COURSES OF INSTRUCTION

This list includes for each course the catalog number, title, credit hours, class and laboratory hours per week, description and prerequisites.

A secondary listing in parentheses indicates that this course is cross-listed with another program.

Graduate credit may be earned only for courses numbered 600 or above. Each 600-level course carries a 400-level undergraduate counterpart. Students who receive graduate credit in such courses must do extra work of an appropriate nature as determined by the department and are graded according to graduate standards. Students who receive credit for the 400-level course may not receive credit later for the same course at the 600 level.

Courses at the 700 level are designed primarily for the degrees that emphasize professional practice rather than research.

COURSE ABBREVIATIONS

Accounting.................................................ACCT
Aerospace Studies........................................A S
Agricultural Education ...............................AG ED
Agricultural Mechanization and Business ....AG M
Agriculture..................................................AGRIC
Agriculture, Forestry and Life Sciences ......AFLS
American Sign Language..........................ASL
Animal and Veterinary Sciences ..................AVS
Anthropology.............................................ANTH
Applied Economics.....................................AP EC
Architecture .............................................ARCH
ArtART
Art and Architectural History .................AA H
Astronomy...............................................ASTR
Athletic Leadership.................................A L
Automotive Engineering..........................AU E
Biochemistry...........................................BIOCH
Bioengineering.......................................BIO E
Biological Sciences ..................................BIOSC
Biology..................................................B IOL
Biomolecular Engineering.........................B MOLE
Biosystems Engineering............................B E
Botany.....................................................BOT
Business..................................................BUS
Business Administration.........................MB A
Calhoun Honors Seminar........................C H S
Career and Technology Education ..........CTE
Ceramic and Materials Engineering ........CM E
Chemical Engineering..............................CH E
Chemistry................................................CH
Chinese..................................................CHIN
City and Regional Planning....................C P R
Civil Engineering......................................C E
Clemson University..................................CU
College of Engineering and Science.........CES
Communication Studies.............................COMM
Community and Rural Development ..........C RD
Computer Science..................................CP SC
Construction Science and Management ......CS M
Crop and Soil Environmental Science .........CSENV
Dance....................................................DANCE
Design Studies........................................DSIGN
Digital Production Arts ............................D P A
Early Childhood Education ......................ED EC
East Asian Studies....................................E AS
Economics...............................................ECON
Education...............................................ED
Educational Counseling............................ED C
Educational Foundations..........................ED F
Educational Leadership.............................ED L
Electrical and Computer Engineering ........EC E
Elementary Education ...............................ED EL
Engineering............................................ENGR
Engineering Graphics..............................E G
Engineering Mechanics............................E M
English....................................................ENG
Entomology............................................ENT
Environmental and Natural Resources ........ENV
Environmental Engineering and Science ......EN & S
Environmental Science and Policy .............EN SP
Environmental Toxicology........................ENTOX
Executive Leadership and Entrepreneurship ...E L E
Experimental Statistics............................EX ST
Family and Community Studies...............FCS
Finance..................................................FIN
Food Science..........................................FD SC
Food Technology.....................................FD TH
Forestry................................................F R
Forestry and Natural Resources .................F N R
French....................................................FR
Genetics.................................................GEN
Geography..............................................GEOG
Geology..................................................GEOL
German..................................................GER
Graduate Studies.....................................G S
Graphic Communications........................G C
Great Works...........................................G W
Health....................................................HLTH
Health Administration............................H A
Health, Education and Human Development ...H E D
History....................................................HIT
Horticulture............................................HORT
Human Resource Development ................H R D
Humanities...............................................HUM
Industrial Engineering............................I E
Integrated Pest Management.....................IP M
Italian....................................................ITAL
Japanese................................................JPN
Landscape Architecture............................LARCH
Language...............................................LANG
Language and International Trade ..............L & IT
Latin.....................................................LATIN
Law.......................................................LAW
Leisure Skills.........................................L S
Library...................................................LIB
Management...........................................MGT
Marketing................................................MKT
Materials Science and Engineering ........MS & E
Mathematical Sciences.............................MTH SC
Mechanical Engineering..........................M E
Microbiology..........................................MICRO
Military Leadership...............................ML L
Music....................................................MUSIC
Nonprofit Leadership.............................NPL
Nursing.................................................NURS
Nutrition...............................................NUTR
Packaging Science..................................PK GSC
Pan African Studies ................................PA S

Parks, Recreation and Tourism Management ...PRTM
Performing Arts.......................................P A
Philosophy.............................................PHIL
Physical Science......................................PH SC
Physics..................................................PHYS
Planning, Design and the Built Environment ..PD BE
Plant and Environmental Sciences ..............PES
Plant Physiology......................................PL PA
Political Science......................................PO SC
Polymer and Fiber Chemistry.....................PFC
Portuguese.............................................PORT
Psychology.............................................PSYCH
Public Administration.............................P ADM
Reading................................................READ
Real Estate Development........................RED
Religion..................................................REL
Rhetoric, Communication and Information Design.................................................................RCID
Rural Sociology........................................R S
Russian..................................................RUSS
Secondary Education...............................SE D
Sociology................................................SOC
Soils and Sustainable Crop Systems ........SSCS
Spanish..................................................SPAN
Special Education.....................................SP E
Textile..................................................TEXT
Theatre...................................................THEA
Vocational-Technical Education ...............VT ED
Wildlife and Fisheries Biology..................W FB
Women’s Studies......................................WS

ACCOUNTING

ACCT 604 Individual Taxation 3(3,0)
Interpretation of federal income tax laws, regulations and court decisions with practice in application of these laws to the returns of individuals, partnerships and corporations. Preq: ACCT 311 with a C or better.

ACCT 610 Budgeting and Executive Control 3(3,0)
Study and application of selected techniques used in the planning and control functions of business organizations. Preq: ACCT 303 with a C or better.

ACCT 821 Controllership 3(3,0)
Advanced internal accounting emphasizing accounting implications for management decision making. Preq: ACCT 303 or equivalent.

ACCT 851 Tax Research 3(3,0)
Tax research methodology as applied to the solution of routine and complex tax problems emphasizing the methodology of solution rather than a specific tax area. Preq: ACCT 404 or equivalent.

ACCT 852 Financial Accounting Theory and Research 3(3,0)
Evolution of financial accounting theory and its application to contemporary reporting. Emphasis is on learning to research, document and present a rationale for a recommended alternative. Research problems are derived from actual audit disputes concerning financial presentation. Preq: ACCT 313 or equivalent.

ACCT 853 Advanced Accounting Problems 3(3,0)
Study of specialized aspects of financial reporting, including business combinations, fund accounting and emerging practices and developments in financial accounting. Preq: ACCT 313 or equivalent.
ACCT 854 Ethical, Professional and Societal Responsibilities 3(3,0) Study of ethical and societal responsibilities and constraints that define and affect the practice of accountancy. Includes selected readings and cases. Preq: ACCT 404 and 415, or equivalent.

ACCT 856 CPA Exam Review–A 0 Preparation for the auditing and attestation section of the Certified Public Accountant exam. Must be completed prior to receiving MPAcc degree. Does not contribute hours toward degree completion. To be taken Pass/Fail only. Preq: Enrollment in MPAcc program.

ACCT 857 CPA Exam Review–B 0 Preparation for the business environment and concepts section of the Certified Public Accountant exam. Must be completed prior to receiving MPAcc degree. Does not contribute hours toward degree completion. To be taken Pass/Fail only. Preq: Enrollment in MPAcc program.

ACCT 858 CPA Exam Review–F 0 Preparation for the financial accounting and reporting section of the Certified Public Accountant exam. Must be completed prior to receiving MPAcc degree. Does not contribute hours toward degree completion. To be taken Pass/Fail only. Preq: Enrollment in MPAcc program.

ACCT 861 Operational Auditing 3(3,0) Provides in-depth understanding of concepts underlying operational auditing and experience in planning, conducting and reporting in operational auditing using a risk-based, process and controls focused approach. Preq: ACCT 415 or equivalent.

ACCT 862 Financial Auditing 3(3,0) Advanced course in financial auditing to provide a framework for thinking about contemporary auditing and assurance issues and evaluating alternative rationales regarding the value and purpose of an audit as well as conducting financial audit research. Preq: ACCT 415 or equivalent.

ACCT 863 Forensics and Analysis 3(3,0) Study of financial statement analysis with quality assessments and forensic analysis. Includes forecasting, asset and business valuation approaches and other special topics. Preq: ACCT 313 or equivalent.

ACCT 864 Accounting Information Systems 3(3,0) Accounting systems including database concepts, systems design and evaluation, systems controls and systems implementation. Preq: ACCT 322 and 415, or equivalent.

ACCT 865 Taxation of Business Decisions 3(3,0) Discusses the interrelationships of taxation and business decisions. Designed for students not specializing in taxation. Preq: ACCT 404 or equivalent.


ACCT 872 Taxation of Flowthrough Entities 3(3,0) Covers federal income taxation of entities treated as partnerships, S corporations, estates and trusts. Preq: ACCT 404 or equivalent.

ACCT 873 International and Special Topics in Taxation 3(3,0) Seminar on international and special topic areas that impact practicing tax professionals. Preq: ACCT 404 or equivalent.

ACCT 874 Tax Aspects of Financial Planning 3(3,0) Covers federal estate and gift tax laws; federal income tax laws related to trusts and estates. Preq: ACCT 404 or equivalent.

ACCT 875 State, Local and Advanced Topics in Taxation 3(3,0) Explores state and local income taxation issues and planning, retirement plans, deferred compensation plans, IRS practice and procedures and current sophisticated developments in taxation. Preq: ACCT 404 or equivalent.

AGRICULTURAL EDUCATION

AG ED 601 Instructional Methods in Agricultural Education 3(2,3) Appropriate methods of teaching vocational agriculture in high schools. Includes procedures for organizing teaching programs, teaching high school students and directing FFA activities.

AG ED 603 Principles of Adult/Extension Education 3(3,0) Overview of adult/extension education and adult learning. Selection of adult education providers is reviewed with emphasis on extension. Preq: Junior standing or consent of instructor.

AG ED 609 Agriscience Institutes: Applications of Agriscience to the Secondary Curriculum 3(2,2) Designed for pre-service and in-service agricultural educators or secondary level counselors. Surveys current developments in agriscience with an emphasis on modern practices, current job opportunities and meeting state and national science and math education standards through agricultural instruction. Students construct lesson plans and career planning modules for high school. Preq: AG ED 102.

AG ED 615 Leadership of Volunteers 3(3,0) Provides an overview of volunteer management. Examines the knowledge, skills and abilities required of professional managers to involve volunteers effectively in the work of organizations.

AG ED 616 Ethics and Issues in Agriculture and the Food and Fiber System 3(3,0) Explores ethical theories, concepts of critical thinking and major ethical issues in American agriculture. The major social, political, economic and ethical issues that arise in connection to the “food and fiber system” are examined and potential solutions considered.

AG ED 623 Curriculum 2(2,0) Curriculum goals and related planning for career and continuing education programs.

AG ED 625 Teaching Agricultural Mechanics 2(1,3) Organizing course content, conducting and managing an agricultural mechanics laboratory, shop safety, microteaching demonstrations of psychomotor skills and methods of teaching manipulative abilities.

AG ED 628 Special Studies in Agricultural Education 3(1-3,0) Students study, individually or collectively, selected topics and/or problems in agricultural education to meet the particular needs of the clientele enrolled. May be repeated for a maximum of six credits.

AG ED 640 Program Development in Adult/Extension Education 3(3,0) Principles, theory and practice in planning and conducting educational programs in adult/extension settings. Preq: Junior standing or consent of instructor.

AG ED (CTE, ED F) 680 Digital Technology in the 21st Century Classroom 3(2,2) See ED F 680.

AG ED (CTE, ED F) 682 Advanced Educational Applications of Microcomputers 3(2,2) See ED F 682.

AG ED 736 Internship Teaching 3(1,6) Increases professional competency and program development through classroom and practical experiences in planning, conducting and evaluating educational programs. Offered spring semester only.

AG ED 737 Internship in Agribusiness Firms 3(1,6) Provides classroom and practical experiences in selected agricultural businesses and industries. Students identify and practice entry-level competencies required in selected agribusiness and natural resource management enterprises. Offered summer session only.

AG ED 750 Special Institute Course: Selected Topics in Agricultural Education 3(1-3,0) Subject areas organized according to institute needs. Topics vary from course to course. May be repeated for a maximum of nine credits. Preq: Consent of instructor.

AG ED 801 Systems for Technology Transfer 3(3,0) Development of a philosophical foundation and utilization of cooperative learning strategies and techniques to disseminate effectively technological change for expanding clientele and diverse socio-economic environments.

AG ED 804 Special Problems 3(2,3) Planning, conducting and reporting a special problem in agricultural and vocational education appropriate to students’ needs.

AG ED 805 Administration and Supervision in Agricultural Education 3(3,0) Guides students in developing a philosophy of education including application of administrative concepts in supervising agricultural education programs. Offered spring semester of even-numbered years only. Preq: Experience in agricultural education.

AG ED 810 Clinical Research in Agricultural Education 1-3(1-3,18) Individual work on an assigned research topic in agricultural education. May be repeated for a maximum of nine credits. Preq: AG ED (CTE, ED) 889, EX ST 801.

AG ED 812 Development of Supervised Agribusiness Experiences Programs 3(3,0) Provides secondary agriculture teachers with strategies for supervising and guiding students’ supervised agricultural experiences (SAE). Preq: Student teaching in agricultural education.
AG ED 815 Teaching Agricultural and Power Mechanics 3(2,3) Methods of determining course content, organizing teaching modules in logical sequence, equipping shop, teaching agricultural and power mechanics to farm and agribusiness clientele, providing individualized instruction and developing off-farm experience programs. Offered summer session of odd-numbered years only.

AG ED 821 Theories and Practices of Adult Education 3(3,0) Study of recent research on adult learning. Includes a comparison of the assumptions supporting pedagogy and andragogy and teaching adults through formal classes and community organizations. Offered spring semester only. Prereq: ED 302 or PSYCH 201 or equivalent.

AG ED 869 Seminar 1-3(1-3,0) Students and faculty review current topics in agricultural education.

AG ED (CTE, ED) 889 Research in Education 3(3,0) Includes problem selection. Investigates types of educational research and techniques employed. Includes the use of ERIC system and computer program packages. Requires interpretation of research findings.

AGRICULTURAL MECHANIZATION AND BUSINESS

AG M 602 Landscape Drainage and Irrigation 3(2,3) Uses basic soil-water-plant relationships to determine the need for and methods of irrigation and drainage. Topics include irrigation methods, drainage needs and drainage methods.

AG M 605 Agricultural Structures and Environmental Control 3(2,3) Technical considerations of buildings used for agriculture with emphasis on structural materials, structural adequacy, environmental control and indoor air quality. Prereq: AG M 221, 303, PHYS 200.

AG M 606 Mechanical and Hydraulic Systems 3(2,3) Study of power transmission systems for agricultural production with emphasis on mobile equipment. Characteristics, requirements and design of both V-belt drive and roller-chain drives are presented. Emphasizes hydraulic power transmission systems, including pumps, actuators, control devices and hydraulic circuitry. Prereq: AG M 206, PHYS 200 or 207, or consent of instructor.

AG M 610 Precision Agriculture Technology 3(2,3) Includes principles and hands-on application of technologies supporting precision agriculture. Topics include Global Positioning System (GPS) and Geographic Information System (GIS) software, variable rate technologies, collection of spatial data, automated guidance of equipment, spatial data mapping and analysis, remote sensing and economic considerations. Prereq: Graduate standing.

AG M 652 Mobile Power 3(2,3) Study of tractors with emphasis on internal combustion engines and support systems necessary for their proper functioning; application of power, maintenance, adjustment and general repair. Prereq: PHYS 200, 207, or consent of instructor.

AG M 660 Electrical Systems 3(2,3) Students in agriculture and related curricula study electric and other utilities on the farm and in the home. Selection, installation and maintenance of wiring systems, lighting systems, motors, controls, water systems and waste disposal systems are emphasized. Prereq: Junior standing.

AG M 712 Farm Machinery Management 3(2,3) Investigates selection, functional analysis and maximum utilization of existing and developing farm machinery. Discusses computer applications to programming of field operations, available capital and labor, machine size, critical field operations, growing degree days, weather and maintenance equipment, procedures and scheduling.

AG M 771 Selected Topics in Agricultural Mechanization 1-3(1-3,0) Selected topics not covered in other courses. Performance is measured by oral or written reports or examinations. May be repeated for a maximum of six credits.

AG M 781 Special Problems 1-3(1-3,0) Independent analysis through literature review and laboratory or field research. Requires written documentation. May be repeated for a maximum of six credits.

AGRICULTURE

AGR M 640 Microclimatology 3(3,0) Study of energy balance in the earth's atmosphere and soil: solar and thermal radiation, air and soil temperature, humidity, evaporation and the hydrologic cycle, wind fields. Weather variables to describe microclimates and the energy balance of plants, animals and insects. Modification of microclimates. Rural and urban climates. Prereq: PHYS 240 or equivalent or consent of instructor; second semester Junior standing.

ANIMAL AND VETERINARY SCIENCES

AVS 601 Beef Production 4(3,2) Discusses breeding, feeding, reproduction and management of beef cattle. Emphasizes production systems integrating disciplines of animal agriculture into management plans and alternatives. Practical applications of beef production and management practices are also presented. Offered fall semester only. Prereq: AVS 202, 370.

AVS 610 Domestic Animal Behavior 3(3,0) Provides knowledge and understanding of behavior related to perception, learning, sociality, reproduction, feeding and health for application in production, training and design of environments for optimum health and welfare of domestic animals. Prereq: AVS 150, 151 and junior standing.

AVS 611 Animal Growth and Development 3(3,0) Integration of the nutritional, physiological and genetic basis for animal growth and development with application to livestock and poultry production. Includes the cellular and molecular mechanisms controlling these processes and emphasizes the genes that regulate animal products (meat, eggs, wool and milk). Prereq: AVS 301.

AVS 612 Advanced Equine Management 4(3,2) Further discussion of special considerations of the equine regarding housing, manure management, nutrition, reproduction, transportation and behavior. Students gain insight into how horses differ from other livestock species and their unique requirements for the above systems. Prereq: AVS 370.

AVS 613 Animal Products 3(2,3) Introduction to the safe and humane production of red meat, poultry, and dairy products. Includes HACCP principles and production of value-added animal products.

AVS (BIOSC, MICRO) 614 Basic Immunology 4(3,3) See MICRO 614.

AVS 615 Contemporary Issues in Animal Science 3(3,0) Provides knowledge, understanding and critical analytical skills on current issues in animal agriculture in diverse regional, national and global social-cultural and political environments as they impact animals and man. Prereq: Junior standing in Animal and Veterinary Sciences.

AVS 616 Equine Exercise Physiology 4(3,2) Integration of muscle, bone, cartilage, cardiovascular, and respiratory systems as related to the equine athlete. Encompasses biomechanics, kinetics, and kinesiology related concepts specific to the horse. Further discussion of diseases related to specific systems is covered. Prereq: AVS 301.

AVS 617 Animal Agribusiness Development 2(1,2) Team-based development of a business relating to the animal industries. Students develop the business from the initial idea through operations. Focuses on the development of the business plan, including financials, personnel management, and resources needed. Prereq: ACCT 201 and AP EC 202 or consent of instructor.


AVS 620 Poultry Science On-line 3(3,0) On-line course covering the physiology, nutrition, health, reproduction, genetics, breeding, housing and management of commercial poultry species including the processing of meat and egg products.

AVS 643 AVS International Experience 1-3(1-3,0) Preplanned and approved international education/cultural experience supervised by an Animal and Veterinary Sciences faculty member. Periodic reports or record keeping are required. Final report and oral presentation are required at the end of the experience. May be repeated for a maximum of four credits. To be taken Pass/Fail only. Prereq: Consent of instructor.

AVS 653 Animal Reproduction 3(2,2) Reproductive physiology and endocrinology of mammals with emphasis on farm animals and frequent reference to reproduction in laboratory animals and humans. Prereq: AVS 150, 301.

AVS 655 Animal Reproductive Management 2(1,3) Physiology and endocrinology of pregnant and non-pregnant cows are discussed. Emphasis is on methods of artificial insemination, pregnancy detection and computer record keeping for achieving a high level of reproductive efficiency in cattle. Prereq: AVS 150, 301; AVS 453 (or concurrent enrollment).

AVS 665 Animal Physiology I 3(3,0) Advanced study of the physiological systems of domestic animals as these systems relate to the integrated functions of the body. Exposes students to advanced physiological concepts and current literature perspectives on a variety of body systems and processes. Prereq: Introductory physiology and biochemistry.
A V S 821 Nutritional Bioenergetics 2(2,0) Quantitative approach to the losses of dietary energy during digestion and metabolism; factors governing the energetic efficiency of different biological functions in animals and man; regulation of energy balance; body temperature regulation; techniques of calorimetry. Prq: BIOCH 623 or equivalent; NUTR 601 or 651 or equivalent; or consent of instructor. 

A V S 822 Special Problems 1-3(0,3-9) Laboratory, library, or field study of problems related to animal, dairy and veterinary sciences emphasizing development and testing of hypotheses and reporting of results. May be repeated for a maximum of four credits. Prq: Consent of instructor supervising study. 

A V S 825 Immunobiology 3(3,0) Conceptual approach to immunobiology emphasizing the molecular and cellular aspects. Classical and current literature is the major source for the discussion/lecture format. Offered spring semester only. Prq: Consent of instructor. 

A V S 891 Master’s Thesis Research 1-12 

AP EC (C R D) 645 Economic Development Theory and Policy 3(3,0) See C R D 612. 

AP EC 613 Advanced Real Estate Appraisal 3(3,0) Topics include highest and best use analysis, data collection and analyses. Advanced appraisal procedures for income, cost and comparable sales approach to real estate valuation are stressed. Emphasis on the appraisal of property in transition and specialized property are covered. Offered spring semester only. Prq: AP EC 313, FIN 307, or consent of instructor. 

AP EC 620 World Agricultural Trade 3(3,0) Review of practical considerations of agricultural trade and trade policy analysis. Considers the role of international institutions. Special emphasis is placed on concepts of agricultural trade, analysis of trade policies of major trading partners/competitors and export/import marketing of products. Offered spring semester only. Prq: AP EC 309, ECON 412, or consent of instructor. 

AP EC 621 Globalization 3(3,0) Utilizes basic principles of international economics (comparative advantage, free trade vs. protectionism, exchange rate determination, etc.) to analyze the contemporary problems and issues of the world economy. Emphasizes application of economic principles to current globalization trends. Prq: ECON 310 or 412 or 415 or consent of instructor. 

AP EC (CSENV) 626 Cropping Systems Analysis 3(2,2) See CSENV 626. 

AP EC 633 Agricultural Law and Related Environmental Issues 3(3,0) Introduction to agricultural and agricultural-related environmental legal issues. Topics include a review of laws, agencies, programs, court structure, torts, taxation, biotechnology, land and water use, regulated industry and environment liabilities as they relate to agriculture and natural resources. Offered spring semester only. Prq: LAW 322 or consent of instructor. 

AP EC 652 Agricultural Policy 3(3,0) Review of public agricultural policy programs in the United States and a critical examination of current and proposed government policies and programs affecting the agricultural sector of the economy. Includes economic considerations as related to past and current farm price and income problems. Offered spring semester only. Prq: AP EC 302, 309. 

AP EC 656 Prices 3(3,0) Review of the basic theory of price under competitive conditions and various modifications; nature, measurement and causes of daily, seasonal and cyclical price fluctuations; geographical price relationships; nature, function and behavior of futures markets; government price programs. Offered spring semester only. Prq: AP EC 308, ECON 314, EX ST 462. 

AP EC 657 Natural Resource Use, Technology and Policy 3(3,0) Focuses on economic analyses of actual, efficient and sustainable uses of natural resources, impacts of technologies that affect these uses and policies that affect development and use of such technologies. Resource-technology-policy combinations may vary, but an example is crude oil, hybrid automotive engines and fuel efficiency standards. Prq: MTHSC 102; and C R D (AP EC) 357 or ECON 314.
Courses of Instruction

AP EC 658 Economics of Risk Management
3(3,0) Focuses on cost-benefit analysis of risks, incorporation of economic considerations into risk assessments and microeconomic analysis of activities, insurance and policies that reduce, mitigate, or increase these risks. Possible topics include climate change, wildland fire, erosion, pests and invasive species, pestilence, food contamination and hurricanes. Prereq: MTHSC 102 and C R D 357 or ECON 314.

AP EC 660 Agricultural Finance
3(3,0) Study of the principles and techniques of financing in the agricultural sector. Topics include the capital situation in agriculture, concepts of farm financial management, use of credit, capital markets, lending agencies and estate planning. Offered spring semester only. Prereq: ACCT 201, AP EC 202.

AP EC 675 Economics of Wildlife Management and Policy
3(3,0) Integrated approach to the study of the economics of wildlife. Topics include determination of market and nonmarket value, single and multiple species management, enterprise cost and returns, marketing wildlife, leasing methods, complementarity and competitiveness with agricultural and forestry enterprises and timber and crop damage cost estimates and control. Prereq: AP EC 202, ECON 200, FOR 304, W F B 306, or consent of instructor.

AP EC (ECON) 800 History of Economic Thought
3(3,0) See ECON 800.

AP EC (ECON) 801 Microeconomic Theory
3(3,0) See ECON 801.

AP EC (ECON) 802 Advanced Economic Concepts and Applications
3(3,0) See ECON 802.

AP EC (ECON) 804 Applied Mathematical Economics
3(3,0) Discusses mathematical tools needed in economic analysis; matrix algebra, differentiation, unconstrained and constrained optimization, integration and linear programming.

AP EC (ECON) 806 Econometrics I
3(3,0) See ECON 808.

AP EC (ECON) 809 Advanced Natural Resource Economics
3(3,0) Applications of economic theory to problems of natural resource management, epistemological considerations, rent theory, public and private investment criteria, benefit-cost analysis and general equilibrium management models. Offered spring semester only. Prereq: ECON (AP EC) 801 or consent of instructor.

AP EC (ECON) 810 Natural Resources Management and Policy
3(3,0) Economic, institutional and legal aspects of control and management of natural resources; concepts of economic science applied to public policy questions related to land and water resources. Specialized background in economics is not necessary. Offered fall semester only. Prereq: Consent of instructor.

AP EC (ECON) 811 Economics of Environmental Quality
3(3,0) See ECON 811.

AP EC 813 Water Resource Economics
3(3,0) Discusses benefit-cost analysis of public water development programs, economic analysis of selected water allocation issues, freshwater management, pollution abatement, efficient pricing and valuation, multiple use management, reservoir management, wetland protection, minimum stream flows for endangered species and environmental and developmental tradeoffs. Prereq: AP EC (ECON) 822 and ECON 823, or consent of instructor.

AP EC (ECON) 816 Labor Economics
3(3,0) See ECON 816.

AP EC (ECON) 817 Advanced Production Economics
3(3,0) Discusses production economics theory in a quantitative framework; technical and economic factor-product, factor-factor, and product-product relationships in single- and multi-product firms under conditions of perfect and imperfect competition in both factor and product markets. Offered spring semester only. Prereq: AP EC (ECON) 804 or consent of instructor.

AP EC 819 Futures and Options Markets
3(3,0) Introduction to the economic theory and operation of futures and options markets in the United States. Includes determination of prices and price differences, speculation and the use of these markets for forward pricing and price risk management. Prereq: Consent of instructor.

AP EC (ECON) 820 Public Finance
3(3,0) See ECON 820.

AP EC (ECON) 822 Public Policy Economics
3(3,0) Covers contemporary public policy, including price and resource policy, affecting rural areas. Discusses public participation, or the lack thereof, related to programs designed to implement public policy. Offered spring semester only. Prereq: ECON 314 or equivalent and knowledge of first-year calculus, or consent of instructor.

AP EC (ECON) 824 Organization of Industry
3(3,0) See ECON 824.

AP EC (ECON) 826 Economic Theory of Government Regulation
3(3,0) See ECON 826.

AP EC (ECON) 827 Economics of Property Rights
3(3,0) See ECON 827.

AP EC (ECON) 828 Market Structure in Agricultural Industries
3(3,0) Market structure and other approaches related to agricultural marketing. Individual assignments in the student's field of interest are required. Prereq: Consent of instructor.

AP EC (ECON) 831 Economic Development
3(3,0) See ECON 831.

AP EC (ECON) 832 Community and Regional Economics
3(3,0) Covers economic theory and research methods needed to understand happenings in the regional and community economy and how local and non-local decisions influence local economic change. Offered fall semester only. Prereq: C R D (AP EC) 612 or consent of instructor.

AP EC 836 Dynamic Optimization with Economic Applications
3(3,0) Dynamic optimization entails the use of optimal control to solve minimization or maximization problems in which choice variables affect how state variables change over time. Differential or difference equations describe the temporal changes. Economic applications pertain to actual use and efficient management over time of financial, human, physical and natural capital. Prereq: Applied mathematical economics or multivariable calculus or consent of instructor.

AP EC (ECON) 840 International Trade Theory
3(3,0) See ECON 840.

AP EC (ECON) 841 International Finance
3(3,0) See ECON 841.

AP EC (ECON) 855 Financial Economics
3(3,0) See ECON 855.

AP EC 881 Internship in Community and Resource Development
1-6 Supervised employment in an agency dealing with socioeconomic aspects, community development and/or natural resource management. Monthly reports covering the student's experience are required. Prereq: 18 semester hours of graduate credit.

AP EC 891 Master's Thesis Research
1-12 AP EC (ECON) 899 Selected Topics
1-3(1-3,0) Selected topics under the guidance of a professor. May be repeated for a maximum of six credits.

AP EC (ECON) 901 Price Theory
3(3,0) See ECON 901.

AP EC 903 General Equilibrium and Welfare Theory
3(3,0) Second in a two-course sequence in advanced price theory covering the capital theory and the determination of the rate of interest. Offered spring only. Prereq: ECON (AP EC) 901.

AP EC (ECON) 906 Seminar in Area Economic Development
3(3,0) Consideration of recent research developments in economic development. Includes a review of research publications, journal articles and other literature. Objectives, analytical techniques and procedures are used in area or regional development efforts. Offered spring semester only. Prereq: AP EC (ECON) 806.

AP EC (ECON) 917 Advanced Seminar in Labor Economics
3(3,0) See ECON 917.

AP EC (ECON) 950 Monetary Economics
3(3,0) See ECON 950.

AP EC (ECON) 991 Doctoral Dissertation Research
1-12 ARCHITECTURE

ARCH 605 American Architectural Styles
1650-1950 3(3,0) Survey of American architectural styles and the architects responsible for them, from the Colonial period to our recent past. Emphasis is on identifying architectural elements that serve as clues in determining a building's architectural style.

ARCH 612 Architectural History Research
3(3,0) Directed investigations related to the art and architectural history of Europe. May be repeated for a maximum of six credits. Prereq: Junior standing or consent of instructor.

ARCH 614 Design Seminar
3(3,0) Exploration of topical issues in architecture, art, construction and planning. May be repeated for a maximum of six credits. Prereq: Junior standing or consent of instructor.
ARCH 616 Field Studies in Architecture and Related Arts 3(0,9) Documentation and analysis of architectural structures observed during European travels in graphic and written form. May be repeated for a maximum of six credits. Prq: Junior standing or consent of instructor.

ARCH 624 Product Design 3(0,9) Furniture and product system design with emphasis on ergonomics and the relationship of form and materials. Prq: Senior standing and consent of instructor.

ARCH 625 Energy in Architecture 3(3,0) Climate design methodology and its influence on building energy patterns and architectural form. Prq: Senior standing and consent of instructor.

ARCH 626 Architectural Color Graphics 3(3,0) Architectural color graphics by computer. Theories of color classification and interaction; application of color theories to art and architecture. Prq: Consent of instructor.

ARCH 627 Advanced Color Graphics 3(3,0) Theories of color classification and interaction; three-dimensional color modeling by computer; advanced application of color theories to art and architecture. Prq: ARCH 426 or consent of instructor.

ARCH 628 Computer-Aided Design 3(2,3) Introduction to the concepts, skills and applications of computer-aided design as they relate to the practice of architecture. Prq: Senior standing or consent of instructor.

ARCH 629 Architectural Graphics 3(3,0) Provides students with an understanding of concepts, skills, techniques and strategies of visual presentation/graphics as they relate to the design professions—architects/landscape architects. Prq: Graduate standing or consent of instructor.

ARCH 630 Theories and Philosophies of Technology and Architecture 3(3,0) Theoretical and practical examination of technology and architecture from pre-modern and modern viewpoints to study its nonneutral role in shaping and reflecting knowledge, beliefs and actions within a cultural context.

ARCH 631 Virtual Reality in Architecture 3(5,0) Introduction and exploration of the theories and concepts of virtual reality and their use in modeling three-dimensional spaces; computer modeling, lighting and texture mapping. Projects focus on the creation and presentation of a virtual environment. Prq: Junior standing or consent of instructor.

ARCH 640 New York Field Study 3(3,0) Study of architecture, art, planning and urban design of New York. Two weeks' residence are required with scheduled field trips to relevant sites in all five boroughs, with counseling to determine research interests. Guidance is provided to resources in the city. A final report is required. Offered Maymester only.

ARCH 677 Introduction of Craft 1-3(0,2-6) Architectural craft lab offered under different material specializations, all of which introduce students to design as informed by craft through a hands-on lab. Basic craft operations and material properties are introduced for the subject material (wood, steel, etc.) May be repeated for a maximum of six credits. Prq: Consent of instructor.

ARCH 685 History and Theory of Architecture + Health 3(3,0) Introduces relationships between health and architectural settings for health. Examines connections between cultural context, medical thought, health-care delivery and health facility design within different time periods. Introduces contemporary theories on the relationships between human beings, their health and well-being and the design of the physical environment. Prq: Consent of instructor.

ARCH 688 Architectural Programming and Predesign 3(3,0) Introduces the theory, mechanics and practice of architectural programming and post-occupancy evaluation. Presents programming as a means to create architectural settings sensitive to the needs of their inhabitants. Emphasizes collaborative methodologies that involve identifying significant goals, facts, issues, needs and concepts. Students develop an architectural program. Prq: Consent of instructor.

ARCH 699 Selected Topics in Architecture 1-3(1-3) Study of selected topics in architecture. May be repeated for a maximum of nine credits, but only if different topics are covered. Prq: Junior standing or consent of instructor.

ARCH 801 Architecture Seminar 3(3,0) Contempory issues in the architectural profession.

ARCH 803 Theories of Architecture 3(3,0) Evolution of architectural theories from Vitruvius to the present. Emphasis is on the writings of leading architects and theorists and the impact of these theories on architectural solutions.

ARCH 804 Seminar in Modern Masters 3(3,0) In-depth examination of one or more related groups of architects from the 20th century (Kahn, Scarpia, Barrigan, Wright, Corbusier, etc.). Content varies from semester to semester.

ARCH 810 Visualization and Representation I 3(3,0) Develops students' capacity for graphic representation of architectural form and space. Intended as a corollary to ARCH 840; provides the tools necessary to analyze and translate concepts into three-dimensional constructions through the utilization of manual and digital drawing techniques. Coreq: ARCH 940.

ARCH 811 Visualization and Representation II 3(3,0) Develops and improves student's capacity for the digital and graphic representation of three-dimensional architectural form and space. Introduces and explores the latest technologies—from advanced digital modeling tools to equipment for computer-controlled fabrication. Prq: ARCH 810 or equivalent or consent of instructor.

ARCH 819 Selected Topics in Visualization and Representation 1-5(1-5) Critical consideration of a special topic in architectural visualization and representation from which students construct their own informed and reasoned ideas about what this topic means for their own developing architectural practices. May be repeated for a maximum of six credits. Prq: ARCH 810 or equivalent or consent of instructor.

ARCH 820 Building Design and Construction Principles 3(3,0) Essential principles for quality design and construction. Emphasis is on design, programming and sustainability issues for different project types. Nature and characteristics of construction materials, equipment and systems used in modern buildings are presented as well as how they affect function and feasibility. Prq: Consent of instructor.

ARCH 821 Research Methods 3(3,0) Covers foundations and procedures of architectural research. Explores alternate research methodologies and their philosophical and epistemological limits.

ARCH 840 Design Studio I 6(0,12) Studio for students entering the Master of Architecture program with undergraduate degrees in subjects other than Architecture or Environmental Design. Considers aspects of visualization and representation of architecture, the history and theory of architecture, architectural technology and strategies of design. Coreq: ARCH 810.

ARCH 841 Architecture Studio I 6(0,12) Studio course focused on increasingly complex works of architecture at various scales for different physical site conditions. Prq: ARCH 810 or equivalent.

ARCH 842 Architecture Studio II 6(0,12) Studio course focused on architectural materials and assembly. Course is comprised of architectural design explorations of increasing complexity. Students develop a detailed sectional model of their design proposal. Prq: ARCH 841.

ARCH 850 Architecture Studio 6(0,18) Architectural design studies in the context of the Genoa urban setting. May substitute for ARCH 853 or 854 and for ARCH 857 with consent of advisor.

ARCH 851 Studio Clemson 6(0,12) Addresses architectural problems with varied scales, programs and locations. Emphasizes the relationship between architecture and context. Projects involve collaboration in the studio and with other disciplines to result in architectural solutions for the built environment. Design problems vary according to current issues. May be repeated for a maximum of 12 credits. Prq: ARCH 842 or consent of program coordinator.

ARCH 852 Studio Charleston 6(0,12) Addresses architectural problems with varied scales and programs in Charleston, SC. Emphasizes the relationship between architecture and context. Projects involve collaboration in the studio and with other disciplines to result in architectural solutions for the built environment. Design problems vary according to current issues in the city of Charleston. May be repeated for a maximum of 12 credits. Prq: ARCH 842 or consent of program coordinator.

ARCH 855 Studio South 6(0,12) Addresses architectural problems with varied scales and programs in the context of the South. Emphasizes the relationship between architecture, community and context. Projects involve collaboration with other disciplines in the studio to result in architectural solutions for the built environment. Design problems vary according to current issues in the South. May be repeated for a maximum of 12 credits. Prq: ARCH 842 or consent of program coordinator.

ARCH 857 Architecture Studio 6(0,18) Architectural design studies dealing with comprehensive problem-solving situations. Prq: ARCH 854.
ARCH 858 Thesis Research 3(0,9) Architectural predesign inventory and analysis for the thesis project. Preq: ARCH 854.

ARCH 859 Thesis Manuscript 1-3(0,3-9) Architectural predesign synthesis of research for the thesis project. Preq: ARCH 858.

ARCH 861 History and Theory of Modern Architecture 3(3,0) Overview of architectural concepts drawn from Modernity and current in contemporary architectural discourse. Students critically consider what these concepts mean for their own developing architectural practices. Preq: A A H 102 or equivalent.

ARCH 862 History and Theory of Contemporary Architecture 3(3,0) View of how art, philosophy and technology have influenced recent architectural production and thought. Students critically consider these relations towards constructing their own informed ideas about how influences from outside the discipline of architecture might inform their own developing architectural practices. Preq: A A H 102 or equivalent.

ARCH 863 History and Theory of Landscape and Urbanism 3(3,0) Cultivates different ways of seeing, representing and understanding the landscape and the city. Both landscape and city are viewed as dynamic, living systems evolving from Roman, Medieval, Baroque, Industrial, Idealized and non-Western roots and shaped by political, economic, social, cultural and physical intentions and incidents. Preq: A A H 102 or equivalent.

ARCH (E C E) 868 Architectural Robotics 3(3,0) See E C E 868.

ARCH 869 Selected Topics in History, Theory and Criticism 1-5(1-5,0) Critical consideration of special topics in architectural history, theory and criticism from which students construct their own informed and reasoned ideas about what the topic means for their own developing architectural practices. May be repeated for a maximum of six credits.

ARCH 881 Professional Practice Survey 3(3,0) Provides an understanding of the basic principles and legal aspects of architectural practice organization: financial management; risk mitigation and arbitration; business planning; time, project and personnel management; client, owner and user needs; selecting consultants; project delivery methods; internship, licensure and registration; professional leadership; ethical standards; and expanding practice settings.

ARCH 882 Building Economics, Costs and Legal Issues 3(3,0) Explores economic factors determining materials, building components and methods of construction. Legal aspects of design are discussed in the context of building cost. Preq: ARCH 881 or consent of instructor.

ARCH 886 Health Facilities Planning and Design 3(3,0) Current planning and design considerations for healthcare facilities. Conducted as a series of professional seminars examining overall infrastructural planning and design considerations and detailed considerations for specific areas in hospitals. Topics are covered by Architecture + Health faculty and nationally recognized practitioners. Coreq: ARCH 897.

ARCH 889 Mentorship 1-6 Mentorship in professional practice. Paid work/study in a variety of related disciplines provides students with hands-on experience in design and fabrication fields relevant to the environmental design professions. Consists of two parts: a professional component, managed by an approved sponsor and an academic component, taught by the instructor. May be repeated for a maximum of 18 credits. Preq: Consent of instructor and acceptance by sponsor.

ARCH 890 Directed Studies 1-5(1-5,0) Special topics in architecture undertaken on an individual basis with faculty guidance. Preq: Consent of advisor.

ARCH 891 Thesis Project 3-90(9-27) Complex architectural project emphasizing design exploration and independent work. To be taken Pass/Fail only. Preq: ARCH 857, 858.

ARCH 893 Synthesis Studio 3(0,12) Studio themes and programs, defined by individual critics, carry an educational objective and present an opportunity for the critic to develop with his/her students a specific area of work or research. Culminates in a comprehensive proposal. Preq: Second-year studio.

ARCH 894 Research Studio 6(0,12) Themes and programs, defined by individual critics, carry an educational objective and present an opportunity for the critic to develop with his/her students a specific area of work or research. Preq: ARCH 893.

ARCH 895 Architecture + Health Studio Selected Projects 3-6(0,12) Studio for students in Architecture + Health Concentration offering selected projects engaging a variety of health-related topics from health community design, sustainable/green architecture, long-term care and community health-care projects associated with health and wellbeing. Projects executed are similar to professional practice, combining teamwork with individual design alternatives. May be repeated for a maximum of 12 credits. Preq: Consent of instructor.

ARCH 896 Architecture + Health Studio: Tectonic Projects 3-6(0,12) Studio for students in Architecture + Health Concentration focused on the design and technical development of small-scale healthcare projects and spaces. Projects are often conducted by interdisciplinary teams as design-build projects where full-scale mock ups are conceived and constructed for evaluation and research. May be repeated for a maximum of 12 credits. Preq: Consent of instructor.

ARCH 897 Architecture + Health Studio: Hospital and Urban Design 3-6(0,12) Studio course for students in Architecture + Health Concentration, focused on the master planning and conceptual design of an academic medical center or hospital within an urban context. The master planning and design problem is preceded by a comparative analysis of both urban structures and hospital structures. May be repeated for a maximum of 12 credits. Coreq: ARCH 886.

ART

ART 605 Advanced Drawing 3(0,6) Advanced-level studies of drawing which explore the synthesis of refined drawing skills and philosophies of art. Student’s understanding of drawing as a form of art is developed through studio practice augmented by critiques, demonstrations, lectures, field trips and independent research. Preq: ART 305 or consent of instructor.

ART 607 Advanced Painting 3(0,6) Advanced studio course in painting. Study of contemporary painters and directions is included. Students select painting media and are expected to develop a strong direction based on prior painting experience. Preq: ART 307 or consent of instructor.
ART 609 Advanced Sculpture 3(0,6) Intensive independent studio concentration to further develop personal direction and content. Emphasis is on continued investigation of sculptural context, materials and processes, and relative historical research. Prq: ART 309 or consent of instructor.

ART 611 Advanced Printmaking 3(0,6) Culmination of process, techniques and individual development. Students are expected to have mastered process and technique for the benefit of the image produced. Creativity and self-expression are highly emphasized as students select a process for concentrated study. Prq: ART 311 or consent of instructor.

ART 613 Advanced Photography 3(0,6) Continuation of ART 313. Advanced problems in photography. Prq: ART 313 or consent of instructor.

ART 617 Advanced Ceramic Arts 3(0,6) Students are directed toward further development of ideas and skills. Glaze calculation and firing processes are incorporated to allow for a dynamic integration of form and ideas. Prq: ART 317 or consent of instructor.

ART 620 Selected Topics in Art 1-3(0,6,9) Intense course in studio art. May be repeated for a maximum of six credits, but only if different topics are covered. Prq: Senior standing or consent of instructor.

ART 690 Directed Studies 1-5(0,2-10) Additional advanced work. Must be arranged with a specific instructor prior to registration. May be repeated for a maximum of 15 credits. Prq: Consent of instructor.

ART 803 Fundamentals of Visual Art 3(0,6) Intensive introduction of visual art and design fundamentals. Includes two- and three-dimensional studio work with emphasis on time-based media and design.

ART 805 Visual Arts Seminar on Theories and Practice I 3(3,0) Issues related to the practice of the artist, emphasizing theories and criticism of contemporary art.

ART 806 Visual Arts Seminar on Theories and Practice II 3(3,0) Continuation of ART 805.

ART 813 Photo-Based Imaging Theories and Techniques 3(0,6) Offers in-depth examination of photographic imaging processes for artistic expression, utilizing both traditional and digital tools and concepts. Prq: Master of Fine Arts student or consent of instructor.

ART 821 Visual Narrative 3(3,0) Students develop visual communication skills through the vernacular of cinema, and express concepts and ideas in sequential narrative design. Prq: Consent of instructor.

ART 840 Visual Arts Studio 3-6(0,9-18) Studio work in visual arts with adjunct lectures and gallery tours. May be substituted for ART 800-level visual arts studio.

ART 850 Visual Arts Studio 3(0,9) Concentrated and advanced work in ceramics, drawing, painting, printmaking, sculpture, photography, graphic design, or multimedia. Prq: Consent of department chair or instructor.

ART 851 Visual Arts Studio 3-6 Continuation of ART 850. May be repeated for maximum of six credits. Prq: Consent of department chair or instructor.

ART 870 Visual Arts Studio 6(0,16) Advanced theory; directed research in art criticism; applied work in ceramic arts, drawing, painting, sculpture, photography, graphic design, or multimedia. Prq: Consent of department chair or instructor.

ART 871 Visual Arts Studio 3-6(0,8-16) Continuation of ART 870. May be repeated for maximum of six credits. Prq: Consent of department chair or instructor.

ART 880 Visual Arts Studio 3-15(0,6-30) Continuation of ART 871. May be repeated for maximum of 15 credits. Prq: Consent of department chair or instructor.

ART 891 Master’s Thesis Research 3-15(0,6-30) May be repeated for maximum of 15 credits. Prq: Consent of department chair or instructor.

ART AND ARCHITECTURAL HISTORY

A A H 611 Directed Research in Art History I 3(3,0) Comprehensive studies and research of special topics not covered in other courses. Emphasis is on field studies, research activities and current developments in art history.

A A H 612 Directed Research in Art History II 3(3,0) Continuation of A A H 611.

A A H 623 Studies in the Art and Architecture of the Renaissance I 3(3,0) Consideration of the visual arts and architectural monuments of the Renaissance (Western Europe from the 15th–18th centuries), with a study in depth of selected examples from the period. Prq: A A H 204 or 206 or consent of instructor.

A A H 624 Studies in the Art and Architecture of the Renaissance II 3(3,0) Consideration of the visual arts and architectural monuments of the Renaissance (Western Europe from the 15th–18th centuries), with a study in depth of selected examples from the period. Prq: A A H 423.

A A H 630 Twentieth Century Art I 3(3,0) Acquaints students with the major artists’ monuments and issues of the Modern period in art. Through lecture/discussions and the reading of primary sources, course places the major modern movements in the context of the period (1860s–1945). Prq: Consent of instructor.

A A H 632 Twentieth Century Art II 3(3,0) Overview of trends in art and architecture since World War II. Specific artists, artworks and movements are presented in a socio/historic context with specific emphasis on the transition from a late-modernist to a post-modern perspective. Prq: Consent of instructor.

A H (PHIL) 633 Issues in Contemporary Art and Philosophy 3(3,0) See PHIL 633.

A A H 815 Art and Architectural History Seminar I 3(3,0) Particular aspect of period of art/architectural history. Prq: Consent of instructor.

A A H 816 Art and Architectural History Seminar II 3(3,0) Continuation of A A H 815.

A A H (COMM, ENGL) 840 Selected Topics 3(3,0) See ENGL 840.

ASTRONOMY

ASTR 802 Stellar Structure and Evolution 3(3,0) Physical principles governing the structure, power, luminosity and evolution of stars; equation of state, equations for pressure and thermal balance, heat transport, thermonuclear power and numerical techniques of structure calculation. Prq: PHYS 455 or equivalent or consent of instructor.

ASTR 803 Galactic Structure 3(3,0) Kinematics, dynamics and content of the Milky Way galaxy; galactic rotation, galactic distance scale, stellar populations, spiral structure, the galactic center and the evolution of the Milky Way and other galaxies. Prq: Consent of instructor.

ASTR 875 Selected Topics 1-3(1-3,0) Study of one or more advanced topics in contemporary astrophysics. May be repeated for credit, but only if different topics are covered. Prq: Consent of instructor.

ATHLETIC LEADERSHIP

A L 653 Athletic Injuries: Prevention, Assessment and Rehabilitation 3(3,0) Gives students an understanding of prevention, treatment and rehabilitation procedures of injured athletes. Prq: A L 349.

AUTOMOTIVE ENGINEERING

AU E 805 Ground Vehicle Aerodynamics 3(3,0) Basic and applied aspects of aerodynamics relevant for internal and external design for performance, including drag, handling, noise and ventilation. Wind tunnel and track testing methods and computational modeling approaches are utilized.

AU E 816 Engine Combustion and Emissions 3(2,3) Spark and compression ignition engines are investigated in terms of design, performance and emissions. Includes exergy models. Integrates theory of fuel air cycles with laboratory breakdown and dynanometer testing to correlate prevalent mathematical models with test results.

AU E 817 Alternative Energy Sources 3(3,0) Demand for petroleum alternative propulsion sources has focused attention on hybrid vehicles with fuel cells, electric motors and battery packs and internal combustion engines burning hydrogen and reformulated fuels. Comparison of performance, emissions, fuel efficiency, operational requirements and vehicle configurations is studied.

AU E 825 Automotive Sensors and Actuators 3(3,0) Study of automotive sensor and actuator requirements, design and selections as well as future needs. Sensor and actuator networks, noise and interference issues, wired and wireless systems are examined as well as integrated smart sensors and actuators with applications to traditional and intelligent vehicle systems.

AU E 826 On-Board Vehicle Diagnostics and Reliability 3(3,0) Discussion of legislated state, federal and international requirements. On-board automotive sensors to monitor vehicle operation and typical diagnostic algorithms are studied. Includes analytical methods for designing fault-tolerant systems and assessing vehicle reliability including safety-critical systems and “limp-home” modes, as well as use of hand-held scanners and specialized diagnostic equipment to classify faults.
AU E 827 Automotive Control Systems Design 3(3,0) Investigation into derivation of models and design of control strategies for powertrain and chassis control modules and integration into automotive platforms. Also presents software design, sensor selection, system architecture, diagnostics and reliability issues. Application is made to engine management, transmission and chassis systems with a consideration of vehicle performance, safety and information provision. Prq: M E 416 or equivalent.

AU E 828 Fundamentals of Vehicle Drivelines and Powertrain Integration 3(3,0) Study of vehicle powertrain arrangement, manual and automatic transmissions, automotive axles, four-wheel and two-wheel drives and design and manufacturing of gearing systems. Other topics, such as powertrain control to address dynamics in shifting, engine balancing and fuel economy, are addressed. Modeling and computer simulation are used extensively to analyze dynamic performance of various transmissions. Prq: M E 405, 416, or consent of instructor.

AU E 829 Tire Behavior and Its Influence on Vehicle Performance 3(3,0) In-depth analysis of the tire and its influence on vehicle performance including design, construction, structural response, rolling resistance, force and moment generation and behavior under dry/wet conditions. Tire models, their limitations and governing equations, tire characteristics on vehicle handling and stability and advanced control concepts in vehicle stability/braking are investigated. Prq: M E 453 or equivalent.

AU E 832 Vehicle Development and Integration Processes, Methods and Tools 3(3,0) Overview of the vehicle development process and the tools used in it, including voice of the customer, concept creation, packaging, product specification and target setting, including cost structures, lifecycle product management, prototype development and the role of the supplier. Prq: AU E 881.

AU E 833 Automotive Manufacturing Process Development, Methods and Tools 3(3,0) Overview of automotive manufacturing systems. Issues such as supplier integration, flexible manufacturing, aggregate planning, quality engineering and their applications to manufacturing systems are presented. Emphasizes opportunities and challenges presented with automotive manufacturing in a global environment, integrated processes, product development and automotive supply chain management.

AU E 834 Automotive Production Preparation, Management and Launch 3(3,0) Effective leadership and management of the product development and launch process. Includes responsibility and role definition, process management tools and software systems, detailed management of the supply chain, performance metrics and cost models and factors affecting launch success. Case studies of historic launch data and improvements are utilized.

AU E 835 Automotive Electronics Integration 3(3,0) Addresses the integration of electronic components and systems in automotive designs. Provides an overview of the major electronic systems in automobiles and describes how automotive manufacturers specify, integrate and evaluate these systems.

AU E 847 Vehicle Suspension Systems Design and Analysis 3(3,0) Study of concepts, theory, design and application of automotive suspension systems. Discusses suspension structure, configuration, geometry, kinematics, motion, static and dynamic load conditions as well as active, semi-active and passive systems. Suspension design factors and their effects are presented. Computer-aided engineering tools and other analytical techniques are demonstrated. Prq: M E 453 or equivalent.

AU E 848 Vehicle Braking Systems 3(3,0) Study of vehicle braking performance; development of system specifications; regulatory, customer and manufacturing requirements; brake balance and effects on stability and stopping distance; ABS systems; and computer simulation for system performance. Prq: M E 453 or equivalent.

AU E 849 Automotive Chassis Design 3(3,0) Integrative systems approach to the design and manufacture of automotive chassis and body components. Considers influence of design and manufacture on overall structural performance of the automobile, ride comfort, safety, durability, weight and cost. Prq: AU E 855 or equivalent, AU E 881.

AU E 850 Automotive Stability and Safety Systems 3(3,0) Discussion of passive/active systems and design philosophies. Investigates stability issues associated with vehicle performance and use of sensors and control system strategies for stability enhancement. Implementation and application to intelligent cruise control, lane departure warning systems, ABS, traction control, active steering systems and vehicle dynamic control systems are also discussed. Prq: M E 453 or equivalent.

AU E 853 Crash Analysis Methods and Crashworthiness 3(3,0) Consideration of crash legislation and testing; design constraints for crash; computational methods to analyze the mechanical response of automotive structure, systems and components to dynamic impact loading such as in crash situations; crush characteristics, structural collapse and their influence on safety; large-scale finite element analysis for large-scale deformation. Prq: AU E 852, 855, or consent of instructor.

AU E 855 Structural/Thermal Analysis Methods for Automotive Structure, Systems and Components 3(3,0) Methods to analyze the response of automotive structure, systems and components to static, dynamic and thermal loading. Includes coverage of critical loading conditions and system response objectives. Analysis methods focus on finite element approaches supplemented by simple computational methods when appropriate.

AU E 866 Advanced Materials for Automotive Applications 3(3,0) In-depth study of the broad range of engineering materials used in the construction of motor vehicles. Considers interrelations between materials microstructure, components manufacturing process and components service behavior. Prq: Consent of instructor.

AU E 867 Vehicle Manufacturing Processes I 3(3,0) In-depth analysis of main component and subsystem prototyping, fabrication assembly and integration processes used during production of automotive vehicles. Also discusses design for manufacturing, computer-aided manufacturing and rapid tooling technologies. Prq: Consent of instructor.

AU E 868 Vehicle Manufacturing Processes II 3(3,0) Continuation of AU E 867 with more emphasis placed on opportunities and challenges presented by automotive manufacturing in a global environment, integrated processes and product development and flexible and agile manufacturing. Prq: AU E 867.

AU E 875 Vehicle Development and Realization 3(3,0) In-depth analysis of component and subsystem design, representation, data management and analysis for vehicles. Voice of the customer, customer-driven design, product design specifications, life cycle product management, CAD/CAE representations, domestic and international standards, prototyping, design review and supplier relationships are considered using case studies.

AU E 876 Mass Customization Design for Vehicles 3(3,0) Consideration of concepts of platforms and product families, identification of common functionalities and the translation of functions into forms taking commonality into consideration. Also investigates designing product families and their role in vehicle design, the tie between market needs and appropriate manufacturing paradigm and specific applications to vehicle systems designs: chassis, wiring harnesses, engines.

AU E 877 Light-Weight Vehicle Systems Design 3(3,0) Methodological approaches to weight trade-off during design of vehicle systems, accounting for other functions, cost, safety, materials characteristics and manufacturing constraints. Includes topology optimization, multimaterial approaches and identification of the function optimal material and material combinations using multi-objective formulations.

AU E 880 Vehicle Design/Manufacture Project Management 3(3,0) Development of management, leadership, sociocultural and technical skills training for the successful management of an automotive development or research team. Includes problem identification, team dynamics, decision making, ethics, strategy setting, project planning, scope management and implementation, target costing, marketing, design methods and design for Xconcepts.

AU E 881 Automotive Systems: An Integrated Overview 3(3,0) Promotes understanding of the vehicle as a complex system and interactions of its subsystems in terms of performance. Topics include propulsion systems, suspensions and steering systems, tire-road interface, structural behavior and crashworthiness, materials and manufacturing, driver/occupants-vehicle interactions and onboard electronics. Modeling and simulation are used.

AU E 882 Systems Integration Concepts and Methods 3(3,0) Study of methods and tools to handle functional, geometric, production and IT integration. Includes instruction in managing performance trade-offs from the combination of systems designed for individual functions. Topics also include optimization methods, complexity, validation, signal and IT design and testing methods, robustness, architecture and quality.
**Courses of Instruction**

**AU E 883 Applied Systems Integration 3(2,3)** Application of integration methods to practical and complex vehicle design and manufacturing systems. Includes prototyping, measurements, tolerancing and validation, as well as diagnosis and sensitivities, methods to diagnose sporadic software errors with hardware in the loop, design reviews, FMEA on function signal, geometry, production. Also includes Fault Tree analysis, innovation and change management, risk analysis and value analysis. Prq: M E 882, consent of instructor.

**AU E 884 Styling Design 3(3,0)** Considers fundamentals of styling design for the outer body and the interior cockpit. Utilizes concept sketching, drawing and prototyping, including virtual and physical, layered and clay based. Includes 2-D and 3-D representations, brand identifications, textures, materials, lighting, colors, and their use in automotive industrial design.

**AU E 885 Vehicle Layout Engineering and Ergonomic Design 3(2,3)** Study of vehicle layout specifications and considerations related to exterior and interior design. Ergonomics methods and tools as related to occupant accommodation and driver function are presented. Issues of assembly and manufacturing ergonomics are also covered. Case studies are utilized.

**AU E 886 Vehicle Noise, Vibration and Harshness 3(3,0)** Application of engineering tools and specifications for noise, vibrations and harshness. Sources, mitigation methods, complexity and influences on other vehicle functions are considered. Utilizes design, simulation and validation methods. Prq: M E 845 or equivalent.

**AU E 887 Methods for Vehicle Testing 3(2,3)** Investigates test planning for various performance regimes, data acquisition and analysis, uncertainty analysis, sensor selection, noise filtering, data reduction methods and track testing methods. Project includes actual vehicle tests.

**AU E 890 Automotive Engineering Project 1-6(0,3-9)** Industrial project work culminating in writing engineering reports. Projects cover comprehensive analytical and/or experimental treatment of phenomena of current interest in automotive engineering emphasizing modern technological problems. May be repeated for a maximum of nine credits.

**AU E 893 Selected Topics in Automotive Engineering 3(3,0)** Advanced concepts in multibody systems dynamics including kinematics and kinetics of multibody systems, various methods for equation formulation and their limitations, numerical solution methods, and applications to automotive systems and subsystems.

**AU E 991 Doctoral Dissertation Research 1-12**

**BIOCHEMISTRY**

**BIOCH 606 Physiological Chemistry 3(3,0)** Studies chemical basis of the mammalian physiological processes of muscle contraction, nerve function, respiration, kidney function and blood homeostasis. Discusses composition of specialized tissue such as muscle, nerve, blood and bone and regulation of water, electrolytes and acid-base balance. Prq: BIOCH 305 or Organic Chemistry.

**BIOCH 623 Principles of Biochemistry 3(3,0)** Study of the chemistry of amino acids, monosaccharides, fatty acids, purines, pyrimidines and associated compounds leads to an understanding of their properties and the relationship between structure and function that makes them important in biological processes. The use of modern techniques is stressed. Prq: CH 224 or equivalent.

**BIOCH 651 Physical Approach to Biochemistry 3(3,0)** Study of chemical and physical properties of amino acids, lipids, nucleic acids, sugars, and their biopolymers. Physical and mathematical analyses are correlated with biological structure and function. Prq: BIOCH 301 with a C or better or consent of instructor. Coreq: Physical Chemistry.

**BIOCH 632 Biochemistry of Metabolism 3(3,0)** Study of central pathways of carbohydrate, lipid and nucleotide metabolism. Bioenergetics, limiting reactions, and the regulation and integration of the metabolic pathways are emphasized. Prq: BIOCH 423 or 431 or consent of instructor.

**BIOCH 633 General Biochemistry Laboratory 1 2(0,4)** Experiments selected to illustrate current methods used in biochemical research. Coreq: BIOCH 423 or 431.

**BIOCH 634 General Biochemistry Laboratory II 2(0,4)** Continuation of BIOCH 433. Prq: Concurrent enrollment in BIOCH 432.

**BIOCH 636 Molecular Biology Genes to Proteins 3(3,0)** Examines how nucleic acids and proteins are synthesized in prokaryotic and eukaryotic cells. Designed for students interested in biochemistry, cell biology, molecular biology and cell physiology. Prq: BIOCH 301 and GEN 302 or consent of instructor.

**BIOCH (GEN) 640 Bioinformatics 3(3,0)** See GEN 640.

**BIOCH 643 Biochemical Basis of Disease 3(3,0)** Topics in heritable human metabolic disorders including clinical features and newborn screening, genetic testing, the biochemical basis and treatment. Prq: BIOCH 301, GEN 302, or consent of instructor.

**BIOCH (GEN) 805 Issues in Research 3(3,0)** Scientific writing, oral presentations and critical evaluation of them; legal and ethical issues associated with modern biochemical research. Science job hunting, time management and creativity for professional scientists are treated. Prq: Graduate enrollment in Biochemistry and Molecular Biology or consent of instructor.

**BIOCH (GEN) 810 Principles of Molecular Biology 3(3,0)** Introduction to the principles and techniques used to analyze prokaryotic and eukaryotic gene and genome structure, regulation of transcription initiation, regulation of protein synthesis and protein function. Prq: Enrollment in Genetics or Biochemistry and Molecular Biology or consent of instructor.

**BIOCH 814 Advanced Biochemistry 3(3,0)** Contemporary topics of functional and cellular aspects in biochemistry with particular focus on new observations, emerging ideas and important techniques. Prq: Two-semester sequence in biochemistry or consent of instructor.

**BIOCH 815 Lipids and Biomembranes 3(3,0)** Discusses isolation, chemical and physical properties, and metabolism of lipids; purification, structure, function and biosynthesis of biomembranes. Prq: BIOCH 632 or consent of instructor.

**BIOCH 816 Signal Transduction 3(3,0)** Characteristics and components of signal transduction processes in model species of plants, animals and microbes. Prq: BIOCH (GEN) 810 and GEN (BIOCH) 820, or consent of instructor.

**BIOCH 818 Cellular Metabolism 3(3,0)** Evolution, regulation, characterization and manipulation of metabolic pathways. Prq: BIOCH 814 and GEN (BIOCH) 820, or consent of instructor.

**BIOCH (GEN) 820 Genomics and Proteomics 3(3,0)** See GEN 820.

**BIOCH 821 Proteins 3(3,0)** Isolation, composition, structure and properties of proteins; methods of isolation, analysis and characterization; properties of "unusual" protein systems. Prq: BIOCH 623 or 631 or consent of instructor.

**BIOCH 822 Enzymes 3(3,0)** Kinetics, mechanisms of action, inhibition and general properties of enzymes. Prq: BIOCH 623 or 631.

**BIOCH (GEN) 825 Seminar I 1(1,0)** See GEN 825.

**BIOCH 828 Supramolecular Structure 3(3,0)** Cellular structures such as viruses, ribosomes and various membrane systems, including rafis and some organelles, are described using modern methods of structural characterization. The methods and the theory of the methods are discussed along with the structures and their functions. Prq: BIOCH 814 or consent of instructor.

**BIOCH 832 Structure and Function of Nucleic Acids 3(3,0)** Physical, chemical and biochemical properties of nucleotides, oligonucleotides, DNA and RNA; antisense oligonucleotides and aptmers; unusual structures of RNA and DNA; nucleic acids-protein interactions; nucleic acids-metal interactions; small RNAs and RNA interference; catalytic nucleic acids; nucleic acids repair. Prq: BIOCH 814 or GEN 814 or consent of instructor.

**BIOCH 841 Biochemical Genetics 3(3,0)** Regulation of replication and transcription. Students present papers from recent literature and write a research proposal. Prq: One year of biochemistry or consent of instructor.

**BIOCH (GEN) 851 Seminar II 1(1,0)** Investigation of current topics in biochemistry. May be repeated for a maximum of ten credits. To be taken Pass/Fail only.

**BIOCH 890 Special Topics in Biochemistry 1-6(0,3-9)** Group discussions of recent developments in biochemical research. May be repeated for a maximum of six credits, but only if different topics are covered. Prq: BIOCH 814 or consent of instructor.

**BIOCH 891 Master's Thesis Research 1-12**

**BIOCH 991 Doctoral Dissertation Research 1-12**