECON 2020 or ECON 2023 or ECON 2027) and (STAT 2010 or STAT 2017 or STAT 2510 or STAT 2513 or STAT 2610 or BUAL 2600 or BUAL 2603) and (ACCT 2110 or ACCT 2113 or ACCT 2117 or ACCT 2810 or ACCT 2813) and AGEC 3100. ECON 2020/ECON 2027 minimum grade of C. Principles of economics applied to agriculture; uses of farm records to improve management of the farm; developing enterprise budgets and use in preparing a profit-maximizing farm plan.

**AGEC 6030 AGRICULTURAL PRICES (3)** LEC. 3. Pr. (MATH 1680 or MATH 1683 or MATH 1610 or MATH 1613 or MATH 1617) and (STAT 2010 or STAT 2017 or STAT 2510 or STAT 2513 or STAT 2610 or BUAL 2600 or BUAL 2603) and ECON 3020. Functions of prices and principles of supply and demand in price determination for agricultural products and markets. Statistical estimation of price and demand relationships. Spring.

**AGEC 6090 ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS I (3)** LEC. 3. Pr. ECON 3020. Supply, demand, future requirements and availability of environmental and natural resources plus institutional framework affecting and conditioning such use through property rights, zoning, taxation, etc.

**AGEC 6100 AGRICULTURAL BUSINESS MANAGEMENT (3)** LEC. 3. Pr. (ECON 2020 or ECON 2023 or ECON 2027) and (ACCT 2210 or ACCT 2217 or ACCT 2810) and P/C AGEC 4040. Principles and problems in acquiring or starting, organizing, and operating successful agribusiness; financial and operational efficiency; human resource and public relations; decision-making tools.

**AGEC 6210 ADVANCED AGRIBUSINESS MANAGEMENT (3)** LEC. 3. Pr. AGEC 6100 and ECON 3020 and MATH 1690 and (STAT 2010 or STAT 2510 or STAT 2513 or STAT 2610). Case studies, managerial economics.

**AGEC 6250 BIG DATA FOR AGRIBUSINESS MANAGEMENT (3)** LEC. 3. To expose students to essential tools for acquiring, managing, visualizing, and analyzing large datasets in agribusiness.

**AGEC 7000 ADVANCED AGRICULTURAL AND ENVIRONMENTAL POLICY (3)** LEC. 3. Pr. AGEC 6090 and (AGEC 3300 or AGEC 6030 or AGEC 5030). Food and farm problems and related governmental actions from historical, political and analytical viewpoints. Welfare economics and other procedures used to evaluate costs and benefits of existing and proposed governmental programs and actions affecting agriculture, environment and the consumer.

**AGEC 7030 ADVANCED AGRICULTURAL PRICES (3)** LEC. 3. Pr. AGEC 6030 and ECON 6020. Theory and measurement of farm supply, retail demand and marketing-margin relationships. Introduction to equilibrium-displacement modeling.

**AGEC 7080 PRODUCTION ECONOMICS I (3)** LEC. 3. Pr. ECON 6020. Resource allocation and efficiency of production in the firm, between firms, and between agriculture and other industries.

**AGEC 7090 RESOURCE ECONOMICS II (3)** LEC. 3. Pr. AGECE 6090. Analysis of institutional and economic factors affecting use of natural resources including economic feasibility/conservation, benefit-cost analysis, environmental controls and other interventions.

**AGEC 7100 OPERATIONS RESEARCH METHODS IN AGRICULTURAL ECONOMICS (3)** LEC. 3. Optimization techniques with emphasis on linear programming and its extensions applied to agriculture. General theoretical background and associated computational procedures are used for presentation of models and modeling techniques.

**AGEC 7110 AGRICULTURAL ECONOMIC DEVELOPMENT (3)** LEC. 3. Pr. ECON 2020 or ECON 2027 or ECON 2023. Conceptual and empirical analysis of economic development with emphasis on the lesser developed areas and countries. Analysis of financial and technical aid to other countries case studies of development problems.

**AGEC 7200 AQUACULTURAL ECONOMICS I (3)** LEC. 3. Pr. ECON 2020 or ECON 2027 or ECON 2023. Application of economic theories and principles to production, marketing, and consumption of aquacultural enterprises and products. Role of aquaculture in economic development.

**AGEC 7590 INTRODUCTION TO AGRICULTURAL ECONOMETRICS (3)** LEC. 3. Pr. (MATH 1610 or MATH 1613 or MATH 1617) and STAT 2610. Regression analysis in economic research. Model specification and estimation plus introduction to detection and correction of violations of assumptions of OLS. Hypothesis testing, dummy variables, heteroschedasticity, autocorrelation and measurement errors.

**AGEC 7690 MICROECONOMETRICS IN AGRICULTURAL ECONOMICS I (3)** LEC. 3. Pr. AGECE 7590. The focus will be on implementation and interpretation, as well as on the microeconomic foundations of the econometric models covered in the course.

**AGEC 7700 RESEARCH METHODS IN AGRICULTURAL ECONOMICS (3)** LEC. 3. Pr. ECON 7130 and AGECE 7590. Overview of the philosophy of science, detailed discussion of how various research tools are used to perform applied research in agricultural economics.

**AGEC 7960 SPECIAL PROBLEMS IN AGRICULTURAL ECONOMICS (1-3)** AAB. Departmental approval required; Individualized direction/instruction by faculty on research, teaching and/or outreach issues. Course may be repeated for a maximum of 6 credit hours.

**AGEC 7970 SPECIAL TOPICS IN AGRIC ECON (3)** LEC. 3. Departmental approval. New topics in agricultural and applied economics.

**AGEC 7990 RESEARCH AND THESIS (1-10)** MST. Course may be repeated with change in topics.

**AGEC 8060 THEORY OF AGRICULTURAL MARKETS (3)** LEC. 3. Pr. AGECE 7590 and ECON 6020. Theory and methods for estimating complete demand systems (e.g., LES, Translog, ALIDS, and Rotterdam) for food products. Introduction to imperfect competition models.

**AGEC 8080 PRODUCTION ECONOMICS II (3)** LEC. 3. Pr. AGECE 7080. Firm-level economics problems are extended. Consideration of the influence of risk on firm behavior; empirical analysis of theoretical problems; welfare analysis; technical change; impacts of research investments.

**AGEC 8090 FOOD AND AGRICULTURAL POLICY (3)** LEC. 3. Pr. ECON 6020 or ECON 7000 or ECON 7110. The course will cover current issues in the economics and policies associated with food, food production and marketing.

**AGEC 8690 MICROECONOMETRICS IN AGRICULTURAL ECONOMICS II (3)** LEC. 3. Pr. AGECE 8310. The focus will be on implementation and interpretation, as well as on the microeconomic foundations of the econometric models covered in the course. May count either AGECE 8310 or AGECE 8690.

**AGEC 8890 TOPICS IN AGRICULTURAL MICROECONOMETRICS (3)** LEC. 3. Pr. AGECE 8690. This course is meant to assimilate knowledge acquired throughout core coursework in the Agricultural Economics PhD program.

**AGEC 8990 RESEARCH AND DISSERTATION (1-10)** DSR. Course may be repeated with change in topics.

## Agriculture Courses

**AGRI 1000 INTRODUCTION TO AGRICULTURE (2)** LEC. 1. LAB. 2. Provide information about the College of Agriculture and Alabama Agriculture. An emphasis will be placed on learning about the different departments in the college.

**AGRI 1080 AGRICULTURAL COMMUNICATIONS (3)** LEC. 3. Departmental approval. Introduction to agricultural communications and professional development as applied to the ag sector; overviews of common communication methods and possible careers.

**AGRI 3000 AGRICULTURAL GENETICS (4)** LEC. 3. LAB. 2. Pr. BIOL 1020 or BIOL 1023 or BIOL 1027. Introductory understanding of the applications of genetics to agricultural and natural systems. Theoretical and practical knowledge of qualitative, quantitative, molecular, population, and biotechnological aspects of genetics will be developed.

**AGRI 3800 LEADING PEOPLE AND TEAMS IN AGRICULTURE (3)** LEC. 3. Course focuses on creating and leading high functioning teams in Agriculture.

**AGRI 4000 AGRICULTURE STUDY ABROAD (1-10)** AAB/FLD. Departmental approval. Study abroad programs with emphasis on agricultural topics. Credit awarded in consultation with departmental chair. Course may be repeated for a maximum of 10 credit hours.

**AGRI 4920 INTERNSHIP IN AGRICULTURAL COMMUNICATION AND LEADERSHIP (1-3)** INT. Departmental approval. Supervised, closely monitored work experience in agricultural communications or leadership. Course may be repeated for a maximum of 6 credit hours.

**AGRI 4940 AGRICULTURAL COMMUNICATIONS CAPSTONE (3)** LEC. 3. Pr. AGRI 1080. A capstone experience for the Agricultural Communications major that brings together the agricultural topics and communication techniques that have been developed throughout the course of the student's study.

**AGRI 4970 SPECIAL TOPICS IN AGRICULTURAL COMMUNICATION AND LEADERSHIP (1-3)** DSL. Departmental approval. Directed study in agricultural communications or leadership. Course may be repeated for a maximum of 6 credit hours.

**AGRI 5010 ANALYSIS OF PLANT, SOIL, AND ANIMAL DATA (3)** LEC. 3. Pr. (MATH 1130 or MATH 1133) or (STAT 2510 or STAT 2513). Principles of data analysis based on real examples will be discussed. Topics include measures of central tendency, dispersion, confidence intervals, sampling issues, probability distributions, etc. Credit will be given for only one of either AGRI 5010, AGRI 5013, AGRI 6010, or AGRI 6016.

**AGRI 5840 LEADING ORGANIZATIONAL AND COMMUNITY CHANGE IN AGRICULTURE (3)** LEC. 3. Course designed for students who want to make meaningful change in agricultural organizations and communities. Focuses on leading organizations/communities to adapt and thrive. Credit will only be given for one of the following: AGRI 5840 or AGRI 6840.

**AGRI 6010 ANALYSIS OF PLANT, SOIL & ANIMAL DATA (3)** LEC. 3. Principles of data analysis based on real examples will be discussed. Topics include measures of central tendency, dispersion, confidence intervals, sampling issues, probability distributions, etc. Credit will be given for only one of either AGRI 5010, AGRI 5013, AGRI 6010, or AGRI 6016.

**AGRI 6840 LEADING ORGANIZATIONAL AND COMMUNITY CHANGE IN AGRICULTURE (3)** LEC. 3. Course designed for students who want to make meaningful change in agricultural organizations and communities. Focuses on leading organizations/communities to adapt and thrive. Credit will only be given for one of the following: AGRI 5840 or AGRI 6840.

**AGRI 7080 ADVANCED ANALYSIS OF PLANT, SOIL, AND ANIMAL DATA (3)** LEC. 3. Pr. AGRI 5010 or AGRI 5013 or AGRI 6010 or AGRI 6016 or STAT 7000. Analysis of continuous, count, and binary data from randomized, paired, blocked, and split-plot experimental designs used in agricultural research. Use of statistical software and interpretation of results for applied agricultural research with plants, soils, and animals.

**AGRI 7820 RESEARCH PROPOSAL WRITING (3)** LEC. 3. Graduate level standing or Departmental approval. Experience in all aspects of writing and reviewing competitive research proposals through a workshop-format culminating in each student writing a proposal on research topics of their choosing. Fall.

## Animal Sciences Courses

**ANSC 1000 INTRODUCTION TO ANIMAL SCIENCES (4)** LEC. 3. LAB. 2. The importance of livestock to agriculture and to the health and nutrition of a modern society. Livestock terminology, selection, reproduction, nutrition, management, marketing, and species characteristics of beef and dairy cattle, swine, sheep and horses.

**ANSC 1050 INTRODUCTION TO EQUINE CARE AND USE (3)** LEC. 2. LAB. 2. This course serves as an introductory course to the history, care, use, and enjoyment of horses. Students will learn the foundations of numerous topics of working with horses and how to handle horses safely and effectively.

**ANSC 1100 ORIENTATION TO ANIMAL SCIENCES (1)** LEC. 1. SU. An introduction to the departmental programs and personnel and how to make the most of the college experience. Breadth of career opportunities for animal science graduates.

**ANSC 2000 COMPANION ANIMAL MANAGEMENT (3)** LEC. 3. Practical aspects of behavior, nutrition, breeding, reproduction, health and management of dogs, cats and other animals generally considered to be human companions.

**ANSC 2010 ANIMALS AND SOCIETY (3)** LEC. 3. Ethical and scientific issues surrounding human-animal interactions and the role human-animal interactions play in modern society.

**ANSC 2050 EQUINE BEHAVIOR AND TRAINING (3)** LEC. 1. LAB. 4. Pr. ANSC 1050. This course is designed to teach students concepts of how equine behavior applies to training. Students will be exposed to a variety of training methods used in the equine industry.

**ANSC 2100 DAIRY GOAT U PROGRAM PLANNING (1)** LEC. 1. Pr. ANSC 1000. Students will be involved in planning and hosting the Dairy Goat U event for youth (ages 6-18) and adults. Course may be repeated for a maximum of 3 credit hours.

**ANSC 2150 SKILLS AND CONCEPTS OF EQUESTRIAN SPORTS (1)** LAB. 4. SU. Departmental approval. Basic management and care of animals used in intercollegiate equestrian and rodeo sports. Must be affiliated with the NCEA Equestrian Team or IHSA Equestrian Team in current term. Course may be repeated for a maximum of 2 credit hours.

**ANSC 2200 DAIRY U PROGRAM PLANNING (1)** LEC. 1. Pr. ANSC 1000. Students will be involved in planning and hosting the Dairy U event for youth (ages 6-18) and adults. Course may be repeated for a maximum of 3 credit hours.

**ANSC 2300 BEEF U PROGRAM PLANNING (1)** LEC. 1. Pr. ANSC 1000. Students will be involved in planning and hosting the Beef U event for youth (ages 6-18) and adults. Course may be repeated for a maximum of 3 credit hours.

**ANSC 2400 HORSE U PROGRAM PLANNING (1)** LEC. 1. Pr. ANSC 1000. Students will be involved in planning and hosting the Horse U event for youth (ages 6-18) and adults. Course may be repeated for a maximum of 3 credit hours.

**ANSC 2720 THE MEAT WE EAT (3)** LEC. 3. Foundation course on the global meat industry with emphasis on meat products, modern processing techniques, concepts of food safety, sanitation, inspection, grading and meeting consumer demands.

**ANSC 2910 PRACTICUM IN LIVESTOCK WELFARE AND MANAGEMENT (2)** LAB. 6. Pr. ANSC 1000. Departmental approval. Hands-on laboratory teaching applied management of livestock species, including horses, cattle, swine and small ruminants, using modern equipment and techniques.

**ANSC 3000 HERD HEALTH MANAGEMENT (3)** LEC. 3. Pr. ANSC 1000. The prevention and control of the major diseases of farm animals and the development of herd health programs.

**ANSC 3150 EQUINE MARKETING (3)** LEC. 3. Pr. ANSC 1000 and (ECON 2020 or ECON 2023 or ECON 2027). Practical concepts of equine marketing including evaluating the horse, assessing the market, targeting customers, and presenting the horse.

**ANSC 3300 INTRODUCTORY LIVESTOCK EVALUATION AND MARKETING (2)** LAB. 6. Pr. ANSC 1000. Comprehensive study of live animal and carcass evaluation techniques used in the selection and marketing of beef cattle, swine and sheep. The development of decision-making oral communication skills is emphasized.

**ANSC 3310 INTRODUCTION TO MEAT SELECTION AND GRADING (2)** LAB. 4. Instruction for the evaluation of meat carcasses, cuts, and products from cattle, swine, sheep, and goats. Understanding and calculating meat yield and quality for each species, evaluation of valuable traits, understanding product specifications, and preparation of written reasons. This course is required for participation in the meat judging program but is open to all students.

**ANSC 3400 ANIMAL NUTRITION (4)** LEC. 3. LAB. 2. Pr. CHEM 1040 and (BIOL 1030 or BIOL 1037 or POUL 3150). Principles and practice of animal nutrition, nutrient contents of feedstuff, and diet formulation.

**ANSC 3410 ANIMAL METABOLISM AND NUTRITION (3)** LEC. 3. Pr. (CHEM 2030 or CHEM 2070 or CHEM 2077) and (BIOL 1030 or BIOL 1037 or POUL 3150). Principles of animal nutrition and nutrient metabolism and a study of nutrients and their utilization by animals.

**ANSC 3420 APPLIED ANIMAL FEEDING AND NUTRITION (3)** LEC. 2. LAB. 1. Pr. ANSC 3410. Feedstuffs, diet formulation, and feeding practices applicable to the well-being and performance of economically important livestock and companion animals.



**ANSC 3500 ANIMAL BREEDING (3)** LEC. 3. Pr. ANSC 1000 and (STAT 2510 or STAT 2513 or BIOL 3000 or BIOL 3003 or AGRI 3000). Genetic and environmental effects of animal differences. Selection and mating systems used in the improvement of domestic animals with an emphasis on livestock.

**ANSC 3600 REPRODUCTIVE PHYSIOLOGY (4)** LEC. 3. LAB. 2. Pr. ANSC 1000 and BIOL 2510. Comparative anatomy, physiology and endocrinology of animal reproduction; principles of reproductive biotechnologies used to enhance reproductive efficiency in mammalian systems.

**ANSC 3610 ANIMAL GROWTH AND DEVELOPMENT (4)** LEC. 3. LAB. 2. Pr. ANSC 1000 and (BIOL 1030 or BIOL 1037). Biology of prenatal and postnatal growth of meat animals, emphasizing muscle, adipose, and bone tissues from a molecular, cellular, endocrine perspective. Application of concepts to improve rate, efficiency, and composition of growth.

**ANSC 3650 PHYSIOLOGY OF EQUINE ATHLETE (3)** LEC. 3. Pr. ANSC 1000 and BIOL 2510. Selection and development of the horse for athletic performance; exercising, training, and fitness conditioning for performance horses.

**ANSC 3700 MUSCLE FOODS (4)** LEC. 3. LAB. 2. Pr. ANSC 1000. Introduction to domestic animal growth and development, comparative evaluation of livestock and carcass composition. Biochemical and physiological factors affecting fresh meat and processed meat quality. Fundamentals of ante-and postmortem muscle biology, slaughter, processing, storage and merchandising of meat and meat products.

**ANSC 3760 VALUE BASED MARKETING OF LIVESTOCK (3)** LEC. 2. LAB. 2. Livestock grading standards and their application to carcasses of meat producing animals, concepts and principles of marketing, advertising, promotion and sales of commercial livestock.

**ANSC 3800 CAREERS IN ANIMAL SCIENCE (1)** LEC. 1. SU. Career opportunities for animal science graduates. Identifying and investigating careers and presenting oneself professionally for employment or post-baccalaureate education.

**ANSC 3840 STUDY/TRAVEL IN ANIMAL SCIENCE (1-10)** AAB/FLD. Departmental approval. Concentrated study in animal production and management, equine science and the meats industry within the US or international locations. Course may be repeated for a maximum of 10 credit hours.

**ANSC 4000 MODERN LIVESTOCK SYSTEMS (4)** LEC. 3. LAB. 2. Pr. (ANSC 3400 or ANSC 3420) and ANSC 3500 and ANSC 3600. Overview of beef, dairy, swine and small ruminant production systems. Modern concepts, ideas, and methodology associated with the application of technology to reproduction, breeding, health, nutrition, waste nutrient utilization, and management.

**ANSC 4010 BEEF PRODUCTION (4)** LEC. 3. LAB. 2. Pr. (ANSC 3400 or ANSC 3420) and ANSC 3500 and ANSC 3600. Overview of the beef cattle industry. Modern concepts, ideas and methodology associated with the application of technology to reproduction, breeding, nutrition, management and the use of facilities in a modern beef cattle enterprise.

**ANSC 4050 EQUINE PRODUCTION AND MANAGEMENT (4)** LEC. 3. LAB. 2. Pr. (ANSC 3400 or ANSC 3420 or ANSC 4450) and ANSC 3500 and ANSC 3600. Practical application and integration of nutrition, breeding, reproduction, selection, herd health, and management for efficient horse production.

**ANSC 4150 ADVANCED SKILLS AND CONCEPTS OF EQUESTRIAN SPORTS (1)** LAB. 4. SU. Pr. ANSC 2150. Principles and skills utilized in intercollegiate equestrian and rodeo team competition and management. Issues affecting management, training, marketing, and promotion of animals used in equestrian and rodeo sports. Must be affiliated with the NCEA Equestrian Team or IHSA Equestrian Team in current term. Course may be repeated for a maximum of 2 credit hours.

**ANSC 4300 ADVANCED LIVESTOCK JUDGING (1)** LAB. 4. Departmental approval. Advanced course in principles and techniques of livestock selection based on visual criteria, performance records, and other advanced technologies. Course may be repeated for a maximum of 2 credit hours.

**ANSC 4450 EQUINE NUTRITION (3)** LEC. 2. LAB. 2. Pr. ANSC 3410 or ANSC 3400. Principles of digestive physiology, nutrition, and metabolic disorders unique to various classes of horses.

**ANSC 4700 MEAT PROCESSING (4)** LEC. 3. LAB. 3. Integration of topics in meat and non-meat ingredient chemistry and their applications to muscle food processing. Physical, chemical, and sensory properties of fresh and processed meat products.

**ANSC 4800 ISSUES IN ANIMAL AGRICULTURE (2)** LAB. 4. Pr. COMM 1000 or COMM 1003. Issues affecting animal agriculture, dealing with concerns of consumers and activists, involvement in public debate, and the political process.

**ANSC 4810 PROFESSIONAL DISCOURSE IN AGRICULTURE (1) LAB. 2.** Pr. COMM 1000 or COMM 1003. Methods for enhancing effective discourse concerning issues facing the livestock industry.

**ANSC 4920 INTERNSHIP IN ANIMAL SCIENCES (5-15) INT.** SU. Course may be repeated for a maximum of 15 credit hours.

**ANSC 4960 SPECIAL PROBLEMS (1-5) IND.** Departmental approval. Students will work under the direction of staff members on specific problems. Course may be repeated for a maximum of 15 credit hours.

**ANSC 4967 HONORS SPECIAL PROBLEMS (3-6) IND.** Pr. Honors College. Departmental approval.. Course may be repeated for a maximum of 6 credit hours.

**ANSC 4970 SPECIAL TOPICS IN ANIMAL SCIENCES (1-4) IND.** Instruction and discussion of selected current topics in Animal Sciences. Course may be repeated for a maximum of 4 credit hours.

**ANSC 4980 UNDERGRADUATE RESEARCH (2-4) IND.** Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**ANSC 4997 HONORS THESIS (3-6) IND.** Pr. Honors College. Departmental approval.. Course may be repeated for a maximum of 6 credit hours.

**ANSC 5070 ANIMAL WELFARE (3) LEC. 3.** Pr. (POUL 1000 or ANSC 1000) and (POUL 3150 or ANSC 3600 or ANSC 3410). This course covers the key principles and application of animal welfare, and concepts will be applied to livestock, companion animals, animals in research, and animals in entertainment. May count either POUL/ANSC 5070 or POUL/ANSC 6070.

**ANSC 5700 MICROBIOLOGY OF MEATS AND OTHER FOODS (4) LEC. 3. LAB. 1.** Pr. BIOL 1030 or BIOL 1037 or BIOL 3200. Microorganisms associated with meat and other foods production, spoilage, and safety with training in both traditional and modern detection techniques May count either ANSC 5700, FDSC 5700, ANSC 6700 or FDSC 6700.

**ANSC 6070 ANIMAL WELFARE (3) LEC. 3.** This course covers the key principles and application of animal welfare, and concepts will be applied to livestock, companion animals, animals in research, and animals in entertainment. May count either POUL/ANSC 5070 or POUL/ANSC 6070.

**ANSC 6700 MICROBIOLOGY OF MEATS AND OTHER FOODS (4) LEC. 3. LAB. 1.** Pr. BIOL 1030 or BIOL 3200 or BIOL 1037. Microorganisms associated with meat and other foods production, spoilage, and safety with training in both traditional and modern detection techniques. May count either ANSC 6700, FDSC 6700, ANSC 5700, or FDSC 5700. May count either ANSC 6700 or FDSC 6700.

**ANSC 7010 ADVANCED BEEF SYSTEMS (3) LEC. 3.** Advanced study of contemporary beef cattle production systems, including principles of planning, resource management and financing plus integrated biology in areas of breeding and selection, reproduction, metabolism, nutritional physiology and growth, health and disease; integration of forage system biology, soil and forage management as related to performance and sustainability.

**ANSC 7400 RUMINANT NUTRITION (3) LEC. 3.** Digestive physiology, mechanisms of rumen fermentation, postruminal nutritional biochemistry.

**ANSC 7410 NONRUMINANT NUTRITION (3) LEC. 3.** Departmental approval. Digestion, absorption, and utilization of macro and micro nutrients, nutrient interrelationship in swine and other non-ruminant species.

**ANSC 7610 PHYSIOLOGY OF GROWTH (3) LEC. 3.** Pr. BCHE 7210. Molecular and cellular basis of tissue differentiation, growth and development with emphasis on muscle, adipose and connective tissues and factors influencing gene expression controlling such events.

**ANSC 7700 MUSCLE FOODS AND APPLIED MUSCLE BIOLOGY (4) LEC. 3. LAB. 2.** Pr. ANSC 3700 and BCHE 7210. Investigations of muscle microanatomy, biochemistry of muscle proteins and lipids, biochemistry of skeletal muscle contraction, lipid/protein interactions, antemortem and postmortem factors affecting fresh and processed meat quality; discussion of classic and current scientific literature.

**ANSC 7950 SEMINAR (1) LEC. 1.** An intensive scientific literature study and subsequent seminar presentation of selected topics in some facet of animal sciences (Animal Genetics, Reproductive Biology, Growth and Development, Nutrition, Animal Production, Equine Studies, Meat Science and Food Animal related Biochemistry) by enrolled students. Course may be repeated for a maximum of 3 credit hours.

**ANSC 7960 SPECIAL PROBLEMS (1-5)** DSL/LEC. Conference problems, assigned reading, literature searches in one or more of the following major fields; (a) biochemistry, (b) nutrition, (c) animal breeding, (d) reproductive physiology, (e) growth physiology, (f) muscle foods, (g) microbiology, and (h) behavior. Course may be repeated for a maximum of 15 credit hours.

**ANSC 7970 SPECIAL TOPICS IN ANIMAL SCIENCES (1-5)** IND. Emerging topics in Animal Science and related industries. Course may be repeated for a maximum of 5 credit hours.

**ANSC 7990 RESEARCH AND THESIS (1-15)** MST. Research and thesis may be on technical laboratory problems or on problems directly related to beef and dairy cattle, sheep, swine, or laboratory animals. Course may be repeated with change in topics.

**ANSC 8400 PROTEIN AND ENERGY METABOLISM (3)** LEC. 3. Pr. BCHE 7210. Nutritional biochemistry of protein and energy metabolism of mammalian, avian and aquatic species. Concepts of protein turnover, nutrient-gene interactions, control of bioenergetics, nutritional assessment, nutritional quality of nutrient sources.

**ANSC 8410 VITAMIN AND MINERAL METABOLISM (3)** LEC. 3. Departmental approval. Vitamin and mineral nutrition with emphasis on chemical structures and characteristics, metabolic functions, deficiencies and toxicity syndromes, interrelationships and requirements of vitamins and minerals.

**ANSC 8990 DOCTORAL RESEARCH AND DISSERTATION (1-15)** DSR. Course may be repeated with change in topics.

## Applied Biotechnology Courses

**APBT 1000 INTRODUCTION TO APPLIED BIOTECHNOLOGY (1)** LEC. 1. Introduction to the field of biotechnology including key concepts from biology, chemistry, and physics, and career opportunities.

**APBT 2950 PROFESSIONAL DEVELOPMENT (1)** LEC. 1. Development of professional skills required for modern careers in entomology, plant pathology and applied biotechnology.

**APBT 2980 INTRODUCTION TO UNDERGRADUATE RESEARCH (1-4)** IND/RES. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**APBT 3100 METHODS OF SYNTHETIC BIOLOGY (4)** LEC. 2. LAB. 5. Pr. (BIOL 1030 or BIOL 1037) and APBT 1000. This course provides an overview of the basic cellular processes harnessed by synthetic biology and biotechnology. It also provides an introduction to recombinant DNA and its applications. It combines lectures with labs to provide hands-on experience with molecular techniques, DNA cloning, heterologous protein expression, and methodologies used to engineer organisms.

**APBT 4100 APPLIED BIOTECHNOLOGY (4)** LEC. 2. LAB. 4. Pr. (BIOL 1030 or BIOL 1037) and (BIOL 3000 or BIOL 3003 or AGRI 3000) and APBT 3100. or instructor's approval. Principle and up-to-date advances of genetic modification of organisms; its practices and influences in a broad range of basic and applied sciences which have revolutionized "mean" of sustainable agriculture.

**APBT 4920 INTERNSHIP (3)** LEC. 3. SU. Pr. APBT 1000. Practical professional experience under the supervision of internship faculty and/or representatives of state, federal or private agency.

**APBT 4980 UNDERGRADUATE RESEARCH (1-4)** LAB. 2-8. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**APBT 5660 FIGURE FUNDAMENTALS : SCIENTIFIC ILLUSTRATION (3)** LEC/STU. 1. Scientific illustration and data visualization implemented through the Adobe creative cloud package. May count either APBT 5660, ENTM 5660, or ENTM 6660.

**APBT 5800 OMICS IN AGRICULTURE (3)** LEC. 2. LAB. 2. Pr. BIOL 1030 or BIOL 3000 or AGRI 3000. This course will introduce students to the recent advances in high-throughput technologies such as genomics, transcriptomics, metagenomics, metabolomics, phenomics, modeling, and digital agriculture and how these technologies can be applied to tackling new and old problems in agriculture and human health. Students will be able to gain hands-on experience in analyzing and interpreting datasets obtained using these technologies.

**APBT 5820 PRINCIPLES AND TOOLS FOR REPRODUCIBLE SCIENCE IN AGRICULTURE (2)** LEC. 2. Pr. STAT 2510. Reproducibility is fundamental to science. This course will cover basic concepts in scientific reproducibility, accessibility, and organization as it relates to handling large datasets and publishing data workflows.

## Bio Ag Technology Management Courses

**BATM 1110 INTRODUCTION TO TECHNOLOGY DESIGN (3)** LEC. 2. LAB. 3. Introduction to the design process, 2D and 3D parametric solid modeling, and both manual and automated fabrication processes.

**BATM 2110 DIGITAL ANALYTICS IN AGRICULTURE AND TECHNOLOGY (3)** LEC. 2. LAB. 1. Pr. BATM 1110 or BIOP 2120. An introduction to creative and analytical methods to solve technological problems. Define the problem, explore strategies, select and implement solutions, and evaluate results.

**BATM 3100 COMPUTER AIDED DESIGN TECHNOLOGY (3)** LEC. 2. LAB. 1. Introductory course in computer aided design (CAD) and land mapping. Students gain competence in CAD operations used to fabricate parts and to develop field- and watershed-scale maps. Class and project topics include drawing for mechanical part fabrication and scale mapping for construction site development and agricultural field management. Must be in Junior standing Course may be repeated for a maximum of 6 credit hours.

**BATM 3110 AG TECHNOLOGY GEOSPATIAL APPLICATIONS (3)** LEC. 2. LAB. 3. Pr. PHYS 1500 or PHYS 1600. Geospatial applications for agricultural land resource management. Course introduces equipment and practices used in conventional land surveying and geospatial mapping as they interface with global positioning systems (GPS), geographic information systems (GIS), and computer-aided design (CAD).

**BATM 3500 NATURAL RESOURCE SYSTEMS CONSERVATION (3)** LLB. Pr. (MATH 1130 or MATH 1133 or MATH 1150 or MATH 1610 or MATH 1680) and (PHYS 1500 or PHYS 1600). Natural resource conservation technologies including rainfall-runoff relationships, sediment transport capacity, runoff control structures, water supply development, surveying techniques including GPS methods.

**BATM 3510 AGRICULTURAL POWER AND MACHINERY FUNDAMENTALS (3)** LLB. Pr. (MATH 1130 or MATH 1133 or MATH 1150 or MATH 1610 or MATH 1680) and (PHYS 1500 or PHYS 1600). Power unit fundamentals with emphasis on diesel and small gasoline engines; mechanics of operation, safety, use, and adjustment of machines used for horticultural and agronomic crop production; and precision agriculturr principles and technology.

**BATM 3530 AGRICULTURAL PRODUCTION AND PROCESSING FACILITY TECHNOLOGY (3)** LEC. 3. Pr. MATH 1130 or MATH 1133 or MATH 1150 or MATH 1610 or MATH 1680. Fundamental requirements for the design and operation of agricultural production and processing facilities.

**BATM 3560 TURF SYSTEMS IRRIGATION DESIGN (3)** LEC. 3. Pr. MATH 1120 or MATH 1130 or MATH 1133 or MATH 1150 or MATH 1610 or MATH 1680. 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.

**BATM 4100 PROFESSIONAL PRACTICE IN TECHNOLOGY MANAGEMENT (2)** LEC. 1. LAB. 3. Pr. BATM 5110. First in the two-course capstone experience. This course focuses on professional topics that prepare students for technical careers; teamwork, communication, standards and codes, economics, project and time management. Teams initiate the capstone design project.

**BATM 4110 TECHNOLOGY CAPSTONE (3)** LEC. 1. LAB. 6. Pr. BATM 4100. Development and evaluation of a team-based capstone project using tools from the technology curriculum; emphasizing communication, critical thinking, and technical and economic analyses.

**BATM 5110 AGRI-INDUSTRIAL ELECTRICAL APPLICATIONS (3)** LEC. 2. LAB. 3. Pr. BATM 2110 and (PHYS 1500 or PHYS 1600). An introduction to the fundamentals of electricity and electrical systems used in agricultural and industrial applications. Electricity basics include safety, AC (single and three phase) and DC power. Selecting and sizing components include wiring conductors, safety devices, motors, other loads.

**BATM 5120 AGRI-INDUSTRIAL ELECTRONICS AND CONTROLS (3)** LEC. 2. LAB. 3. Pr. BATM 5110. An introduction to the fundamentals of electronic control systems used in agricultural and industrial production and processing applications. Electronic control system components include programmable logic controllers (PLCs), switches, relays, sensors, and ladder logic.

**BATM 5130 PRECISION AG TECHNOLOGY (3)** LEC. 2. LAB. 3. Pr. BATM 3510. An overview of the principles of precision agriculture with focus on prescriptive agriculture and the ability to effectively execute input management plans using today's technologies. Course material and discussions will include how technologies such as GPS, agricultural GIS, sensors for qualitative and quantitative measurement of soil and plant variables, variable-rate technology are being implement with data informing sub-field level management and subsequent farm business decisions.

**BATM 5140 COMMERCIAL POULTRY & LIVESTOCK HOUSING (3)** LEC. 2. LAB. 3. Pr. STAT 2510. An introduction to the basic design, operation, and maintenance of modern commercial animal housing systems. Emphasis will be placed on poultry and swine systems with elements of dairy and beef when applicable.

**BATM 5550 PRINCIPLES OF FOOD ENGINEERING TECHNOLOGY (4)** LEC. 3. LAB. 3. Pr. (MATH 1130 or MATH 1133 or MATH 1150 or MATH 1153 or MATH 1610 or MATH 1613 or MATH 1617) and (PHYS 1000 or PHYS 1003 or PHYS 1007 or PHYS 1500 or PHYS 1600 or PHYS 1607). Engineering concepts and unit operations used in processing food products. Fall.

**BATM 6110 AGRI-INDUSTRIAL ELECTRICAL APPLICATIONS (3)** LEC. 2. LAB. 3. Departmental approval. An introduction to the fundamentals of electricity and electrical systems used in agricultural and industrial applications. Electricity basics include safety, AC (single and three phase) and DC power. Selecting and sizing components include wiring conductors, safety devices, motors, other loads.

**BATM 6120 AGRI-INDUSTRIAL ELECTRONICS AND CONTROLS (3)** LEC. 2. LAB. 3. Pr. BATM 6110. An introduction to the fundamentals of electronic control systems used in agricultural and industrial production and processing applications. Electronic control system components include programmable logic controllers (PLCs), switches, relays, sensors, and ladder logic.

**BATM 6130 PRECISION AG TECHNOLOGY (3)** LEC. 2. LAB. 3. An overview of the principles of precision agriculture with focus on prescriptive agriculture and the ability to effectively execute input management plans using today's technologies. Course material and discussions will include how technologies such as GPS, agricultural GIS, sensors for qualitative and quantitative measurement of soil and plant variables, variable-rate technology are being implemented with data informing sub-field level management and subsequent farm business decisions.

**BATM 6140 COMMERCIAL POULTRY AND LIVESTOCK HOUSING (3)** LEC. 2. LAB. 1. An introduction to the basic design, operation, and maintenance of modern commercial animal housing systems. Emphasis will be placed on poultry and swine systems with elements of dairy and beef when applicable.

**BATM 6550 PRINCIPLES OF FOOD ENGINEERING TECHNOLOGY (4)** LEC. 3. LAB. 3. Pr. (MATH 1130 or MATH 1133) and (PHYS 1000 or PHYS 1003 or PHYS 1007). Engineering concepts and unit operations used in processing food products. Fall.

## Crop, Soil, Environ Sciences Courses

**CSES 1010 SOILS AND LIFE (4)** LEC. 3. LAB. 2. Science Core. Practical applications of important soil properties and their function in everyday life. Connections between soils and human life will be made. Topics include food security, sustainable agricultural production, soil and water quality, and waste disposal.

**CSES 1020 CROPS AND LIFE (4)** LEC. 3. LAB. 2. Science Core. Essential role of crop plants to human life. Topics will include historical development of crop science, impact of crop science on human development, and major issues and problems facing modern crop science and technology.

**CSES 2000 BASIC CROP SCIENCE (4)** LEC. 3. LAB. 2. Agronomic principles of classification, growth, structure, and soil-plant relationship of field crops, with emphasis on influence of man and environment, and importance of crop production.

**CSES 2040 BASIC SOIL SCIENCE (4)** LEC. 3. LAB. 2. Pr. (CHEM 1010 and CHEM 1011) or (CHEM 1030 and CHEM 1031) or (CHEM 1110 and CHEM 1111) or (CHEM 1117 and CHEM 1118) or (CHEM 1033 and CHEM 1031). Formation, classification, properties, management, fertility and conservation of soils in relation to the growth of plants. Fall, Spring.

**CSES 2910 TURFGRASSES: USES AND CARE FOR SPORTS AND LEISURE (2)** LEC. 2. Introduction to the commonly used turfgrasses of the southeastern United States including of these turfgrasses for golf courses, athletic fields and home lawns will be included. This course may not be substituted for CSES 3150.

**CSES 3120 PRINCIPLES OF WEED SCIENCE (4)** LEC. 3. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043) and (BIOL 1020 or BIOL 1027). Weed identification and biology, methods of weed management and classification of herbicides and how they are used in weed control. Laboratory subjects are weed identification and sprayer calibration. Fall.

**CSES 3150 TURFGRASS MANAGEMENT (4)** LEC. 3. LAB. 2. Pr. (CSES 2040 or CSES 2043 or AGRN 2040 or AGRN 2043) and (BIOL 1020 or BIOL 1027). The management of recreational and home area turfgrass will be studied including establishment and maintenance of turf and the effect of light, traffic, soil fertility and water on its growth. Fall, Spring.

**CSES 3200 APPLIED TURF MANAGEMENT (3)** LEC. 1. LAB. 4. Pr. (P/C CSES 3150 or CSES 3153) or (AGRN 3150 or AGRN 3153). Familiarize students with the operation and maintenance of the equipment used for turfgrass maintenance. Effects on turfgrass performance will also be covered.

**CSES 3300 PLANT GENETICS AND CROP IMPROVEMENT (3)** LEC. 3. Pr. (P/C CSES 2000) or (BIOL 1020). Principles related to mendelian, population, and molecular genetics of plants including inheritance of qualitative and quantitative traits, and plant transformation. Improvement of crop plants including heritability, role of environment, pedigree selection, recurrent selection, the backcross method, and marker-assisted selection. Fall

**CSES 3920 INTERNSHIP (3)** INT. 3. Practical experience under the the supervision of an approved employer and the department. Internship may be in the areas of production, business, turf or science. Course may be repeated for a maximum of 6 credit hours.

**CSES 3960 SPECIAL PROBLEMS (2)** LAB. 2. Departmental approval. Individual and group problems investigations in crop, soil or weed science. Course may be repeated for a maximum of 4 credit hours.

**CSES 3970 SPECIAL TOPICS (3)** ST1. 3. New topics in agronomy and soils. Course may be repeated for a maximum of 6 credit hours.

**CSES 4100 CROPS JUDGING (2)** LEC. 1. LAB. 2. Departmental approval. Crops Judging is a course designed to prepare students for the national Crops Judging contest held at the Students of Agronomy, Soils and Environmental Sciences annual meeting. Students will learn practical knowledge to diagnose in-field agronomic problems such as crop nutrient deficiencies, disease damage, insect damage, weed pressure, herbicide injury, and soil management issues. Students must participate in the Crops Judging Contest at the SASES meeting in the semester the class is taken. Course may be repeated for a maximum of 6 credit hours.

**CSES 4200 SOIL JUDGING (2)** LEC. 1. LAB. 4. Description, evaluation and interpretation of soil-profile characteristics. Fall. Course may be repeated for a maximum of 8 credit hours.

**CSES 4210 ADVANCED SOIL JUDGING (2)** LEC. 1. LAB. 2. Pr. CSES 4200 or (AGRN 4200 or AGRN 4203). Advanced description, evaluation, and interpretations of soil-profile characteristics. Spring. Course may be repeated for a maximum of 8 credit hours.

**CSES 4300 TURFGRASS COMPETITIONS (2)** LEC. 1. LAB. 2. Departmental approval. The class is a comprehensive overview of practical turfgrass management in preparation for student competitions organized by the Sports Field Managers Association 9SFMA Student Challenge)and the Golf Course Superintendents Association of America (Turf Bowl). Students will compete in one or both of these contests during the semester following successful completion of the course. Course may be repeated for a maximum of 6 credit hours.

**CSES 4950 SENIOR SEMINAR (2)** LEC. 2. This course will cover professional presentations, both oral and written, in the area of Agronomy and Soils.

**CSES 4967 HONORS SPECIAL PROBLEMS (1-3)** IND. Pr. Honors College. Course may be repeated for a maximum of 3 credit hours.

**CSES 4997 HONORS THESIS (1-3)** IND. Pr. Honors College. Departmental approval.. Course may be repeated for a maximum of 3 credit hours.

**CSES 5000 ENVIRONMENTAL QUALITY (3)** LEC. 3. Role of global land use in biogeochemical cycling of major elements and compounds of environmental concern; interactions of pollutants with soils and aquatic and atmospheric environments; methods to minimize or correct pollution; risk assessment.

**CSES 5010 ANALYSIS OF PLANT, SOIL, AND ANIMAL DATA (3)** LEC. 3. Pr. (MATH 1130 or MATH 1133) or (STAT 2510 or STAT 2513). Principles of data analysis based on real examples will be discussed. Topics include measures of central tendency, dispersion, confidence intervals, sampling issues, probability distributions, etc.

**CSES 5020 NUTRIENT MANAGEMENT (3)** LEC. 3. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). Lectures and problems illustrate principles of nutrient management as related to soil or growth media, plant, fertilizer practices, management systems and environment. Required for all students majoring in Agronomy and Soils. Spring.

**CSES 5030 ADVANCED CROP SCIENCE (3)** LEC. 3. Pr. (CSES 1000 or CSES 1003 or CSES 2000) or (AGRN 1000 or AGRN 1003 or AGRN 1007) or (AGRN 2040 or AGRN 2043) and (CSES 2040 or CSES 2043) and (BIOL 1030 or BIOL 1037). Application and integration of principles from undergraduate agricultural, biological and physical sciences courses in management of crop production systems. May count either CSES 5030.

**CSES 5060 SOIL MICROBIOLOGY LECTURE (3)** LEC. 3. Pr. BIOL 3200. Ecology, physiology, and biochemistry of soil microorganisms with emphasis on soil microbial processes that are important to environmental quality and soil productivity. Spring.

**CSES 5061 SOIL MICROBIOLOGY LAB (1)** LAB. 2. Pr. (P/C CSES 5060 or P/C CSES 5063) or (P/C AGRN 5060 or P/C AGRN 5063). Laboratory exercises illustrating ecology, physiology, and biochemistry of soil microorganisms. Credit will not be given for both CSES 5061 and CSES 6061. Spring.

**CSES 5080 SOIL RESOURCES AND CONSERVATION (4)** LEC. 3. LAB. 2. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). Soils as a natural resource for land-use planning; their use and management for sustainable crop production, urban and industrial development and ecosystem protection. CSES 5080 Summer. CSES 5083 Fall.

**CSES 5100 PLANT GENETICS AND CROP IMPROVEMENT (3)** LEC. 3. Pr. BIOL 1030 or BIOL 1037. Principles related to mendelian, population, and molecular genetics of plants including inheritance of qualitative and quantitative traits, and plant transformation. Improvement of crop plants including heritability, role of environment, pedigree selection, recurrent selection, the backcross method, and marker-assisted selection. Fall

**CSES 5110 PLANT BREEDING I (3)** LEC. 3. Pr. CSES 3300 or BIOL 3000 or BIOL 3003 or AGRI 3000. Fundamental principles and theories utilized in the science of plant breeding and cultivar development and the role breeding plays in crop improvement.

**CSES 5120 PLANT BREEDING II (3)** LEC. 3. Pr. CSES 5110. Review and contrast how major crop species breeding strategies are determined. Emphasis on integration of traditional methodologies with modern genetic and genomic technologies.

**CSES 5150 SOIL MORPHOLOGY (4)** LEC. 3. LAB. 2. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). Physical, chemical and mineralogical properties of soils are studied in relation to their distribution and classification for environmental, engineering and agricultural use and interpretations. Spring.

**CSES 5160 ADVANCED TURFGRASS MANAGEMENT (3)** LEC. 3. Pr. (CSES 3150 or CSES 3153) or (AGRN 3150 or AGRN 3153). Factors affecting the turfgrass plant as a component of a dynamic community. Influence of soil chemical and physical conditions, management practices and climate are discussed. Theoretical and practical aspects of turfgrass management practices are discussed along with design and construction of golf courses and other athletic purpose turf areas.

**CSES 5200 APPLIED WEED SCIENCE TECHNOLOGY (3)** LEC. 3. SU. Pr. (CSES 3120 or CSES 3123) or (AGRN 3120 or AGRN 3123). Advanced weed identification, pesticide application technology, identification of herbicide injury symptomology, and develop of interaction techniques and problem solving skills for dealing with potential herbicide efficacy problems. Course may be repeated for a maximum of 6 credit hours.

**CSES 5240 CROP PHYSIOLOGY (3)** LEC. 3. Pr. BIOL 3100 or HORT 3000. Integrates principles of plant physiology, biochemistry, ecology, and genetics as they relate to plant growth and development and crop yield. The effect of management practices and abiotic stress on plant growth and development will be discussed. Credit will only be given for one of the following: CSES 5240 or CSES 6240.

**CSES 5250 AQUATIC SEDIMENTS (4)** LEC. 3. LAB. 1. An overview of sediments in aquatic environments with a focus on the biogeochemistry, storage capacity, and use in paleoenvironmental reconstruction.

**CSES 5300 SOIL CHEMISTRY (4)** LEC. 3. LAB. 2. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). An introduction to the basic soil chemical properties of mineral composition, weathering, absorption, cation exchange, acidity, alkalinity, salinity and soil reactions with fertilizers, pesticides and heavy metals. Spring.

**CSES 5400 BIOENERGY AND THE ENVIRONMENT (3)** LEC. 3. The role of bioenergy in reducing environmental problems related to use of fossil fuels and certain agricultural practices, and in addressing declining rural economies.

**CSES 5500 FORAGE PRODUCTION AND UTILIZATION (3)** LEC. 3. Grass and legume forage crops. The crops are considered from the standpoint of (a) pasture crops, (b) hay and silage crops, (c) soil-improving crops. Spring. May count either CSES 5500 or CSES 5503.

**CSES 5590 ENVIRONMENTAL SOIL PHYSICS AND VADOSE ZONE HYDROLOGY (4)** LEC. 3. LAB. 2. Pr. CSES 2040. Explore the dynamic interplay of soil physical properties and vadose zone hydrology in this comprehensive environmental soil physics course. Delve into the intricate mechanisms governing the movement of water, chemicals, heat, and gases through soils within diverse ecosystems, including agricultural, urban, and natural landscapes. Uncover the complexities of the soil-plant-atmosphere continuum and gain hands-on experience with field instrumentation for precise measurement and assessment of soil physical properties.

**CSES 5800 CLIMATE, WATER, AND LIFE (3)** LEC. 3. LAB. 0. The course will introduce essential hydroclimate processes and phenomena, and their impacts on water resources, food and agriculture, and ecosystems. Major topics include climate variability and change, radiation, temperature, humidity, precipitation, land surface energy and water fluxes, their linkages with plants and humans, and climate hazards and resiliency.

**CSES 5960 SPECIAL PROBLEMS (1-3)** IND. Work under the direction of a staff member on special problems in crop, soil or weed science. Course may be repeated for a maximum of 6 credit hours.

**CSES 6000 ENVIRONMENTAL QUALITY (3)** LEC. 3. Role of global land use in bio-geochemical cycling of major elements and compounds of environmental concern; interactions of pollutants with soils and aquatic and atmospheric environments; methods to minimize or correct pollution; risk assessment.

**CSES 6010 ANALY PLANT, SOIL & ANI DATA (3)** LEC. 3. Pr. (MATH 1130 or MATH 1133) or (STAT 2510 or STAT 2513). Principles of data analysis based on real examples will be discussed. Topics include measures of central tendency, dispersion, confidence intervals, sampling issues, probability distributions, etc.

**CSES 6020 NUTRIENT MANAGEMENT (3)** LEC. 3. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). Lectures and problems illustrate principles of nutrient management as related to soil or growth media, plant, fertilizer practices, management systems and environment. Required for all students majoring in Agronomy and Soils. Spring.

**CSES 6030 ADVANCED CROP SCIENCE (3)** LEC. 3. Application and integration of principles from undergraduate agricultural, biological and physical sciences courses in management of crop production systems. May count either CSES 5030/CSES 6030 or CSES 5033/CSES 6036.

**CSES 6060 SOIL MICROBIOLOGY LECTURE (3)** LEC. 3. Pr. BIOL 3200. Ecology, physiology, and biochemistry of soil microorganisms with emphasis on soil microbial processes that are important to environmental quality and soil productivity. Spring.

**CSES 6061 SOIL MICROBIOLOGY LAB (1)** LAB. 2. Pr. (P/C CSES 6060 or P/C CSES 6066) or (P/C AGRN 6060 or P/C AGRN 6066). Laboratory exercises illustrating ecology, physiology, and biochemistry of soil microorganisms. Credit will not be given for both CSES 5061 and CSES 6061. Spring.

**CSES 6080 SOIL RESOURCES AND CONSERVATION (4)** LEC. 3. LAB. 2. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). Soils as a natural resource for land-use planning; their use and management for sustainable crop production, urban and industrial development and ecosystem protection. CSES 6080 Summer. CSES 6086 Fall.

**CSES 6110 PLANT BREEDING I (3)** LEC. 3. Fundamental principles and theories utilized in the science of plant breeding and cultivar development and the role breeding plays in crop improvement.

**CSES 6120 PLANT BREEDING II (3)** LEC. 3. Pr. CSES 6110. Review and contrast how major crop species breeding strategies are determined. Emphasis on integration of traditional methodologies with modern genetic and genomic technologies.

**CSES 6150 SOIL MORPHOLOGY (4)** LEC. 3. LAB. 2. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). Physical, chemical and mineralogical properties of soils are studied in relation to their distribution and classification for environmental, engineering and agricultural use and interpretations. Spring.

**CSES 6160 ADVANCED TURFGRASS MANAGEMENT (3)** LEC. 3. Pr. (CSES 3150 or CSES 3153) and (BIOL 3100 or BIOL 6130) or (AGRN 3150 or AGRN 3153). Factors affecting the turfgrass plant as a component of a dynamic community. Influence of soil chemical and physical conditions, management practices and climate are discussed. Theoretical and practical aspects of turfgrass management practices are discussed along with design and construction of golf courses and other athletic purpose turf areas.

**CSES 6200 APPLIED WEED SCIENCE TECH (3)** LEC. 3. SU. Pr. (CSES 3120 or CSES 3123) or (AGRN 3120 or AGRN 3123). Advanced weed identification, pesticide application technology, identification of herbicide injury symptomology, and develop of interaction techniques and problem solving skills for dealing with potential herbicide efficacy problems. Course may be repeated for a maximum of 6 credit hours.

**CSES 6240 CROP PHYSIOLOGY (3)** LEC. 3. Integrates principles of plant physiology, biochemistry, ecology, and genetics as they relate to plant growth and development and crop yield. The effect of management practices and abiotic stress on plant growth and development will be discussed. Credit will only be given for one of the following: CSES 5240 or CSES 6240.

**CSES 6250 AQUATIC SEDIMENTS (4)** LEC. 3. LAB. 1. An overview of sediments in aquatic environments with a focus on the biogeochemistry, storage capacity, and use in paleoenvironmental reconstruction.



**CSES 6300 SOIL CHEMISTRY (4)** LEC. 2. LAB. 4. Pr. (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). An introduction to the basic soil chemical properties of mineral composition, weathering, absorption, cation exchange, acidity, alkalinity, salinity and soil reactions with fertilizers, pesticides and heavy metals. Spring.

**CSES 6400 BIOENERGY AND THE ENVIRONMENT (3)** LEC. 3. The role of bioenergy in reducing environmental problems related to use of fossil fuels and certain agricultural practices, and in addressing declining rural economies.

**CSES 6500 FORAGE PRODUCTION AND UTILIZATION (3)** LEC. 3. Pr., In major or departmental approval. Grass and legume forage crops. The crops are considered from the standpoint of (a) pasture crops, (b) hay and silage crops, (c) soil-improving crops and (d) energy crops. May count either CSES 6500 or CSES 6506.

**CSES 6590 ENVIRONMENTAL SOIL PHYSICS AND VADOSE ZONE HYDROLOGY (4)** LEC. 3. LAB. 2. Pr. CSES 2040. Explore the dynamic interplay of soil physical properties and vadose zone hydrology in this comprehensive environmental soil physics course. Delve into the intricate mechanisms governing the movement of water, chemicals, heat, and gases through soils within diverse ecosystems, including agricultural, urban, and natural landscapes. Uncover the complexities of the soil-plant-atmosphere continuum and gain hands-on experience with field instrumentation for precise measurement and assessment of soil physical properties.

**CSES 6800 CLIMATE, WATER, AND LIFE (3)** LEC. 3. The course will introduce essential hydroclimate processes and phenomena, and their impacts on water resources, food and agriculture, and ecosystems. Major topics include climate variability and change, radiation, temperature, humidity, precipitation, land surface energy and water fluxes, their linkages with plants and humans, and climate hazards and resiliency.

**CSES 6900 DIRECTED STUDIES (1-3)** DSL/LEC. Conferences, problems and assigned reading in soils and crops, including results of agronomic research from the substations and experiment fields. Course may be repeated for a maximum of 6 credit hours.

**CSES 6930 ADVANCED DIRECTED STUDIES (1-3)** DSL/LEC. SU. Conferences, problems and assigned reading in soils and crops, including results of agronomic research from the substations and experiment fields. Course may be repeated for a maximum of 6 credit hours.

**CSES 6960 SPECIAL PROBLEMS (1-3)** DSL/IND. Conferences, problems and assigned reading in soils and crops, including results of agronomic research from the substations and experiment fields. Course may be repeated for a maximum of 6 credit hours.

**CSES 7080 EXPERIMENTAL METHODS (3)** LEC. 3. Pr. STAT 7000. Experimentation in the agricultural sciences including experimental techniques, interpretation of research data, use of library references, and preparation of publications. Problems, assigned readings and lectures. Summer.

**CSES 7120 PLANT GENOMICS (3)** LLB. Hands-on bioinformatics of complex plant genomes, including assembly and annotation. Writing- and bioinformatics-intensive course that culminates in a plant genome manuscript. Fall.

**CSES 7140 CHEMISTRY AND USE OF HERBICIDES IN CROP PRODUCTION (4)** LEC. 3. LAB. 2. Pr. CHEM 1040. Principles and use of herbicides in agronomic crops. Methods of herbicide application, including time, incorporation and formulation, the fate of herbicides in soil and the ecological impact on succeeding plant species. Fall.

**CSES 7160 GENETIC DATA ANALYSIS (3)** LEC. 3. Pr. (CSES 5100 or CSES 5103) or (CSES 6100 or CSES 6106) and STAT 4020 or (AGRN 5100 or AGRN 5103) or (AGRN 6100 or AGRN 6106). Introduces procedures to study the genetic characteristics of individuals and populations. Computer models will be used to simulate genomes and traits. Application of quantitative methods to experimental populations used to plan breeding programs. Fall.

**CSES 7170 ADVANCED PLANT BREEDING (3)** LEC. 3. Pr. CSES 7160 or (AGRN 7160 or AGRN 7166). Estimation and interpretation of genetic variance components, heritability, selection response, yield stability indices and their effect on choice of breeding method. Recurrent selection theory and breeding for resistance to plant stresses.

**CSES 7180 SUSTAINABLE AGROECOLOGY (3)** LEC. 3. Pr. (BIOL 6130 or CSES 7250) or (AGRN 7250 or AGRN 7256) and (CSES 2040 or CSES 2043) or (AGRN 2040 or AGRN 2043). The study of interactions between crops and abiotic and biotic environments. Emphasis is placed on quantitatively examining theory and principles for production, stability and sustainability of agricultural ecosystems. Graduate standing in CSES or departmental approval

**CSES 7270 QUANTITATIVE GENETICS IN PLANT BREEDING (3)** LEC. 3. Quantitative and population plant genetics and their interrelationship with plant breeding. Genetic and environmental variation and how they relate to selection procedures and choice of type of variety. Predictive plant breeding. QTL discovery, molecular breeding, and genomic selection in an applied breeding program.

**CSES 7540 PRINCIPLES OF PLANT NUTRITION (3)** LEC. 3. Pr. CSES 6020 or CSES 6026 or (AGRN 6020 or AGRN 6026). Processes of nutrient flux to plant roots growing in soil. Chemistry and properties of soil in relation to the nutrition and growth of plants. Summer.

**CSES 7600 AGROCLIMATOLOGY (3)** LEC. 3. The relationships between climatological processes and agriculture, including precipitation, evapotranspiration, meteorological hazards, irrigation and drainage, crop development, climate data acquisition and analysis, crop-weather models, and impacts of global climate change. May count either CSES 7600 or CSES 7606.

**CSES 7670 SPECIAL TOPICS (1-4)** DSL/LEC. Advanced topics related to Crop, Soil and Environmental Sciences. Course may be repeated for a maximum of 8 credit hours.

**CSES 7800 DEEP LEARNING FOR ENVIRONMENTAL SCIENCES (3)** LEC. 2. LAB. 2. The course will cover concepts and applications of deep learning for environmental sciences. The goal is to understand the concepts and applications of deep learning methods in environmental sciences, formulate relevant environmental, climate, and earth system science problems, and how to use these methods for understanding and developing creative solutions to these problems.

**CSES 7950 SEMINAR (1)** DSL/SEM. 1. SU. Required of all graduate students in Agronomy and Soils. Fall, Spring. Course may be repeated for a maximum of 2 credit hours.

**CSES 7970 SPECIAL TOPICS (1-4)** LEC. 1-4, LAB. 1-4. Advanced topics related to Crop, Soil and Environmental Sciences. Course may be repeated for a maximum of 8 credit hours.

**CSES 7990 RESEARCH AND THESIS (1-10)** DSL/MST. Research and thesis on problems in the soil and crop sciences. Course may be repeated with change in topics.

**CSES 8570 PHYSICAL SOIL CHEMISTRY (3)** LEC. 3. Pr. (CSES 6300 or CSES 6306) and CHEM 6070 or (AGRN 6300 or AGRN 6306). Interpretation of soil properties and chemical reactions in terms of ion exchange, solubility diagrams, solutions equilibria, electrochemistry and electrokinetics of charged particles. Fall.

**CSES 8580 FATE AND TRANSPORT OF CHEMICALS IN SOILS (3)** LEC. 3. Pr. MATH 1720 and (PHYS 1600 or PHYS 1607) and CSES 7590. Transport phenomena in soils. Physical principles and analysis of the storage and movement of water, solutes, heat, and gases in soils. Spring.

**CSES 8990 RESEARCH AND DISSERTATION (1-10)** DSR. Research and dissertation on problems in the soil and crop sciences. Course may be repeated with change in topics.

## Entomology Courses

**ENTM 2000 PESTS, PATHOGENS, PARASITES, AND PEOPLE (3)** LEC. 3. Past and present problems of pests and disease involving humans and the food chain.

**ENTM 2040 INSECTS: AN INTRODUCTION TO ENTOMOLOGY (3)** LEC. 3. Life processes, importance, and occurrence of insects.

**ENTM 2980 INTRODUCTION TO UNDERGRADUATE RESEARCH (1-4)** IND/RES. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**ENTM 3040 GENERAL ENTOMOLOGY (4)** LEC. 3. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Introduction to the biology and diversity of insects. An insect collection is required.

**ENTM 4020 ECONOMIC ENTOMOLOGY (4)** LEC. 3. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Consideration of the biological aspects, life histories and control of insects.

**ENTM 4920 ENTOMOLOGY INTERNSHIP (5)** INT. 5. SU. Practical professional experience under the supervision of internship faculty and/or representatives of state, federal or private agency.

**ENTM 4960 SPECIAL PROBLEMS IN ENTOMOLOGY (1-3)** IND. Departmental approval. Credit to be arranged. Specialized project or research on a specific topic in entomology to be conducted under faculty supervision. Course may be repeated for a maximum of 3 credit hours.

**ENTM 4980 UNDERGRADUATE RESEARCH (1-4)** LAB. 2-8. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**ENTM 5120 MEDICAL-VETERINARY ENTOMOLOGY (4)** LEC. 3. LAB. 1. Pr. (BIOL 1030 or BIOL 1037) and (ENTM 3040 or ENTM 4020). Survey of insects, ticks, and mites of medical or veterinary importance, emphasizing role as vectors of disease agents and the biology of pathogen-transmission cycles. Labs focus on methods of vector sampling and surveillance, identification, and case studies of special topics. May count either ENTM 5120 or ENTM 6120.

**ENTM 5220 INSECT ECOLOGY (4)** LEC. 3. LAB. 3. Pr. BIOL 3060. Ecological interactions of insects and their environment, with emphasis on is herbivory, predation, parasitism and mutualism, as well as population and community dynamics.

**ENTM 5300 INSECT DIVERSITY (4)** LEC. 3. LAB. 1. Pr. ENTM 3040 or ENTM 4020. Survey of the biodiversity of insects, stressing taxon diagnostics.

**ENTM 5330 INTEGRATED PEST MANAGEMENT (3)** LEC. 3. Aspects of pest management as a broad-based approach that integrates practices for economic control of pests. May count either ENTM/HORT/PLPA 5330/6330.

**ENTM 5360 LANDSCAPE ENTOMOLOGY (4)** LEC. 3. LAB. 3. Pr. (BIOL 1020 or BIOL 1027) or (BIOL 1030 or BIOL 1037). Identification and management of arthropod pests in the landscape. Recognition of pests and damage to trees, turf and ornamental plants.

**ENTM 5370 URBAN ENTOMOLOGY (4)** LEC. 3. LAB. 3. Pr. ENTM 3040 or ENTM 4020. Identification, biology and control of insect and other household arthropod pests.

**ENTM 5500 BEE BIOLOGY AND MANAGEMENT (3)** LEC. 2. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Biology and management of bees, with an emphasis on honey bees and beekeeping. May count either ENTM 5500 or ENTM 6500.

**ENTM 5660 FIGURE FUNDAMENTALS : SCIENTIFIC ILLUSTRATION (3)** LEC/STU. 1. Scientific illustration and data visualization implemented through the Adobe creative cloud package. May count either ENTM 5660, APBT 5660, or ENTM 6660.

**ENTM 5700 VECTOR TRANSMISSION OF PLANT PATHOGENS (3)** LEC. 3. Pr. BIOL 1030 or BIOL 1037. This course is designed to give students an understanding of vectors of plant pathogens. The use of case studies during this course is designed to show real world examples of plant pathogens which utilize insects as an important part of their lifecycle. May only count one of PLPA/ENTM 5700/6700.

**ENTM 5820 PRINCIPLES AND TOOLS FOR REPRODUCIBLE SCIENCE IN AGRICULTURE (2)** LEC. 2. Pr. STAT 2510. Reproducibility is fundamental to science. This course will cover basic concepts in scientific reproducibility, accessibility, and organization as it relates to handling large datasets and publishing data workflows.

**ENTM 5920 INTERNSHIP (3)** IND. 3. SU. Departmental approval. Practical professional experience under the supervision of internship faculty and a representative of a state, federal, or private agency.

**ENTM 6120 MEDICAL-VETERINARY ENTOMOLOGY (4)** LEC. 3. LAB. 3. Survey of insects, ticks, and mites of veterinary importance, emphasizing role as vectors of disease agents and the biology of pathogen-transmission cycles. Labs focus on methods of vector sampling and surveillance, identification, and case studies of special topics. May count either ENTM 5120 or ENTM 6120.

**ENTM 6220 INSECT ECOLOGY (4)** LEC. 3. LAB. 3. Pr. BIOL 3060. Departmental approval. Ecological interactions of insects and their environment, with emphasis on herbivory, predation, parasitism and mutualism, as well as population and community dynamics.

**ENTM 6300 INSECT DIVERSITY (4)** LEC. 3. LAB. 1. Pr. ENTM 3040 or ENTM 4020. Survey of the biodiversity of insects, stressing taxon diagnostics.

**ENTM 6330 INTEGRATED PEST MANAGEMENT (3)** LEC. 3. Aspects of pest management as a broad-based approach that integrates practices for economic control of pests. May count either ENTM/HORT/PLPA 5330/6330.

**ENTM 6360 LANDSCAPE ENTOMOLOGY (4)** LEC. 3. LAB. 3. Pr. (BIOL 1020 or BIOL 1027) or (BIOL 1030 or BIOL 1037). Identification and management of arthropod pests in the landscape. Recognition of pests and damage to trees, turf and ornamental plants.

**ENTM 6370 URBAN ENTOMOLOGY (4)** LEC. 3. LAB. 3. Pr. ENTM 3040 or ENTM 4020. Identification, biology and control of insect and other household arthropod pests.

**ENTM 6440 INSECT MORPHOLOGY (5)** LEC. 3. LAB. 6. Pr. ENTM 3040 or ENTM 4020. Departmental approval. Comparative external anatomy and generalized internal structures of insects. Characteristics used in taxonomy will be emphasized. Credit will not be given for both ENTM 5440 and ENTM 6440.

**ENTM 6500 BEE BIOLOGY AND MANAGEMENT (3)** LEC. 2. LAB. 2. Biology and management of bees, with an emphasis on honey bees and beekeeping. May count either ENTM 5500 or ENTM 6500.

**ENTM 6660 FIGURE FUNDAMENTALS : SCIENTIFIC ILLUSTRATION (3)** LEC. 2, LST. 1. Scientific illustration and data visualization implemented through the Adobe creative cloud package. May take either ENTM 5660, APBT 5660, or ENTM 6660.

**ENTM 6700 VECTOR TRANSMISSION OF PLANT PATHOGENS (3)** LEC. 3. This course is designed to give students an understanding of vectors of plant pathogens. The use of case studies during this course is designed to show real world examples of pathogens which utilize insects as an important part of their lifecycle. May only count one of PLPA/ENTM 5700/6700.

**ENTM 6820 PRINCIPLES AND TOOLS FOR REPRODUCIBLE SCIENCE IN AGRICULTURE (2)** LEC. 2. Reproducibility is fundamental to science. This course will cover basic concepts in scientific reproducibility, accessibility, and organization as it relates to handling large datasets and publishing data workflows.

**ENTM 6920 INTERNSHIP (3)** IND. 3. SU. Departmental approval. Practical professional experience under the supervision of internship faculty and a representative of a state, federal, or private agency.

**ENTM 7100 GENERAL TOXICOLOGY (4)** LEC. 3. LAB. 3. Pr. ENTM 3040 and CHEM 2030. Departmental approval. History, mechanism of action, metabolism, and structure activity relationship of natural and synthetic insecticides. Contemporary laboratory techniques in toxicology will be featured.

**ENTM 7200 INSECT PHYSIOLOGY (4)** LEC. 3. LAB. 3. Pr. ENTM 3040. Departmental approval. Introduction to insect physiology stressing structure and function of each organ system. Methods used in physiological research will be emphasized.

**ENTM 7230 PRACTICAL EVOLUTION (3)** LEC. 3. Pr. BIOL 5800 or BIOL 6800. Students will learn evolutionary biology by making it happen, that is, by building and running simulation models. They will also learn of opportunities to apply evolutionary theory to practical problems in agriculture, public health and conservation.

**ENTM 7900 DIRECTED STUDIES IN ENTOMOLOGY I (1-5)** LEC. SU. Discussion groups on specific topics, assigned readings, on laboratory problems or field research. Course may be repeated for a maximum of 5 credit hours.

**ENTM 7950 SEMINAR (1)** SEM. 1. SU. Presentation and discussion of scientific literature of thesis research findings. Required of all M.S. candidates.

**ENTM 7960 SPECIAL PROBLEMS IN ENTOMOLOGY (1-4)** LAB. 2-8. Departmental approval. Specialized project or research on a specific topic in entomology to be conducted under faculty supervision. Course may be repeated for a maximum of 4 credit hours.

**ENTM 7990 RESEARCH AND THESIS (1-10)** MST. Topics may focus on technical laboratory problems or field research related to arthropod biology. Admission to the M.S. Program. Course may be repeated with change in topics.

**ENTM 8900 DIRECTED STUDIES IN ENTOMOLOGY II (5)** LEC. 5. Discussion groups on specific topics, assigned reading on laboratory problems or field research.

**ENTM 8910 TEACHING PRACTICUM (1)** LAB. 2. SU. Departmental approval. Practical and theoretical issues of laboratory learning, and pedagogical facilitation. Required of all PhD students. Course may be repeated for a maximum of 3 credit hours.

**ENTM 8930 JOURNAL REVIEW FOR ENTOMOLOGY AND PLANT PATHOLOGY (1)** LEC. 1. Pr. ENTM 3040 and ENTM 4020 or (PLPA 3000 or PLPA 3003). Discussion of recent scientific publications on basic aspects of research in entomology and plant pathology. Course may be repeated for a maximum of 3 credit hours.

**ENTM 8950 SEMINAR (1)** LEC. 1. SU. Presentation and discussion of scientific literature or dissertation research findings. Required of all Ph.D. students.

**ENTM 8960 ADVANCED SPECIAL PROBLEMS IN ENTOMOLOGY (1-4)** LAB. 2-8. Departmental approval. Credit to be arranged. Specialized project or research on a specific topic in entomology to be conducted under faculty supervision. Course may be repeated for a maximum of 4 credit hours.

**ENTM 8990 RESEARCH AND DISSERTATION (1-10)** DSR. Admission to the Ph.D. Program. Course may be repeated with change in topics.

## Environmental Science Courses

**ENVI 1010 INTRODUCTION TO ENVIRONMENTAL SCIENCE (1)** LEC. 1. Introduction to the environmental science field and the ENVI major. Course may be repeated for a maximum of 3 credit hours.

**ENVI 1020 FUNDAMENTALS OF ENVIRONMENTAL SCIENCE (3)** LEC. 3. Preference given to students for whom the course is required. Survey of fundamental concepts, issues, and concerns related to environmental science.

**ENVI 3000 INTRODUCTION TO STREAM RESTORATION (4)** LEC. 2. LAB. 4. Introduction to concepts necessary for stream restoration design, construction, and maintenance and how they relate to the physical, chemical and biological processes of streams. Students will participate in research associated with stream restoration by assessing stream stability and classifying streams.

**ENVI 4000 ENVIRONMENTAL REGULATION AND MANAGEMENT APPLICATIONS (3)** LEC. 3. Pr. ENVI 1010 and ENVI 1020. This course provides an introduction to and overview of how municipal, state and federal regulations and programs are used in environmental management. The spectrum and development of environmental requirements, responsibilities, and direct applications as to the release of pollutants to air, soil and water are explored.

**ENVI 4950 ENVIRONMENTAL SCIENCE SENIOR SEMINAR (2)** LEC. 2. Pr. (ENGL 1120 or ENGL 1127) and ENVI 1010 and ENVI 1020. Departmental approval. This course will cover oral and written professional presentations, assessment of students in the ENVI major via standardized testing, and student assessment via exit surveys.

**ENVI 4980 UNDERGRADUATE RESEARCH (2-4)** IND. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**ENVI 5100 CLIMATE CHANGE IMPACTS (3)** LEC. 3. An overview of climate change for the non-climate scientist, how climate change affects global environments (forests, oceans, lakes, coasts, agriculture) in recent time periods and how historic records are used to study past climate change impacts.

**ENVI 5200 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN ENVIRONMENTAL SCIENCE (4)** LEC. 3. LAB. 2, LLB. 0. Pr. (STAT 2510 or STAT 2513) and (MATH 1610 or MATH 1613 or MATH 1617). This course introduces environmental science students to the basics of artificial intelligence (AI) and machine learning (ML) and their applications in environmental science. Students will learn how to use AI/ML tools to analyze large and complex environmental data sets, make predictions, and identify patterns that are not visible to the naked eye. Students will become familiar with the potential and limitations of AI/ML in environmental science and what ethical considerations should be made.

**ENVI 6100 CLIMATE CHANGE IMPACTS (3)** LEC. 3. An overview of climate change for the non-climate scientist, how climate change affects global environments (forests, oceans, lakes, coasts, agriculture) in recent time periods and how historic records are used to study past climate change impacts.

**ENVI 6200 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN ENVIRONMENTAL SCIENCE (4)** LEC. 3. LAB. 2. This course introduces environmental science students to the basics of artificial intelligence (AI) and machine learning (ML) and their applications in environmental science. Students will learn how to use AI/ML tools to analyze large and complex environmental data sets, make predictions, and identify patterns that are not visible to the naked eye. Students will become familiar with the potential and limitations of AI/ML in environmental science and what ethical considerations should be made.

## Fisheries Allied Aqua Courses

**FISH 1100 FISHERIES ORIENTATION (1)** LEC. 1. SU. An introduction to the departmental programs and personnel and how to make the most of a future in fisheries.

**FISH 1110 DIMENSIONS OF FISHERIES, AQUACULTURE, AND AQUATIC SCIENCES (1)** LEC. 1. Consideration of various aspects of fisheries, aquaculture, and aquatic sciences work, career options as related to individual interests, and career planning. Overview of the different research and extension areas of the School.

**FISH 2000 GENERAL BIOLOGY OF FISHES AND AQUATIC ORGANISMS (1)** LEC. 1. To introduce students to the anatomy and physiology of fishes, crustaceans, and mollusks to better prepare them to take advanced courses in the School of Fisheries, Aquaculture & Aquatic Sciences.

**FISH 2020 GLOBAL AND REGIONAL PERSPECTIVES IN FISHERIES, AQUACULTURE, AND AQUATIC SCIENCES (2)** LEC. 2. Overview of socioeconomic and ecological aspects of fisheries, aquaculture, and aquatic sciences. The course will cover human dimensions specific to commercial and recreational fisheries, aquaculture species, and the aquatic environment.

**FISH 3950 CAREERS IN FISHERIES (1)** LEC. 1. SU. Pr. FISH 2100. Consideration of various aspects of fisheries work, career options as related to individual interests, and career planning or departmental approval. Fall.

**FISH 4100 INTRODUCTION TO FISHERIES SCIENCES (3)** LEC. 2. LAB. 3. Departmental approval. Hands-on field activities and site visits related to aquatic ecology, fisheries biology, and aquaculture.

**FISH 4900 DIRECTED STUDIES IN FISHERIES (1-4)** IND. SU. Individualized in depth study on a particular subject under the guidance of a professor. May include directed reading and research. Course may be repeated for a maximum of 4 credit hours.

**FISH 4920 INTERNSHIP (1-5)** INT. SU. Departmental approval. Discipline-related learning while employed with cooperating private industry or public agency. Course may be repeated for a maximum of 5 credit hours.

**FISH 4960 SPECIAL PROBLEMS (1-4)** LEC. Departmental approval. Individual and group problems investigations in fisheries and allied aquacultures. Course may be repeated for a maximum of 4 credit hours.

**FISH 4967 HONORS SPECIAL PROBLEMS (1-4)** IND. Pr. Honors College. Departmental approval.. Course may be repeated for a maximum of 4 credit hours.

**FISH 4980 UNDERGRADUATE RESEARCH (2-4)** IND. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**FISH 4997 HONORS THESIS (1-3)** IND. Pr. Honors College. Departmental approval.. Course may be repeated for a maximum of 3 credit hours.

**FISH 5210 PRINCIPLES OF AQUACULTURE (3)** LEC. 3. Pr. BIOL 1030 or BIOL 1037. Principles underlying aquatic productivity and levels of management as demonstrated by present practices of aquaculture around the world.

**FISH 5215 MARINE AQUACULTURE (2)** LEC. 1. LAB. 2. Departmental approval. Introduction to culture of marine species with emphasis in nutrition and feeding, reproductive biology, production techniques, processing, marketing and economics. Taught at the Dauphin Island Sea Lab.

**FISH 5220 WATER SCIENCE (3)** LEC. 3. Pr. CHEM 1040. Properties of water, the water cycle, basic water chemistry and water quality with emphasis on water in managed ecosystems.

**FISH 5230 CONSERVATION ECOLOGY OF FRESHWATER INVERTEBRATES (4)** LEC. 3. LAB. 1. Foundational knowledge, ecological theory, and illustrative case-studies on conservation issues and solutions for freshwater invertebrates.

**FISH 5240 HATCHERY MANAGEMENT (4)** LEC. 2. LAB. 8. Pr. FISH 5210 or FISH 6210. Study of warm-water hatchery techniques and application of those techniques in the field.

**FISH 5245 SHELLFISH AQUACULTURE IN THE GULF OF MEXICO (2)** FLD. 40. One year of college-level Biology or departmental consent. Overview of the various types of shellfish aquaculture practiced in the Gulf of Mexico, and an understanding of the implications for both for public stock enhancement and private production. Taught at Dauphin Island Sea Lab. May count either FISH 5245 or FISH 6245.

**FISH 5250 AQUACULTURE PRODUCTION (4)** LEC. 3. LAB. 4. Pr. FISH 5210. Factors affecting growth and yield of aquacultural species, with implications toward farming commonly cultured species. Production techniques for commercially important finfish are discussed.

**FISH 5320 LIMNOLOGY (3)** LEC. 3. Pr. CHEM 1040 and (BIOL 1030 or BIOL 1037). Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater communities.

**FISH 5321 LIMNOLOGY LABORATORY (1)** LAB. 4. Pr. (BIOL 1030 or BIOL 1037) and CHEM 1040 and (P/C FISH 5320 or P/C FISH 6320). Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of aquatic communities. May count either FISH 5321 or FISH 6321.

**FISH 5380 GENERAL ICHTHYOLOGY (4)** LEC. 3. LAB. 6. Pr. BIOL 1030 or BIOL 1037. Survey of the biodiversity of world and local fishes, with an overview of ecology, behavior, biology and conservation of fishes.

**FISH 5410 INTRODUCTION TO FISH HEALTH (3)** LEC. 3. Pr. BIOL 1030 or BIOL 1037. Introduction to parasitic, bacterial and viral pathogens of wild and cultured finfish and shellfish.

**FISH 5440 FISH ANATOMY AND PHYSIOLOGY (4)** LEC. 3. LAB. 4. Gross and microscopic fish anatomy.

**FISH 5510 FISHERIES BIOLOGY AND MANAGEMENT (4)** LEC. 3. LAB. 4. Pr. BIOL 1030 or BIOL 1037. This course provides a general overview and introduction to fisheries management with emphasis on freshwater examples. The laboratory will provide hands-on field experience. Credit will not be given for both FISH 5510 and FISH 6510.

**FISH 5520 SMALL IMPOUNDMENT MANAGEMENT (3)** LEC. 5. LAB. 10. Pr. BIOL 1030 or BIOL 1037. Major aspects of primarily recreational fishing pond management, including construction, stocking, water quality management, harvest strategy, diagnosis of problems and communication of analyses.

**FISH 5630 FACILITIES FOR AQUACULTURE (3)** LEC. 2. LAB. 4. Pr. (BIOL 1030 or BIOL 1037) and CHEM 1040. Principles and practice of site selection, design and construction of aquacultural facilities, with emphasis on impoundments and ponds.

**FISH 5670 FISHERIES AND AQUACULTURES EXTENSION METHODS (2)** LEC. 2. Pr. BIOL 1030 or BIOL 1037 and CHEM 1040. Concepts and practices pertaining to aquacultural extension organization, administration, program development and implementation.

**FISH 5710 AQUATIC MICROBIOLOGY (3)** LEC. 3. Pr. BIOL 1030 or BIOL 1037. Departmental approval. Overview of the diversity, genetics, physiology, and ecology of aquatic microorganisms, with an emphasis on bacteria, archaea and viruses.

**FISH 5725 MARINE ICHTHYOLOGY (6)** LEC. 6. Pr. BIOL 3060. Departmental approval. General background in the biology of marine fishes and their taxonomy. Offered only at the Gulf Coast Research Laboratory, Ocean Springs, MS. Summer. Admission to the Gulf Coast Research Laboratory.

**FISH 5970 TOPICS IN FISHERIES AND ALLIED AQUACULTURES (1-4)** LEC. Instruction and discussion in a selected current topic in Fisheries, Aquaculture or Aquatic Sciences. Course may be repeated for a maximum of 4 credit hours.

**FISH 6210 PRINCIPLES OF AQUACULTURE (3)** LEC. 3. Graduate level standing in FISH or departmental approval. Principles underlying aquatic productivity and levels of management as demonstrated by present practices of aquaculture around the world.

**FISH 6215 MARINE AQUACULTURE (2)** LEC. 1. LAB. 2. Departmental approval. Introduction to culture of marine species with emphasis in nutrition and feeding, reproductive biology, production techniques, processing, marketing and economics. Taught at the Dauphin Island Sea Lab.

**FISH 6220 WATER SCIENCE (3)** LEC. 3. Properties of water, the water cycle, basic water chemistry and water quality with emphasis on water in managed ecosystems.

**FISH 6230 CONSERVATION ECOLOGY OF FRESHWATER INVERTEBRATES (4)** LEC. 3. LAB. 1. Foundational knowledge, ecological theory, and illustrative case-studies on conservation issues and solutions for freshwater invertebrates.

**FISH 6240 HATCHERY MANAGEMENT (4)** LEC. 4. Study of warm-water hatchery techniques and application of those techniques in the field.

**FISH 6245 SHELLFISH AQUACULTURE IN THE GULF OF MEXICO (2)** FLD. 40. This course will provide students with an overview of the various types of shellfish aquaculture practiced in the Gulf of Mexico, and an understanding of the implications for both for public stock enhancement and private production. Taught at Dauphin Island Sea Lab. May count either FISH 5245 or FISH 6245.

**FISH 6250 AQUACULTURE PRODUCTION (4)** LEC. 4. Factors affecting growth and yield of aquacultural species, with implications toward farming commonly cultured species. Production techniques for commercially important finfish are discussed.

**FISH 6320 LIMNOLOGY (3)** LEC. 3. Graduate level standing in FISH or departmental approval. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater communities.

**FISH 6321 LIMNOLOGY LABORATORY (1)** LAB. 4. Pr. (P/C FISH 5320 or P/C FISH 6320). Graduate level standing in FISH or departmental approval. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of aquatic communities. May count either FISH 5321 or FISH 6321.

**FISH 6380 GENERAL ICHTHYOLOGY (4)** LEC. 3. LAB. 6. Graduate level standing in FISH or departmental approval. Survey of the biodiversity of world and local fishes, with an overview of ecology, behavior, biology and conservation of fishes.

**FISH 6410 INTRODUCTION TO FISH HEALTH (3)** LEC. 3. Introduction to parasitic, bacterial and viral pathogens of wild and cultured finfish and shellfish.

**FISH 6425 MARINE FISH DISEASES (4)** LEC. 4. Introduction to diseases of marine finfish and shellfish and practical techniques used to isolate and identify diseases.

**FISH 6440 FISH ANATOMY AND PHYSIOLOGY (4)** LEC. 4. Gross and microscopic fish anatomy.

**FISH 6510 FISHERIES BIOLOGY AND MANAGEMENT (4)** LEC. 4. This course provides a general overview and introduction to fisheries management with emphasis on freshwater examples. The laboratory will provide hands-on field experience. Credit will not be given for both FISH 5510 and FISH 6510.

**FISH 6520 SMALL IMPOUNDMENT MANAGEMENT (3)** LEC. 3. Major aspects of primarily recreational fishing pond management, including construction, stocking, water quality management, harvest strategy, diagnosis of problems and communication of analyses.

**FISH 6630 FACILITIES FOR AQUACULTURE (3)** LEC. 2. LAB. 4. Principles and practice of site selection, design and construction of aquacultural facilities, with emphasis on impoundments and ponds. Odd years.

**FISH 6650 FISH AND SEAFOOD PROCESSING TECHNOLOGY (3)** LEC. 3. Graduate level standing in FISH or departmental approval. Emphasis on important species, market forms, preservation techniques, and rules and regulations of the seafood industry.

**FISH 6670 FISHERIES AND AQUACULTURE EXTENSION METHODS (2)** LEC. 2. Concepts and practices pertaining to aquacultural extension organization, administration, program development and implementation.

**FISH 6710 AQUATIC MICROBIOLOGY (3)** LEC. 3. Overview of the diversity, genetics, physiology, and ecology of aquatic microorganisms, with an emphasis on bacteria, archaea and viruses.

**FISH 6725 MARINE ICHTHYOLOGY (6)** LEC. 6. General background in the biology of marine fishes and their taxonomy.

**FISH 6970 TOPICS IN FISHERIES AND ALLIED AQUACULTURES (1-4)** LEC. Instruction and discussion in a selected current topic in Fisheries, Aquaculture or Aquatic Sciences.

**FISH 7100 ADVANCED PARASITE TAXONOMY (6)** LEC. 2. LAB. 16. Departmental approval. This is a lab-based course for practicing parasitologists. The course instructs students on how to describe a metazoan parasite species.

**FISH 7200 MARINE PARASITOLOGY (6)** LEC. 2. LAB. 16. Departmental approval. This is an intensive lab-based course for marine parasitologists. Students will collect and identify marine/estuarine parasites of aquatic animals.

**FISH 7230 WATER AND SEDIMENT QUALITY MANAGEMENT IN AQUACULTURE (4)** LEC. 3. LAB. 3. Pr. FISH 6220. Departmental approval. Advanced treatment of water and sediment quality management in aquaculture. Analytical methods for soil and water quality.

**FISH 7240 RESOURCE USE AND ENVIRONMENTAL ISSUES IN AQUACULTURE (2)** LEC. 2. Resource use, environmental effects, and sustainability of aquaculture with emphasis on approaches to improving efficiency and reducing negative environmental effects.

**FISH 7270 CRUSTACEAN AND MOLLUSCAN AQUACULTURE (4)** LEC. 3. LAB. 3. Departmental approval. General biology and culture techniques of the major shrimp, crawfish and shellfish species cultured throughout the world.

**FISH 7300 PATHOLOGY OF AQUATIC ORGANISMS (6)** LEC. 2. LAB. 16. Departmental approval. Students gain appreciation for histopathological techniques and recognize basic pathological changes to tissues in aquatic organisms.

**FISH 7330 RESERVOIR LIMNOLOGY (3)** LEC. 2. LAB. 5. Departmental approval. Consideration of the ecological characteristics of reservoirs as they relate to modern concepts of ecosystem management. Even years.

**FISH 7340 FISH ECOLOGY (3)** LEC. 2. LAB. 3. Graduate level standing in FISH or departmental approval. Study of interactions among fish and their environment. Laboratory will emphasize critical literature reading and experimental approaches.

**FISH 7350 META-ANALYSIS (3)** LEC. 3. Meta-analysis is a quantitative approach for synthesizing results from diverse research studies (ecology, psychology, medicine, and education) that address a similar hypothesis. Effect sizes calculated from individual studies are combined to elucidate general patterns across studies.

**FISH 7360 MANAGEMENT OF AQUATIC FLORA IN FISHERIES AND AQUACULTURE (4)** LEC. 3. LAB. 6. Graduate level standing in FISH or departmental approval. Role of aquatic vegetation in fish production, its utilization and control.

**FISH 7380 ECOLOGY AND MANAGEMENT OF RIVERINE SYSTEMS (4)** LEC. 3. LAB. 3. River systems within a landscape ecology and ecosystem management context. Laboratory sessions stress techniques for assessment and management. Even years.



**FISH 7410 MOLECULAR DIAGNOSIS: PRINCIPLES AND APPLICATIONS (3)** LEC. 3. Introduction to molecular biology techniques currently used in disease diagnosis.

**FISH 7420 FISH DISEASES (3)** LEC. 3. Pr. BIOL 3200. Viral, bacterial, fungal and parasitic diseases of fishes, including etiologic agents, geographical ranges, species susceptibility, clinical signs, clinical pathology, epidemiology and management.

**FISH 7450 FISH PATHOLOGY (3)** LEC. 2. LAB. 3. Departmental approval. Morphological and physiological changes in fish with infectious or non-infectious diseases. Even years.

**FISH 7460 CLINICAL FISH DISEASE DIAGNOSIS (1-3)** DSL/LEC. Pr. FISH 6410 or FISH 7420. Practical experience in necropsy of diseased fish. Identification of causative agents and prescription of appropriate disease control.

**FISH 7530 FISH POPULATION DYNAMICS (3)** LEC. 2. LAB. 4. Departmental approval. Derivation of fish population estimates, growth, recruitment and mortality; use of modeling techniques to assess exploited fish populations. Even years.

**FISH 7540 QUANTITATIVE TECHNIQUES IN FISHERY ASSESSMENT (3)** LEC. 2. LAB. 4. Departmental approval. Quantitative techniques to assess and manage fish populations in freshwater. The laboratory will analyze actual fisheries data using SAS on personal computers. Odd years.

**FISH 7640 FISH NUTRITION (3)** LEC. 3. Fundamental and applied aspects of fish nutrition, including nutrient requirements, physiology of food assimilation, feed preparation, and practical feeding.

**FISH 7650 TRADITIONAL APPROACHES TO FISH GENETIC ENHANCEMENT (2)** LEC. 2. Graduate level standing in FISH or departmental approval. This course is intended to teach the philosophy of fish, shellfish and crustacean genetics, selective breeding, genetic management and inheritance.

**FISH 7660 MOLECULAR GENETICS AND BIOTECHNOLOGY (4)** LEC. 3. LAB. 3. Graduate level standing in FISH or departmental approval. Principles and application of DNA fingerprinting technologies, gene mapping, genetic information and analysis using internet tools, transgenic technologies.

**FISH 7715 ADVANCED MARINE ECOLOGY (2)** LEC. 2. Departmental approval. Mechanisms that control distribution of plants and animals at scales ranging from individual organism to ecosystem

**FISH 7725 MARINE BIOGEOCHEMICAL PROCESSES (2)** LEC. 2. Departmental approval. Marine biogeochemical cycling of carbon, nitrogen, sulfur, phosphorus and metals, with emphasis on estuarine systems.

**FISH 7750 BIOTECHNOLOGICAL APPROACHES TO FISH GENETICS (2)** LEC. 2. Pr. FISH 7650. Departmental approval. This course is intended to teach the philosophy of fish, shellfish and crustacean genetics, genetic management genetic engineering, genomic manipulation and genetic biotechnology.

**FISH 7785 PHYSICAL OCEANOGRAPHY (4)** LEC. 4. Departmental approval. Describes observed physical setting of the marine environment, and qualitatively explains how and why observed physical phenomena occur.

**FISH 7800 PRINCIPLES OF ECOTOXICOLOGY (3)** LEC. 3. Ecotoxicology-an interdisciplinary science studies the impacts of pollutants upon the structure and function of ecological systems. The broad scope of ecotoxicology requires a multidisciplinary approach of a variety of specialties, such as ecology, environmental chemistry, and applied biology.

**FISH 7900 DIRECTED STUDIES IN FISHERIES I (1-4)** IND. SU. Individualized in-depth study on a particular subject under the guidance of a professor. May include directed readings and research. Course may be repeated for a maximum of 4 credit hours.

**FISH 7920 INTERNSHIP IN FISHERIES AND AQUACULTURE (1-10)** INT. SU. Departmental approval. Field experience in aquaculture, fisheries or aquatic resource management on farm or with research, extension or aquatic management agency. Course may be repeated for a maximum of 10 credit hours.

**FISH 7930 GRADUATE SEMINAR SERIES (1)** LEC. 1. SU. Acquaint students with current research and related activities.

**FISH 7950 GRADUATE RESEARCH SEMINAR (1)** SEM. 1. SU. Departmental approval. Oral presentation and discussion of research in the field of specialization.

**FISH 7960 SPECIAL PROBLEMS IN FISHERIES, AQUACULTURE, AND AQUATIC SCIENCES (1-4)** IND. Individual or group project and research in consultation with faculty member on problem in fisheries, aquaculture, and/or aquatic sciences. Course may be repeated for a maximum of 9 credit hours.

**FISH 7990 RESEARCH AND THESIS (1-10) MST.** Course may be repeated with change in topics.

**FISH 8900 DIRECTED STUDIES IN FISHERIES II (1-4) IND. SU.** Individualized in-depth study on a particular subject under the guidance of a professor. May include directed readings and research. Course may be repeated for a maximum of 4 credit hours.

**FISH 8930 GRADUATE SEMINAR SERIES (1) LEC. 1. SU.** Acquaint students with current research and related activities.

**FISH 8950 GRADUATE RESEARCH SEMINAR (1) SEM. 1. SU.** Departmental approval. Acquaint students with current research and related activities.

**FISH 8960 SPECIAL PROBLEMS IN FISHERIES, AQUACULTURE, AND AQUATIC SCIENCES (1-4) IND.** Individualized work and research in consultation with faculty member on problem in fisheries, aquaculture, and/or aquatic sciences. Course may be repeated for a maximum of 9 credit hours.

**FISH 8990 RESEARCH AND DISSERTATION (1-10) DSR.** Course may be repeated with change in topics.

## Food Science Courses

**FDSC 1000 INTRODUCTORY FOOD SCIENCE (3) LEC. 3.** Overview of food science discipline including food selection, food composition, food safety and sanitation, food processing, packaging, commodity types, and food laws.

**FDSC 4290 PROFESSIONAL DEVELOPMENT IN FOOD SCIENCE (1) LEC. 1.** Preparing for careers; enhancing computer and communication skills; planning for professional advancement.

**FDSC 4920 FOOD SCIENCE INTERNSHIP (3) INT. 3.** Departmental approval. Practical on-the-job training in the food industry. Course may be repeated for a maximum of 9 credit hours.

**FDSC 4960 SPECIAL PROBLEMS IN FOOD SCIENCE (1-3) IND. 2.50 GPA or departmental approval.** Individual or group projects with a faculty member in food science. May include literary research, data analysis or a combination of these. Course may be repeated for a maximum of 6 credit hours.

**FDSC 4970 SPECIAL TOPICS (1-4) LEC.** Departmental approval. Instruction and discussion of current topics associated with food science. Course may be repeated for 8 hours. Course may be repeated for a maximum of 8 credit hours.

**FDSC 4980 UNDERGRADUATE RESEARCH (2-4) IND.** Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**FDSC 5660 FOOD MICROBIOLOGY (4) LEC. 3. LAB. 1. Pr. BIOL 3200.** Introduction to basic and applied microbiology in food; including how bacteria, viruses, parasites, yeasts and molds affect and are in turn affected by foods both positively and negatively. May count either FDSC 5660, BIOL 5660, FDSC 6660 or BIOL 6660.

**FDSC 6660 FOOD MICROBIOLOGY (4) LEC. 3. LAB. 1. Pr. BIOL 3200.** Introduction to basic and applied microbiology in food; including how bacteria, viruses, parasites, yeasts and molds affect and are in turn affected by foods both positively and negatively. May count either FDSC 5660, BIOL 5660, FDSC 6660 or BIOL 6660.

**FDSC 7430 FLAVOR CHEMISTRY (3) LEC. 3.** Chemistry of flavor compounds; Analytical approaches and sensory evaluation to characterize flavor.

**FDSC 7600 MOLECULAR PATHOGENESIS OF FOODBORNE PATHOGENS (3) LEC. 3. Pr. BIOL 6260 or VBMS 7460.** This course covers a detailed description of major foodborne pathogens that affect human health and their pathogenesis. Lectures will detail how the pathogen's adherence and invasion, host dissemination, and host cell damage lead to pathogenesis.

**FDSC 7730 SENSORY EVALUATION (3) LEC. 2. LAB. 2.** History and methods of sensory testing of food products, factors affecting results.

**FDSC 7950 GRADUATE SEMINAR (1) SEM. 1.** Literature in poultry science, food science or related field. Emphasis given to preparation, organization, and presentation of research materials and to reporting current literature in the field. May count either POUL 7950 or FDSC 7950. Course may be repeated for a maximum of 3 credit hours.

**FDSC 7960 SPECIAL PROBLEMS (1-4) IND/ST1.** Departmental approval. Critical analysis of classic and current research. Course may be repeated for a maximum of 8 credit hours.

**FDSC 7970 SPECIAL TOPICS IN FOOD SCIENCE (1-4) LEC.** Instruction and discussion of current advanced topics associated with food science. Course may be repeated for a maximum of 8 credit hours.

**FDSC 7980 NONTHESIS RESEARCH (1-4) RES.** Departmental approval. enrolled as FDSG MAg student. Research conducted as part of the Master of Agriculture degree.

**FDSC 7990 RESEARCH AND THESIS (1-10) MST.** Departmental approval. Research in an area of specialization. Course may be repeated with change in topic.

**FDSC 8990 RESEARCH AND DISSERTATION (1-10) DSR.** Departmental approval. Research in an area of specialization. Course may be repeated with change in topic.

## Horticulture Courses

**HORT 1010 INTRODUCTION TO HORTICULTURE (1) LEC.** 1. Introduces scientific and practical aspects of pomology, olericulture, floriculture and landscape horticulture. Also presents the broad scope of career opportunities in the field of horticultural science. Fall.

**HORT 2010 FRUIT AND NUT PRODUCTION (4) LEC. 2. LAB. 4.** Introductory course in cultural practices and economics associated with commercial fruit and nut production. Fall.

**HORT 2020 HORTICULTURE CROP PRODUCTION (3) LEC. 2. LAB. 3.** Pr. BIOL 1010 or BIOL 1030 or BIOL 1037. Techniques of plant propagation and cultural methods for successful fruit and vegetable production. Fall.

**HORT 2030 VEGETABLE PRODUCTION (3) LEC. 3.** Principles, practices, establishment, production, maintenance, harvesting, storage and marketing of commercial vegetable crops. Fall and Spring.

**HORT 2040 ORGANIC GARDENING (3) LEC. 3.** Principles, production practices, maintenance, harvesting and marketing of organically and traditionally home-grown vegetables.

**HORT 2060 HYDROPONICS: PRINCIPLES AND TECHNIQUES OF SOILLESS PLANT PRODUCTION (3) LEC. 3.** This course is a survey of the science of hydroponic plant production and is focused on commercial and home vegetable crop production. Specific topics include plant growth and nutrition in hydroponic growing systems, challenges and opportunities, and system design. Fall.

**HORT 2210 LANDSCAPE GARDENING (4) LEC. 2. LAB. 4.** Principles of landscape gardening applied to residential and small-scale commercial grounds. Involves plant identification and use, basic landscape design, and landscape installation and management concepts.

**HORT 2240 PLANT PROPAGATION (3) LEC. 2. LAB. 2.** Pr. P/C BIOL 1030 or BIOL 1037. Basic principles and practices involved in the propagation of horticulture plants. Departmental approval. Spring.

**HORT 2250 ART OF FLORAL DESIGN (3) LEC. 2. LAB. 2.** Basic art principles and design elements and their use with flowers and foliage; history and utilization of flowers within society.

**HORT 3000 GROWTH AND DEVELOPMENT OF HORTICULTURAL PLANTS (3) LEC. 3.** Pr. (BIOL 1030 or BIOL 1037) and CHEM 1030. Growth and development of plants with concepts applied to the practice of Horticultural Science. Summer and Fall.

**HORT 3110 A HISTORY OF GARDENS IN CULTURAL CONTEXT (3) LEC. 3.** Heritage and traditions influencing the development of public and private garden styles, context, and function including cultural expressions, plant use, and impact of noted designers and horticulturists throughout history. Only taught in Study Abroad programs.

**HORT 3200 WOODY LANDSCAPE PLANT IDENTIFICATION I (4) LEC. 2. LAB. 4.** This course introduces students to the language of botany and the Southeastern palate of landscape plants with distinguished fall characteristics. Specific topics include taxonomy, morphology, plants with global popularity, cultivation practices, structural plantings, and use in the landscape. Fall.

**HORT 3210 WOODY LANDSCAPE PLANT IDENTIFICATION II (4) LEC. 2. LAB. 4.** This course introduces students to the language of botany and the Southeastern palate of landscape plants with distinguished spring characteristics. Specific topics include taxonomy, morphology, plants with global popularity, cultivation practices, structural plantings, and use in the landscape. Spring.

**HORT 3220 ARBORICULTURE (4) LEC. 2. LAB. 4.** Pr. BIOL 1030 or BIOL 1037. Identification, culture and use of ornamental trees in landscape plantings. Fall.

**HORT 3280 LANDSCAPE CONSTRUCTION (4)** LEC. 2. LAB. 4. Principles and practices used in the interpretation and implementation of landscape construction and planting plans. Fall.

**HORT 3840 STUDY/TRAVEL IN HORTICULTURE (1-10)** AAB/FLD. Study of horticultural or fruit and vegetable science, landscape design, nursery and greenhouse management in U.S. or international location. Course may be repeated for a maximum of 10 credit hours.

**HORT 3910 PROFESSIONAL LANDSCAPE (3)** LEC. 3. Departmental approval. Field-based course designed for learning to prepare and compete in the NALP National Collegiate Landscape Competition. Spring.

**HORT 3920 HORTICULTURE INTERNSHIP (1-4)** INT. 1-4. Practical on-the-job training for selected commercial horticultural companies. Course may be repeated for a maximum of 8 credit hours.

**HORT 3950 CAREERS IN HORTICULTURE (2)** LEC. 2. Current developments and career opportunities in horticulture. Fall and Spring.

**HORT 4000 PESTICIDE MANAGEMENT IN HORTICULTURE (3)** LEC. 3. Pr. (ENTM 4020 or ENTM 3040) and PLPA 3000. Proper management of pesticides in horticulture; decision making skills in relation to control strategies; environmental issues relevant to horticulture; safety considerations; scouting and application techniques. Fall.

**HORT 4100 HERBACEOUS ORNAMENTALS (4)** LEC. 2. LAB. 4. Pr. (BIOL 1020 or BIOL 1027) and (BIOL 1030 or BIOL 1037). Identification, culture, and use of herbaceous annuals and perennials, bulbs, herbs, and ornamental grasses. Consideration of flower bed and border preparation, care and maintenance. Spring and Summer.

**HORT 4250 INTERMEDIATE FRUIT & VEG PROD (3)** LEC. 3. Pr. (HORT 2040 or HORT 2043) or HORT 2030. Intermediate horticulture course in which students apply knowledge gained in the classroom to hands-on fruit and vegetable gardening practices.

**HORT 4270 INTERMEDIATE LANDSCAPE DESIGN (4)** LEC. 2. LAB. 4. Pr. HORT 3210 or HORT 3220 or HORT 4100. A study of the design principles and elements and technical skills used to create a functional and aesthetically pleasing residential landscape design. Fall.

**HORT 4300 COMPUTER AIDED PLANTING DESIGN (3)** LEC. 3. Pr. HORT 4270. Graphic concepts relating to spatial visualization and communication and project cost estimation using computer aided drafting and project management software developed for landscape professionals. Spring.

**HORT 4930 DIRECTED STUDIES (1-3)** AAB/IND. Departmental approval. Directed Studies related to research, teaching or outreach educational programs in Horticulture. Course may be repeated for a maximum of 6 credit hours.

**HORT 4970 SPECIAL TOPICS (1-3)** IND. Principles, methods and techniques for understanding various horticultural disciplines. Course may be repeated for a maximum of 6 credit hours.

**HORT 4980 UNDERGRADUATE RESEARCH (2-4)** IND. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**HORT 5100 HORTICULTURAL PLANT BREEDING (3)** LEC. 3. Pr. (BIOL 3000 or CSES 3300 or AGRI 3000). This class will introduce students to traditional and modern technologies for breeding horticultural crops such as fruits, vegetables, and ornamental crops. Students will learn about the importance of plant breeding for horticultural crop improvement, mechanisms of traditional and modern breeding technologies, and biotechnologies with an emphasis on specific applications for horticultural crops. Credit will only be given for one of the following: HORT 5100 or HORT 6100.

**HORT 5110 TREE FRUIT CULTURE (3)** LEC. 3. Pr. HORT 3000. Manipulation of growth and development of tree fruit crops by cultural methods. Credit will only be given for one of the following courses: HORT 5110 or HORT 6110. Summer.

**HORT 5120 SMALL FRUIT AND PECAN CULTURE (4)** LEC. 2. LAB. 4. Pr. HORT 3000. Principles and practices involved in the production and marketing of small fruits and pecans. Credit will only be given for one of the following courses: HORT 5120 or HORT 6120. Spring.

**HORT 5130 SUSTAINABLE VEGETABLE CROP PRODUCTION (3)** LEC. 2. LAB. 3. Pr. (BIOL 1030 or BIOL 1037) and HORT 3000. Best management practices and quality of vegetable crops. Credit will only be given for one of the following: HORT 5130 or HORT 6130. Spring.

**HORT 5140 POST-HARVEST BIOLOGY AND TECHNOLOGY (3)** LEC. 2. LAB. 3. Pr. (PLPA 3000 or PLPA 3003) and HORT 3000. Physiological changes occurring in fruits, vegetables and other horticultural products after harvest. Spring.

**HORT 5150 RETAIL GARDEN CENTER MANAGEMENT (3)** LEC. 2. LAB. 3. Pr. HORT 3210 or HORT 3220 or Departmental approval. The following topics will be covered: financing, location, design, stocking, selling, personnel management, advertising and maintaining plants. May count either HORT 5150 or HORT 6150. Summer.

**HORT 5200 CONTROLLED ENVIRONMENT AGRICULTURE (4)** LEC. 3. LAB. 2. Pr. HORT 2060. This course will provide a thorough overview of the aerial factors that influence crop production in controlled environments. Credit will only be given for one of the following courses: HORT 5200 or HORT 6200.

**HORT 5210 LANDSCAPE BIDDING, INSTALLATION AND MAINTENANCE (4)** LEC. 3. LAB. 3. Pr. CSES 2040 and PLPA 3000. Principles and practices of the bidding, installation and maintenance of commercial and residential landscapes. Spring.

**HORT 5220 GREENHOUSE MANAGEMENT SCIENCE (4)** LEC. 3. LAB. 2. Pr. HORT 3000 and HORT 2240 and CSES 2040. Management, culture and economics of commercial greenhouse production. Fall.

**HORT 5230 NURSERY MANAGEMENT (4)** LEC. 2. LAB. 4. Pr. HORT 2240 and HORT 3000. Factors affecting plant production. Environmental issues related to facilities design and pesticide and nutrient management. Departmental approval. Spring.

**HORT 5240 PUBLIC GARDEN MANAGEMENT (3)** LEC. 1. LAB. 4. Understanding personnel structure and responsibilities; plant care and management; and the educational, entertainment, and conservation missions of public gardens. Spring.

**HORT 5330 INTEGRATED PEST MANAGEMENT (3)** LEC. 3. Aspects of pest management as a broad-based approach that integrates practices for economic control of pests. May count either ENTM/HORT/PLPA 5330/5333/6330/6336.

**HORT 5910 HORTICULTURE PRACTICUM (4)** LEC. 1. LAB. 6. Practical application of a broad range of horticultural subject-matter knowledge and skills. May count either HORT 5910 or HORT 6910. Spring. Course may be repeated for a maximum of 8 credit hours.

**HORT 6100 HORTICULTURAL PLANT BREEDING (3)** LEC. 3. This class will introduce students to traditional and modern technologies for breeding horticultural crops such as fruits, vegetables, and ornamental crops. Students will learn about the importance of plant breeding for horticultural crop improvement, mechanisms of traditional and modern breeding technologies, and biotechnologies with an emphasis on specific applications for horticultural crops. Credit will only be given for one of the following: HORT 5100 or HORT 6100.

**HORT 6110 TREE FRUIT CULTURE (3)** LEC. 3. Manipulation of growth and development of tree fruit crops by cultural methods. Credit will only be given for one of the following courses: HORT 5110 or HORT 6110. Summer.

**HORT 6120 SMALL FRUIT AND PECAN CULTURE (4)** LEC. 2. LAB. 4. Principles and practices involved in the production and marketing of small fruits and pecans. Credit will only be given for one of the following courses: HORT 5120 or HORT 6120. Spring.

**HORT 6130 SUSTAINABLE VEGETABLE CROP PRODUCTION (3)** LEC. 2. LAB. 2. Advanced course in best management practices and quality of vegetable crops. Credit will only be given for one of the following courses: HORT 5130 or HORT 6130. Spring.

**HORT 6140 POST-HARVEST BIOLOGY AND TECHNOLOGY (3)** LEC. 2. LAB. 2. Physiological changes occurring in fruits, vegetables and other horticultural products after harvest. Spring.

**HORT 6150 RETAIL GARDEN CENTER MANAGEMENT (3)** LEC. 2. LAB. 3. Topics included: financing, location, design, stocking, selling, personnel management, advertising, and maintaining plants. Graduate students will evaluate garden centers and provide feedback for improvement. Summer.

**HORT 6200 CONTROLLED ENVIRONMENT AGRICULTURE (4)** LEC. 3. LAB. 2. This course will provide a thorough overview of the aerial factors that influence crop production in controlled environments. Credit will only be given for one of the following courses: HORT 5200 or HORT 6200.

**HORT 6210 LANDSCAPE BIDDING, INSTALLATION AND MAINTENANCE (4)** LEC. 3. LAB. 3. Principles and practices of the bidding, installation and maintenance of commercial and residential landscapes. Spring.

**HORT 6220 GREENHOUSE MANAGEMENT SCIENCE (4)** LEC. 3. LAB. 2. Management, culture and economics of commercial greenhouse production. Fall.

**HORT 6230 NURSERY MANAGEMENT (4)** LEC. 2. LAB. 4. Factors affecting plant production. Environmental issues related to facilities design and pesticide and nutrient management. Departmental approval. Spring.

**HORT 6240 PUBLIC GARDEN MANAGEMENT (3)** LEC. 1. LAB. 4. Understanding personnel structure and responsibilities; plant care and management; and the educational, entertainment, and conservation missions of public gardens. Spring.

**HORT 6330 INTEGRATED PEST MANAGEMENT (3)** LEC. 3. Aspects of pest management as a broad-based approach that integrates practices for economic control of pests. May count either ENTM/HORT/PLPA 5330/5333/6330/6336.

**HORT 6910 HORTICULTURE PRACTICUM (4)** LEC. 1. LAB. 6. Practical application of a broad range of horticultural subject-matter knowledge and skills. May count either HORT 5910 or HORT 6910. Spring. Course may be repeated for a maximum of 8 credit hours.

**HORT 7010 EXPERIMENTAL METHODS IN HORTICULTURE (4)** LEC. 2. LAB. 3. Principles and methodologies of horticultural research, experimental design, preparation of project and grant proposals, and development of publication skills. Departmental approval. Fall.

**HORT 7040 ADVANCED GROWTH AND DEVELOPMENT OF HORTICULTURAL PLANTS (3)** LEC. 3. Plant growth and development from seed germination, through maturity and senescence. Spring.

**HORT 7050 NUTRITIONAL REQUIREMENTS OF HORTICULTURAL PLANTS (3)** LEC. 3. LAB. 2. Pr. HORT 3000. Nutritional requirements of horticulture crops and factors affecting these requirements. Departmental approval. Summer, odd years.

**HORT 7070 PLANT BIOTECHNOLOGY (4)** LEC. 2. LAB. 4. Departmental approval. Plant biotechnology, including plant tissue culture technologies and genetic transformation and applications to horticultural crop improvement.

**HORT 7840 GRADUATE STUDY/TRAVEL IN HORTICULTURE (1-4)** LEC. Departmental approval. Programmed activities to enhance national/international awareness and enable students to understand horticultural practices in diverse areas. Course may be repeated for a maximum of 8 credit hours.

**HORT 7920 GRADUATE INTERNSHIP (1-4)** INT. Departmental approval. Supervised professional experience in horticulture

**HORT 7950 SEMINAR (1)** SEM. SU. Graduate students are required to attend all seminars. Course may be repeated with change in topics.

**HORT 7960 SPECIAL PROBLEMS (1-3)** IND. 3. Conferences, problems and assigned readings in horticulture. Course may be repeated for a maximum of 6 credit hours.

**HORT 7970 SPECIAL TOPICS IN HORTICULTURE (1-3)** LEC. Principles, methods and techniques involved in gaining an understanding of different horticultural disciplines. Course may be repeated for a maximum of 3 credit hours.

**HORT 7980 NON-THESIS RESEARCH (1-4)** RES. 1-4. Research conducted as part of the Master of Agriculture degree. Course may be repeated for a maximum of 4 credit hours.

**HORT 7990 RESEARCH AND THESIS (1-10)** MST. Course may be repeated with change in topics.

**HORT 8990 RESEARCH AND DISSERTATION (1-10)** DSR. Course may be repeated with change in topics.

## Plant Pathology Courses

**PLPA 2000 PESTS, PATHOGENS, PARASITES, AND PEOPLE (3)** LEC. 3. Past and present problems of pests and disease involving humans and the food chain.

**PLPA 2980 INTRODUCTION TO UNDERGRADUATE RESEARCH (1-4)** IND/RES. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**PLPA 3000 GENERAL PLANT PATHOLOGY (4)** LEC. 3. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Survey of plant diseases common in Alabama, including symptom recognition, pathogen biology and management of plant diseases. Course credit will not be given for both PLPA 3000 and PLPA 3003/3004.

**PLPA 4960 SPECIAL PROBLEMS IN PLANT PATHOLOGY (1-3)** IND. Departmental approval. Supervised work on a project in plant pathology. Areas of study are: A. Mycology; B. Nematology; C. Virology; D. Bacteriology; E. Extension and Clinic Experience; F. Physiological and Molecular Approaches. Course may be repeated for a maximum of 3 credit hours.

**PLPA 4980 UNDERGRADUATE RESEARCH (1-4)** LAB. 2-8. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**PLPA 5050 PLANT DISEASE DIAGNOSIS (3)** LEC. 1. LAB. 3. Pr. PLPA 3000 or PLPA 3003. Approaches, techniques, and practical experience in diagnosis of plant diseases. Credit will not be given for both PLPA 5050 and PLPA 6050. Summer.

**PLPA 5200 MYCOLOGY (2)** LEC. 1. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Biology of fungi with emphasis on taxonomy, morphology, physiology, genetics, reproduction, and how fungi interact with their ecosystems with an emphasis on plant pathogens. Credit will only be given to one of the following: PLPA 5200 or 6200.

**PLPA 5250 MEDICAL AND VETERINARY MYCOLOGY (2)** LEC. 2. A systematic survey of fungi and the diseases they cause on humans and animals.

**PLPA 5300 PLANT-BACTERIAL INTERACTIONS (2)** LEC. 1. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Comprehensive review of plant-bacterial interactions, including colonization, pathogenesis, symbiotic and associative nitrogen fixation, and transformation. Credit will only be given to one of the following: PLPA 5300 or PLPA 6300.

**PLPA 5330 INTEGRATED PEST MANAGEMENT (3)** LEC. 3. Aspects of pest management as a broad-based approach that integrates practices for economic control of pests. May count either ENTM/HORT/PLPA 5330/6330.

**PLPA 5400 PLANT VIROLOGY (2)** LEC. 1. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Plant viruses are one of the major pathogens causing problems in plants. This course will cover the fundamentals of plant viruses such as infectious cycle, genome, structure, and evolution. The course will also introduce applied biotechnology based on virus-plant interaction. Credit will only be given to one of the following: PLPA 5400 or PLPA 6400.

**PLPA 5500 PLANT NEMATOLOGY (2)** LEC. 1. LAB. 2. Pr. BIOL 1030 or BIOL 1037. Presentation of nematodes in relation to plant diseases, identification of plant nematodes; nature of pathogenicity; principles and practices of management; recent advances in phytonematology. Credit will only be given to one of the following: PLPA 5500 or PLPA 6500.

**PLPA 5600 MOLECULAR PLANT-MICROBE INTERACTIONS (3)** LEC. 3. Pr. BIOL 3000. Comprehensive coverage of present advances in plant defense-related metabolic pathways: how to recognize pathogen infections, and activate/potentiate disease resistances. Introduces biochemical, molecular and cellular mechanisms by which plants defend/assimilate themselves towards diverse a/biotic stress stimuli. Credit will only be given for one of the following courses: PLPA 5600 or PLPA 6600.

**PLPA 5700 VECTOR TRANSMISSION OF PLANT PATHOGENS (3)** LEC. 3. Pr. BIOL 1030 or BIOL 1037. This course is designed to give students an understanding of vectors of plant pathogens. The use of case studies during this course is designed to show real world examples of pathogens which utilize insects as an important part of their lifecycle. May only count one of PLPA/ENTM 5700/6700.

**PLPA 5800 OMICS IN AGRICULTURE (3)** LEC. 2. LAB. 2. Pr. BIOL 1030 or BIOL 3000 or AGRI 3000. This course will introduce students to the recent advances in high-throughput technologies such as genomics, transcriptomics, metagenomics, metabolomics, phenomics, modeling, and digital agriculture and how these technologies can be applied to tackling new and old problems in agriculture and human health. Students will be able to gain hands-on experience in analyzing and interpreting datasets obtained using these technologies.

**PLPA 5820 PRINCIPLES AND TOOLS FOR REPRODUCIBLE SCIENCE IN AGRICULTURE (2)** LEC. 2. Pr. STAT 2510. Reproducibility is fundamental to science. This course will cover basic concepts in scientific reproducibility, accessibility, and organization as it relates to handling large datasets and publishing data workflows.

**PLPA 5920 INTERNSHIP (3)** IND. 3. SU. Practical professional experience under the supervision of internship faculty and a representative of a state, federal, or private agency.

**PLPA 6050 PLANT DISEASE DIAGNOSIS (3)** LEC. 1. LAB. 3. Graduate level standing in PLPA, ENTM, AGRO, HORT, AGEC or Department approval. Experience with plant disease diagnosis procedures and the diagnosis of many common plant diseases. Summer.

**PLPA 6200 MYCOLOGY (2)** LEC. 1. LAB. 2. Biology of fungi with emphasis on taxonomy, morphology, physiology, genetics, reproduction, and how fungi interact with their ecosystems with an emphasis on plant pathogens. Graduate level standing or Departmental approval. Credit will only be given to one of the following: PLPA 5200 or PLPA 6200.

**PLPA 6250 MEDICAL AND VETERINARY MYCOLOGY (2)** LEC. 2. Pr. BIOL 3200. or prior approval of the instructor. A systematic survey of fungi and the diseases they cause on humans and animals.

**PLPA 6300 PLANT-BACTERIAL INTERACTIONS (2)** LEC. 1. LAB. 2. Comprehensive review of plant-bacterial interactions, including colonization, pathogenesis, symbiotic and associative nitrogen fixation, and transformation. Credit will only be given to one of the following: PLPA 5300 or PLPA 6300.

**PLPA 6330 INTEGRATED PEST MANAGEMENT (3)** LEC. 3. Aspects of pest management as a broad-based approach that integrates practices for economic control of pests. May count either ENTM/HORT/PLPA 5330/6330.

**PLPA 6400 PLANT VIROLOGY (2)** LEC. 1. LAB. 2. Plant viruses are one of the major pathogens causing problems in plants. This course will cover the fundamentals of plant viruses such as infectious cycle, genome, structure, and evolution. The course will also introduce applied biotechnology based on virus-plant interaction. Credit will only be given to one of the following: PLPA 5400 or PLPA 6400.

**PLPA 6500 PLANT NEMATOLOGY (2)** LEC. 1. LAB. 2. Presentation of nematodes in relation to plant diseases, identification of plant nematodes; nature of pathogenicity; principles and practices of management; recent advances in phytonematology. Credit will only be given to one of the following: PLPA 5500 or PLPA 6500.

**PLPA 6600 MOLECULAR PLANT-MICROBE INTERACTIONS (3)** LEC. 3. Comprehensive coverage of present advances in plant defense-related metabolic pathways: how to recognize pathogen infections, and activate/potentiate disease resistances, biochemical, molecular and cellular mechanism by which plants defend/assimilate themselves towards diverse a/biotic stress stimuli. Credit will only be given for one of the following courses: PLPA 5600 or PLPA 6600.

**PLPA 6700 VECTOR TRANSMISSION OF PLANT PATHOGENS (3)** LEC. 3. This course is designed to give students an understanding of vectors of plant pathogens. The use of case studies during this course is designed to show real world examples of pathogens which utilize insects as an important part of their lifecycle. May only count one of PLPA/ENTM 5700/6700.

**PLPA 6800 OMICS IN AGRICULTURE (3)** LEC. 2. LAB. 2. This course will introduce students to the recent advances in high-throughput technologies such as genomics, transcriptomics, metagenomics, metabolomics, phenomics, modeling, and digital agriculture and how these technologies can be applied to tackling new and old problems in agriculture and human health. Students will be able to gain hands-on experience in analyzing and interpreting datasets obtained using these technologies.

**PLPA 6820 PRINCIPLES AND TOOLS FOR REPRODUCIBLE SCIENCE IN AGRICULTURE (2)** LEC. 2. Reproducibility is fundamental to science. This course will cover basic concepts in scientific reproducibility, accessibility, and organization as it relates to handling large datasets and publishing data workflows.

**PLPA 6920 INTERNSHIP (3)** IND. 3. SU. Departmental approval. Practical professional experience under the supervision of internship faculty and a representative of a state, federal, or private agency.

**PLPA 7080 FIELD SURVEY OF PLANT PATHOLOGY (3)** LEC. 1. LAB. 6. Practical aspects of plant diseases under field conditions, on-site visits via field trips; discussion of experimental design for field research. Summer.

**PLPA 7860 PLANT DISEASE EPIDEMIOLOGY (2)** LEC. 2. Pr. PLPA 3000. Aspects of plant disease epidemiology including disease assessment and temporal progress, pathogen spread, and yield loss determination.

**PLPA 7861 PLANT DISEASE EPIDEMIOLOGY LABORATORY (2)** LAB. 4. Coreq. PLPA 7860. Quantitative aspects of plant disease epidemiology including spatial and temporal modeling, and disease system simulation.

**PLPA 7880 PLANT MICROBIAL ECOLOGY (3)** LEC. 3. LAB. 0. Concepts in ecology of plant-associated microbes and their interactions with plants using molecular approaches.

**PLPA 7881 PLANT MICROBIAL ECOLOGY LABORATORY (2)** LAB. 4. This course will involve hands-on experience with genomic, metagenomic, transcriptomic datasets. Graduate standing in the College of Agriculture/COSAM.

**PLPA 7900 DIRECTED STUDIES IN PLANT PATHOLOGY (1-5)** LEC. SU. Discussion groups on specific topics, assigned reading on laboratory problems or field research.

**PLPA 7910 TEACHING PRACTICUM (1)** LAB. 2. SU. Graduate level standing in PLPA or ENTM or Departmental approval. The teaching practicum will address the practical and heretical issues of laboratory learning and facilitating the skills of pedagogy. Course may be repeated for a maximum of 3 credit hours.



**PLPA 7930 JOURNAL REVIEW FOR ENTOMOLOGY AND PLANT PATHOLOGY (1)** LEC. 1. Graduate level standing in PLPA, ENTM, AGRO, HORT, AGECE or Department approval. Discussion of recent scientific publications on basic aspects of research in entomology and plant pathology. Course may be repeated for a maximum of 2 credit hours.

**PLPA 7950 SEMINAR IN PLANT PATHOLOGY (1)** SEM. 1. SU. Departmental approval. Seminar presentations on current departmental research and current issues in plant pathology and related disciplines. Fall, Spring. Course may be repeated for a maximum of 2 credit hours.

**PLPA 7960 SPECIAL PROBLEMS IN PLANT PATHOLOGY (1-4)** LAB. 2-8. Departmental approval. Credit to be arranged. Specialized project or research on a specific topic in plant pathology to be conducted under faculty supervision. Course may be repeated for a maximum of 4 credit hours.

**PLPA 7970 SPECIAL TOPICS IN PLANT PATHOLOGY (1-5)** ST1. Advanced topics related to plant pathology. Course may be repeated for a maximum of 5 credit hours.

**PLPA 7990 RESEARCH AND THESIS (1-10)** MST. Departmental approval. Research and thesis on problems in plant pathology. Course may be repeated with change in topics.

**PLPA 8880 MOLECULAR PLANT PATHOLOGY (3)** LEC. 2. LAB. 2. Open discussion and article review on current topics and cutting-edge discoveries in the field of molecular plant pathology, covering the cellular mechanisms of plant interactions with, and immune responses against pathogens.

**PLPA 8900 DIRECTED STUDIES IN PLANT PATHOLOGY (1-5)** LEC. SU. Discussion groups on specific topics, assigned reading on laboratory problems or field research. Course may be repeated for a maximum of 5 credit hours.

**PLPA 8910 TEACHING PRACTICUM (1)** LAB. 2. SU. Departmental approval. Practical and theoretical issues of laboratory learning, and pedagogical facilitation. Required of all PhD students. Course may be repeated for a maximum of 3 credit hours.

**PLPA 8930 JOURNAL REVIEW FOR ENTOMOLOGY AND PLANT PATHOLOGY (1)** LEC. 1. Graduate level standing in PLPA, ENTM, AGRO, HORT, AGECE or Department approval. Discussion of recent scientific publications on basic aspects of research in entomology and plant pathology. Course may be repeated for a maximum of 3 credit hours.

**PLPA 8950 SEMINAR (1)** SEM. 1. SU. Departmental approval. Presentations and discussion of scientific literature or dissertation research findings. Required for all Ph.D. candidates. Fall, Spring. Course may be repeated for a maximum of 2 credit hours.

**PLPA 8960 ADVANCED SPECIAL PROBLEMS IN PLANT PATHOLOGY (1-4)** LAB. 2-8. Departmental approval. Credit to be arranged. Specialized project or research on a specific topic in plant pathology to be conducted under faculty supervision. Course may be repeated for a maximum of 4 credit hours.

**PLPA 8990 RESEARCH AND DISSERTATION (1-10)** DSR. Departmental approval. Research and dissertation on problems in plant pathology. Course may be repeated with change in topics.

## Poultry Science Courses

**POUL 1000 INTRODUCTORY POULTRY SCIENCE (3)** LEC. 2. LAB. 2. Introduction to the poultry species and their commercial production, physiology, nutrition and management. Fall.

**POUL 2000 POULTRY AND EGG EVALUATION AND SELECTION (1)** LAB. 1. A hands-on approach to poultry and egg evaluation based on the U.S. poultry and Egg guidelines and how to properly care for and handle the birds. Spring and Fall. Course may be repeated for a maximum of 4 credit hours.

**POUL 2100 PROFESSIONAL DEVELOPMENT FOR ANIMAL AGRICULTURE, PRODUCTION, PROCESSING & FEED INDUSTRIES (1)** LEC. 1. Development of professional skills and career preparation for students in animal agriculture.

**POUL 3030 COMMERCIAL POULTRY PRODUCTION (4)** LEC. 3. LAB. 3. The organization and management principles of the commercial poultry meat and egg production industries. Fall.

**POUL 3060 POULTRY REPRODUCTION (3)** LEC. 2. LAB. 2. Pr. POUL 3030. This course explores the reproductive physiology and endocrinology of poultry species, emphasizing genetics and management strategies impacting production, fertility, and hatchability in the industry. Students will also learn hatchery management and embryonic development of the chick.

**POUL 3150 POULTRY PHYSIOLOGY (4)** LEC. 3. LAB. 3. The physiological principles and anatomical characteristics of poultry species which directly interact with commercial management systems. Spring.

**POUL 4920 POULTRY SCIENCE INTERNSHIP (3)** INT. 3. Departmental approval. Practical on-the-job training in the poultry industry. Course may be repeated for a maximum of 9 credit hours.

**POUL 4960 SPECIAL PROBLEMS IN POULTRY SCIENCE (1-3)** IND. 2.5 GPA or departmental approval. Individual or group projects with a faculty member in poultry science. May include literary research, data analysis or a combination of these. Course may be repeated for a maximum of 6 credit hours.

**POUL 4970 SPECIAL TOPICS IN POULTRY SCIENCE (1-4)** LEC. Departmental approval. Instruction and discussion of selected current topics in poultry science. Course may be repeated for 8 hours. Course may be repeated for a maximum of 8 credit hours.

**POUL 4980 UNDERGRADUATE RESEARCH (2-4)** IND. Departmental approval. Directed research in the area of specialty within the department. Course may be repeated for a maximum of 4 credit hours.

**POUL 5020 PRINCIPLES OF ANIMAL FEED MANUFACTURING (3)** LEC. 2. LAB. 2. Principles of animal food manufacturing for cattle, swine, poultry, horses, aquaculture, and pet foods with emphasis on current animal food manufacturing practices, current animal food ingredient manufacturing, and current animal food regulatory landscapes. May count either POUL 6020 or POUL 5020.

**POUL 5030 ADVANCED COMMERCIAL POULTRY PRODUCTION (3)** LEC. 3. Pr. POUL 3030 and POUL 3150 and POUL 5050 and POUL 5110. The course covers the major principles of the integrated poultry industry, including the interactions and interrelationships between business segments in the poultry industry.

**POUL 5050 POULTRY FEEDING (3)** LEC. 3. Pr. ANSC 3410. The application of the principles of nutrition to poultry; the functions of individual nutrients, their deficiency symptoms and their supply in terms of feedstuffs and practical poultry diets. May count either POUL 5050 and POUL 6050.

**POUL 5070 ANIMAL WELFARE (3)** LEC. 3. Pr. (POUL 1000 or ANSC 1000) and (POUL 3150 or ANSC 3600). This course covers the key principles and application of animal welfare, and concepts will be applied to livestock, companion animals, wildlife, animals in research, and animals in entertainment. May count either POUL/ANSC 5070 or POUL/ANSC 6070.

**POUL 5080 POULTRY HEALTH (3)** LEC. 3. Pr. BIOL 3200 and POUL 3150. Study of the prevention, diagnosis, control and treatment of economically important diseases of poultry. May count either POUL 5080 or POUL 6080.

**POUL 5110 POULTRY PROCESSING (3)** LEC. 2. LAB. 3. Pr. POUL 3030 and (CHEM 1110 or CHEM 1030). The course focuses on poultry processing and related aspects. Students will learn the effects of live production, feed withdrawal and haul on poultry processing and quality as well as pre- and post-harvest food safety, USDA regulations, Halal and Kosher standards. May count either POUL 5110 or POUL 6110.

**POUL 5140 POULTRY FURTHER PROCESSING AND PRODUCTS (3)** LEC. 2. LAB. 3. Pr. CHEM 1110 or CHEM 1030. The course will provide an in-depth understanding of poultry product development, principles and practices, biochemistry, modern technologies used to assess product quality, sensory analysis, food safety as well as USDA regulations associated with poultry products. May count either POUL 5140 or POUL 6140.

**POUL 5160 PRINCIPLES OF FOOD SAFETY (3)** LEC. 2. LAB. 3. Pr. BIOL 3200. Identification and control of foodborne hazards in foods of animal origin. Introduction to Hazard Analysis and Critical Control Points. May count either POUL 5160 or POUL 6160.

**POUL 6020 PRINCIPLES OF ANIMAL FEED MANUFACTURING (3)** LEC. 2. LAB. 2. Principles of animal food manufacturing for cattle, swine, poultry, horses, aquaculture, and pet foods with emphasis on current animal food manufacturing practices, current animal food ingredient manufacturing, and current animal food regulatory landscapes. May count either POUL 5020 or POUL 6020.

**POUL 6030 ADVANCED COMMERCIAL POULTRY PRODUCTION (3)** LEC. 3. The course covers the major principles of the integrated poultry industry, including the interactions and interrelationships between business segments in the poultry industry. Graduate student standing.

**POUL 6050 ADVANCED POULTRY FEEDING (3)** LEC. 3. An advanced study and review of the literature on the application of the principles of nutrition to poultry; the functions of individual nutrients, their deficiency symptoms and their supply in terms of feedstuffs and practical poultry diets. May count either POUL 5050 or POUL 6050.

**POUL 6070 ANIMAL WELFARE (3)** LEC. 3. This course covers the key principles and application of animal welfare, and concepts will be applied to livestock, companion animals, wildlife, animals in research, and animals in entertainment. May count either POUL/ANSC 5070 or POUL/ANSC 6070.

**POUL 6080 ADVANCED POULTRY HEALTH (3)** LEC. 3. Departmental approval. An advanced study of the prevention, diagnosis, control and treatment of economically important diseases of poultry. May count either POUL 5080 or POUL 6080.

**POUL 6110 POULTRY PROCESSING (3)** LEC. 2. LAB. 3. Students will acquire strong knowledge on each step of poultry processing from hanging to chilling and transportation. The course will cover topics on food safety (pre- and post-harvest), spoilage, antimicrobial interventions, USDA regulations as well as Halal and Kosher standards. May count either POUL 5110 or POUL 6110.

**POUL 6140 POULTRY FURTHER PROCESSING AND PRODUCTS (3)** LEC. 2. LAB. 3. The course will provide an in-depth understanding of poultry product development, principles and practices, biochemistry, modern technologies used to assess product quality, sensory analysis, food safety as well as USDA regulations associated with poultry products. May count either POUL 5140 or POUL 6140.

**POUL 6160 ADVANCED PRINCIPLES OF FOOD SAFETY (3)** LEC. 2. LAB. 3. Departmental approval. An advanced study and literature review of the identification and control of foodborne hazards in foods of animal origin. Introduction to Hazard Analysis and Critical Control Points. May count either POUL 5160 or POUL 6160.

**POUL 7100 SUPERVISED INVESTIGATION (1-4)** IND. Departmental approval. Advanced independent investigation in major field of poultry or avian science. Requirements include review of literature, successful and timely completion of research project, and presentation of results in written and/or oral report. Course may be repeated for a maximum of 8 credit hours.

**POUL 7950 GRADUATE SEMINAR (1)** SEM. 1. Literature in poultry science, food science or related field. Emphasis given to preparation, organization, and presentation of research materials and to reporting current literature in the field. May count either FDSC 7950 or POUL 7950. Course may be repeated for a maximum of 3 credit hours.

**POUL 7960 SPECIAL PROBLEMS IN POULTRY SCIENCE (1-3)** IND. Critical analysis of classic and current research in poultry science, including literary research and/or data analysis. Course may be repeated for a maximum of 6 credit hours.

**POUL 7970 SPECIAL TOPICS IN POULTRY SCIENCE (1-4)** LEC. Instruction and discussion of current advanced topics associated with poultry science. Course may be repeated for a maximum of 8 credit hours.

**POUL 7980 NON-THESIS RESEARCH (1-4)** RES. Departmental approval. enrolled as POUL MAg student. Research conducted as part of the Master of Agricultural degree.

**POUL 7990 RESEARCH AND THESIS (1-10)** MST. Technical laboratory problems related to poultry. Course may be repeated with change in topics.

**POUL 8100 GI SYSTEMS AND NUTRIENT UTILIZATION (3)** LEC. 3. Pr. POUL 5050. Structure of feedstuffs and strategy in nutrient recovery from the gastrointestinal systems of fowl, swine, and ruminants.

**POUL 8960 SPECIAL PROBLEMS (1-4)** IND. A) Nutrition, B) Physiology, C) Health, D) Microbiology, E) Processing, F) Product Safety and Quality, G) Teaching, H) Immunonutrition. Course may be repeated with change in topic. Departmental approval.

**POUL 8990 RESEARCH AND DISSERTATION (1-10)** DSR. Technical laboratory problems related to poultry. Course may be repeated with change in topics.

## Rural Sociology Courses

**RSOC 2090 FOOD SYSTEMS: POLICY, PRODUCTION, AND PRACTICE (3)** LEC. 3. Post farm gate transformation of raw commodities into edible food. Supply chain, policy, and consumption issues as they relate to processing, safety, nutrition, and waste in the U.S.

**RSOC 3560 ENVIRONMENT, SOCIETY, AND JUSTICE (3)** LEC. 3. The course focuses on micro and macro structures influencing environmental problems, and possible pathways for their resolution. The course introduces Environmental Sociology through an action-oriented approach to environmental problems.

**RSOC 3620 COMMUNITY ORGANIZATION (3)** LEC. 3. Analysis of social organization at the community level. Conceptual framework developed to examine both internal and external forces affecting urban as well as rural communities in the U.S., and to identify strategies to strengthen local capacity to adapt to changing social and economic environments.

**RSOC 4910 DIRECTED FIELD EXPERIENCE (3)** LEC. 3. Departmental approval. Structured intensive involvement within an agency or organization serving people in communities or rural areas. Supervision is shared between agency personnel and department faculty who plan, consult, discuss, and evaluate student activities and reports.

**RSOC 4930 DIRECTED STUDIES (1-3)** IND. Departmental approval. Individualized study of topics in rural sociology and community development, natural resources and environmental issues conducted in consultation with a faculty member. Course may be repeated for a maximum of 3 credit hours.

**RSOC 4960 SPECIAL PROBLEMS IN RURAL SOCIOLOGY AND COMMUNITY DEVELOPMENT (1-3)** LEC. Departmental approval. Investigation of problems in rural sociology and community development, natural resources and environmental issues conducted in consultation with a faculty member. Course may be repeated for a maximum of 3 credit hours.

**RSOC 5190 SOCIOLOGY OF SUSTAINABLE AGRIFOOD SYSTEMS (3)** LEC. 3. Key trends in alternative production-consumption systems (e.g., rise of small/very-small production and processing, development and feasibility short and values-based supply chains; and food security, justice, equity, sovereignty, and democracy). May count either RSOC 5190 or RSOC 6190.

**RSOC 5410 EXTENSION PROGRAMS AND METHODS (3)** LEC. 3. An introduction to the Cooperative Extension System and other forms of educational outreach. Application of techniques used in extension and outreach planning and programming.

**RSOC 5510 SOCIAL WELFARE, FAMILY AND POVERTY (3)** LEC. 3. Pr. SOCY 1000 or SOCY 1007 or ECON 2020 or ECON 2023 or ECON 2027. Description for Bulletin: Measuring and explaining poverty inequality and their effects on families and society, analysis of anti-poverty programs.

**RSOC 5610 RURAL SOCIOLOGY (3)** LEC. 3. Theories and conceptual approaches to rurality in international and domestic contexts. Rural-urban differences in demographic composition, occupational structure, attitudes, and values of rural people and regional cultures. Rural services and institutions as determinants of the quality of life.

**RSOC 5640 SOCIOLOGY OF COMMUNITY DEVELOPMENT (3)** LEC. 3. Principles of applied social change at the community level in both industrialized and non-industrialized settings; impacts of economic and technological changes on urban and rural communities; citizen participation in community affairs.

**RSOC 5650 SOCIOLOGY OF NATURAL RESOURCES AND THE ENVIRONMENT (3)** LEC. 3. The social origins of contemporary environmental problems, emergence of environmentalism as a social movement within industrialized nations, and other topical issues.

**RSOC 6190 SOCIOLOGY OF SUSTAINABLE AGRIFOOD SYSTEMS (3)** LEC. 3. This is an advanced course that will focus on key trends in alternative production-consumption systems (e.g., rise of small/very-small production and processing, development and feasibility short and values-based supply chains; and food security, justice, equity, sovereignty, and democracy).

**RSOC 6410 EXTENSION PROGRAMS AND METHODS (3)** LEC. 3. An introduction to the Cooperative Extension System and other forms of educational outreach. Application of techniques used in extension and outreach planning and programming.

**RSOC 6510 SOCIAL WELFARE, FAMILY AND POVERTY (3)** LEC. 3. Description for Bulletin: Measuring and explaining poverty and inequality and their effects on families and society; analysis of anti-poverty programs.

**RSOC 6610 RURAL SOCIOLOGY (3)** LEC. 3. Theories and conceptual approaches to rurality in international and domestic contexts. Rural-urban differences in demographic composition, occupational structure, attitudes and values of rural people and regional cultures. Rural services and institutions as determinants of the quality of life.

**RSOC 6650 SOCIOLOGY OF NATURAL RESOURCES AND THE ENVIRONMENT (3)** LEC. 3. The social origins of contemporary environmental problems, emergence of environmentalism as a social movement within industrialized nations, and other topical issues.

**RSOC 7620 SOCIOLOGY OF COMMUNITY (3)** LEC. 3. Emphasis on theories, conceptual approaches and methods for studying communities and assessing developmental needs with attention to organizational structure, power structure, decision-making and linkage networks to societal units.

**RSOC 7630 POLITICAL ECONOMY OF DEVELOPMENT (3)** LEC. 3. Theories of societal development applied to contemporary issues associated with change in non-industrialized nations. Exploration of institutional, class, and state interests that guide development processes, as well as alternative participatory development strategies.

**RSOC 7700 METHODS OF SOCIAL RESEARCH (3)** LEC. 3. Problem identification, hypothesis development and empirical analysis. Quantitative and qualitative procedures for obtaining social data using surveys, direct observation and secondary sources.

**RSOC 7960 SPECIAL PROBLEMS IN RURAL SOCIOLOGY AND COMMUNITY DEVELOPMENT (1-3)** LEC. Pr., departmental approval. Investigation of a problem in a particular area of interest involving an in-depth review of the literature, a research project, or an outreach education activity. Course may be repeated for a maximum of 6 credit hours.

**RSOC 7970 SPECIAL TOPICS IN RURAL SOCIOLOGY AND COMMUNITY DEVELOPMENT (3)** LEC. 3. Departmental approval. New topic in the area of rural sociology and community development.

**RSOC 7990 RESEARCH AND THESIS (1-10)** MST. In conjunction with the preparation of a thesis. Course may be repeated with change in topics.