COURSES OF INSTRUCTION

This list includes for each course the catalog number, title, credit hours, class and laboratory hours per week, description, and prerequisites. Courses numbered 600 and above are graduate courses.

Cross-Listed Courses
A cross-listed course is one that can be taken for credit under different departmental titles. For example, students can take BIOSC (W F B) 468 Herpetology as either BIOSC 468 or W F B 468. The student should select the desired departmental title in conference with an advisor. The departmental title may be changed only during the period allowed by the University calendar for adding a course.

COURSE ABBREVIATIONS

Accounting.................................ACCT
Aerospace Studies.........................A S
Agricultural Education.................AG ED
Agricultural Mechanization..........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
Arabic........................................ARAB
Architecture.................................ARCH
Art................................................ART
Art and Architectural History.........A H
Astronomy.....................................ASTR
Athletic Leadership......................AL
Audio Technology............................AUDIO
Automotive Engineering..............Au E
Biochemistry..................................BIOCH
Bioengineering..............................BIO E
Biological Sciences.....................B IOSC
Biology........................................BIOL
Biomolecular Engineering............BMOLE
Biostystems Engineering..............B E
Biostystems Technology................B T
Business........................................BUS
Business Administration............M B A
Cardiovascular Technology..........CVT
Career and Technology Education...CTE
Chemical Engineering..................CHE E
Chemistry.....................................CHE
Chinese........................................CHIN
City and Regional Planning...........C RP
Civil Engineering..........................C E
Clemson University.....................C U
College of Architecture, Arts and Humanities.........CAAH
College of Engineering and Science.......CES
Communication Studies..................COMM
Community and Rural Development....C R D
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 PA
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....ED EL
Engineering..................................ENGR
Engineering Graphics....................EG
Engineering Mechanics..................EM
English........................................ENGL
Entomology.................................ENT
Environmental and Natural Resources....ENN
Environmental Design and Planning.....ENSP
Environmental Engineering and Science.....EES S
Environmental Science and Policy......ENSP
Environmental Toxicology................EN TO
Executive Leadership and Entrepreneurship............E LE
Entrepreneurship..........................E LE
Experimental Statistics..................EX ST
Finance........................................FIN
Food Science..................................FD SC
Food Technology...........................FD TH
Forestry........................................FOR
Forestry and Natural Resources.........FN R
French..........................................FR
Genetics........................................GEN
Geography....................................GEOG
Geology.........................................GEOL
German........................................GER
Graduate Studies..........................GS
Graphic Communications................G C
Great Works...................................GW
Health..........................................HLTH
Health Care Genetics....................HC G
Health, Education and Human Development...........HEHD
Historic Preservation....................H P
History..........................................HIST
Horticulture.................................HORT
Human Resource Development..........HR D
Humanities.....................................HUM
Industrial Engineering...................IE
Integrated Pest Management............IP M
International Studies.....................IS
Italian..........................................ITAL
Japanese.......................................JPN
Landscape Architecture..................LARCH
Language......................................LANG
Language and International Health......L & IH
Language and International Trade.....L & IT
Latin..........................................LATIN
Law...............................................LAW
Leisure Skills................................L S
Library.........................................LIB
Literacy........................................LIBL
Management..................................MG T
Marketing......................................MKT
Materials Science and Engineering.....MSSE
Mathematical Sciences...................MTHSC
Mechanical Engineering................M E
Microbiology.................................MICRO
Military Leadership.......................M L
Music..........................................MUSIC
Nonprofit Leadership.....................NPL
Nursing........................................NURS
Nutrition.......................................NUTR
Packaging Science.......................PKG SC
Pan African Studies......................PA S
Parks, Recreation and Tourism Management..................PTRM
Performing Arts............................PA
Philosophy.....................................PHIL
Physical Science............................PH SC
Physics.........................................PHYS
Plant and Environmental Sciences.....PES
Plant Pathology..............................PL PA
Plant Physiology.............................PL PH
Policy Studies................................PO ST
Political Science............................PO SC
Portuguese.....................................PORT
Psychology.....................................PSYCH
Public Administration....................PAD M
Real Estate Development................RED
Religion........................................REL
Rhetorics, Communication and Information Design..................RCID
Science and Technology in Society.......S T S
Secondary Education.....................EDSEC
Sociology......................................SOC
Soils and Sustainable Crop Systems.....SSCS
Spanish.........................................SPAN
Special Education...........................ED SP
Theatre.........................................THEA
Wildlife and Fisheries Biology..........WF B
Women’s Studies.............................WS

ACCOUNTING


ACCT 201, H201 Financial Accounting Concepts 3(3,0) Introduction to accounting principles with emphasis on the use of financial data and analysis of financial statements.

ACCT 202, H202 Managerial Accounting Concepts 3(3,0) Introduction to managerial accounting with emphasis on using accounting information to make decisions.

ACCT 204 Accounting Procedures 1(1,2) Lectures, demonstrations, and hands-on experience with accounting systems and analysis required to complete the accounting cycle and prepare financial statements. Intended for students who plan to enroll in ACCT 303 or 311.

ACCT 299 Creative Inquiry—Accounting 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of six credits. To be taken Pass/Fail only.

ACCT 303, H303 Cost Accounting 3(3,0) Application of cost accounting to manufacturing and distribut ing problems; analysis of behavior characteristics of business costs and a study of principles involved in standard cost systems; lectures and problems. Prereq: ACCT 201 and 204 with a C or better.
ACCT 311, H311 Intermediate Financial Accounting I 3(3,0) In-depth treatment of traditional financial accounting topics of standards setting, financial statement form and content, and accounting and reporting of current assets. Emphasizes basic theory, valuation, and measurement, as well as presentation and analysis of accounting information. Preq: ACCT 201 and 204 with a C or better.

ACCT 312, H312 Intermediate Financial Accounting II 3(3,0) Continuation of ACCT 311. In-depth treatment of accounting and reporting for noncurrent assets, current and noncurrent liabilities, and equity. Emphasizes basic theory, valuation, and measurement issues, as well as presentation and analysis of accounting information. Preq: ACCT 311 with a C or better.

ACCT 313, H313 Intermediate Financial Accounting III 3(3,0) Continuation of ACCT 312. In-depth treatment of selected accounting topics, such as investments, cash flows, tax allocation, post-retirement benefits, leases, and error corrections. Emphasizes basic theory, valuation, and measurement, as well as presentation and analysis of accounting information. Preq: ACCT 311 with a C or better.

ACCT 322 Accounting Information Systems 3(3,0) Study of computer-based accounting systems with attention to systems design, application, internal control, auditing the system, and system security. Preq: MGT 218.

ACCT 340 Internal Auditing Theory 3(3,0) Introduces students to internal auditing and covers internal auditing standards, ethics, concepts, audit techniques, and reporting practices. Enrollment priority will be given to students who have completed 60, but not more than 100 credits. Preq: ACCT 311 with a C or better.

ACCT 399 Internship in Accounting 1-3(1-3,0) Faculty-supervised accounting internship designed to give students learning opportunities that support their classroom experiences. Requires a minimum of six full-time weeks. Course enrollment and internship must occur in the same semester. Simultaneous credit cannot be received for another internship offering. May be repeated for a maximum of three credits. To be taken Pass/Fail only. Preq: Junior standing and consent of instructor.

ACCT 404, H404, 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 406 Business Taxation 3(3,0) Introduction to the importance of taxation in business decision making. Emphasizes the interrelationship of taxes, the choice of business form, and various business transactions; exposes students to the breadth of business decisions which are affected by the Federal Income Tax. Preq: ACCT 311 with a C or better.

ACCT 408 Retirement and Estate Planning 3(3,0) Provides students with an understanding of the tax consequences of personal financial, retirement, and estate planning. Subjects include the basic concepts of retirement, gift, income shifting, and estate planning. Preq: ACCT 404 with a C or better.

ACCT 410, 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 415 Auditing 3(3,0) Study of professional and practical auditing theory. Includes a review of internal controls, audit procedures, and development of audit programs for various types of businesses. Considers auditors' professional and ethical standards. Preq: ACCT 311 and 322 with a C or better.

AEROSPACE STUDIES

Professor: J.G. Riemens-Van Laare, Chair; Assistant Professors: T.R. Butler, M.G. Giebner, S.P. Jordan

AS 109 Air Force Today 1(2,1) Deals with Air Force in the contemporary world through a study of the total force structure: strategic offensive and defensive, general purpose, and aerospace support. Leadership laboratory activities include drill fundamentals, customs, and courtesies of the service.

AS 110 Air Force Today II 2(1,2) Continuation of AS 109. Leadership laboratory includes drill, ceremonies, and an introduction to Air Force career opportunities.

AS 209 Development of Air Power I 2(1,2) Study of the development of air power from balloons and dirigibles through the peaceful employment of U.S. air power in relief missions and civic action programs in the late 1960s and also the air war in Southeast Asia. Leadership laboratory provides experience in guiding, directing, and controlling an Air Force unit.

AS 210 Development of Air Power II 2(1,2) Continuation of AS 209.

AS 309 Air Force Leadership and Management I 4(3,2) Emphasizes the individual as a manager. Individual motivational and behavioral processes, leadership, communication, and group dynamics are covered to provide a foundation for the development of the Air Force officer's professional skills. Students prepare individual and group presentations, write reports, participate in group discussions, seminars, and conferences.

AS 310 Air Force Leadership and Management II 4(3,2) Continuation of AS 309. Uses the basic managerial processes involving decision making, utilization of analytical aids in planning, organizing, and controlling environment. Actual case studies are used to enhance learning and communication processes.

AS 409 National Security Policy I 4(3,2) Analysis of the role and function of the military officer in a democratic society and the relationships involved in civil-military interactions. Students prepare individual and group presentations, write reports, and participate in group discussions.

AS 410 National Security Policy II 4(3,2) Continuation of AS 409. Examines the environmental context in which U.S. defense policy is formulated and implemented. Emphasizes initial commissioned service and military justice. Students prepare individual and group presentations for the class, write reports, and participate in group discussions, seminars, and conferences.

AGRICULTURAL EDUCATION

Professor: T.R. Dobbins; Associate Professor: K.D. Layfield; Assistant Professor: P.M. Frawel

AG ED 100 Orientation and Field Experience 1(0,2) Supervised observations and explanations of vocational agriculture teaching while serving as teacher aides. One full week of field experience in representative high schools is required.

AG ED 102 Agricultural Education Freshman Seminar 1(2,0) Introduces students to the South Carolina agriculture education structure and provides opportunities to prepare oral presentations on selected agricultural education organizations. Assists students in understanding the value of professional organizations to agriculture education in the state and nation. Preq: Agricultural Education major.

AG ED 103 Multiculturalism in Agricultural Education 3(3,0) Studies the influence of various groups and their contributions to agriculture. Includes the roles of women, African-, Hispanic-, Asian-, Native, and European-Americans.

AG ED 200 Agricultural Applications of Educational Technology 3(2,2) Overview of microcomputer hardware and software encompassing word processing, spreadsheet, utility, Web development, and graphic communications in an agricultural context.

AG ED 201 Introduction to Agricultural Education 3(2,3) Principles of education, development of agricultural education, and an introduction to the formulation of instructional programs for the teaching of agricultural courses.

AG ED 202 Agricultural Education Sophomore Seminar 1(2,0) Instruction on how to establish a comprehensive student record-keeping system. Includes integration of that data into the FFA Awards program. Allows students hands-on experience with the total FFA Awards program on the state and national level. Preq: AG ED 102.

AG ED 203 Teaching Agriscience 3(2,3) Integrates biological and technological concepts appropriate for teaching introductory middle or secondary school-level courses in agricultural science. Topics emphasize disciplines, theories, and applications in modern agricultural production. Includes teaching techniques, materials, resources, and the design and implementation of new activities to facilitate teaching agriscience. Preq: BIOL 104/106.

AG ED 204 Applied Agriculture Calculations 3(3,0) Demonstrates basic mathematical applications in crop and livestock production and agricultural finance. These applications aid students in understanding the mathematical applications needed in the agriculture field.

AG ED 302 Agricultural Education Junior Seminar 1(2,0) Allows students the opportunity to prepare and deliver information on Career Development Events (CDE) and to understand fully the CDE concepts. Students receive much needed hands-on experience at the state and national levels. Preq: AG ED 202.
AG ED 407 Internship in Extension and Leadership Education 6-12(0,18-36) Internship placements may include county extension offices and other appropriate extension units. Six weeks of supervised experience must be completed for six hours of credit. Twelve weeks of supervised experience must be completed for 12 hours of credit. May be repeated for a maximum of 12 credits. Prereq: AG ED 400, 401, Senior standing, and consent of instructor.

AG ED 412 Senior Agriculture Leadership Seminar 1(1,0) Emphasizes leadership techniques and policies that affect agriculture. Students conduct research and make presentations on issues which influence agriculture policy. Prereq: AP EC 202, 302.

AG ED 415, 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 416, 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 423, 623 Curriculum 3(3,0) Curriculum goals and related planning for career and continuing education programs.

AG ED 425, 625 Teaching Agricultural Mechanics 2(1,3) Instruction in 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 428, 628 Special Studies in Agricultural Education 1-3(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 440, 640 Program Development in Adult/Extension Education 3(3,0) Principles, theory, and practice in planning and conducting educational programs in adult/extension settings. Prereq: Junior standing or consent of instructor.

AG ED 450 Modern Topics and Issues 3(3,0) Students select a major area of concern to teachers of agriculture and county agents for intensive study at least one semester prior to offering the course. Team teaching with faculty from other departments in the College of Agriculture, Forestry and Life Sciences is utilized when feasible. Prereq: Senior standing or relevant experience.

AG ED (ED F) 480, 680 Digital Technology in the 21st Century Classroom 3(2,2) See ED F 480.

AG ED (ED F) 482, 682 Advanced Educational Applications of Microcomputers 3(2,2) See ED F 482.

AGRICULTURAL MECHANIZATION

Professors: J.P. Chastain, Y.J. Han, A. Khalilian; Assistant Professors: D.R. Hitchcock, A. Jayakaran, K.R. Kirk, C.B. Sawyer; Lecturer: H. Massey; Extension Economist: W.N. Ferreira

AG M 101 Introduction to Agricultural Mechanization and Business 1(0,3) Introduces the Agricultural Mechanization and Business program. Gives an overview of the curriculum, introduces students to relevant extracurricular activities, exposes students to employment opportunities through alumni and interns, and helps students to prepare for careers relevant to the major.

AG M 205 Principles of Fabrication 3(2,3) Principles, techniques, and methods in the selection, proper use, and maintenance of hand and power tools. Principal topics include welding, tool fitting, metalworking, woodworking, finishing and preserving, and heat treatment.

AG M 206 Machinery Management 3(2,3) Teaches agriculture students to apply physical principles and sound reasoning to the mechanization of modern agricultural production and processing enterprises. Stress planning efficient operational systems and wise selection of equipment, based on function and economic suitability. Prereq or Coreq: MT HSC 102 and PHY S 207 or consent of instructor.

AG M 221 Surveying: Earthwork and Area Measurements 3(2,3) Fundamentals of surveying relative to earthwork and land area measurements, including linear measurements, leveling, angular measurements, and computations. Levels and total stations are used with an introduction to GPS. Prereq: MT HSC 102 or 106 or consent of instructor.

AG M 301 Soil and Water Conservation 3(3,0) Soil and water management is studied by applying principles of mathematics, fluid flow, hydrology, and soil characteristics as related to soil-water-vegetation complexes in runoff, erosion control, channel design, water conservation, drainage, irrigation, stormwater best management practices and stream restoration. Prereq: MT HSC 102 or equivalent or consent of instructor.

AG M 371 Agricultural Mechanization Practicum 1-3 Pre-planned internship with an approved employer involved in agricultural technical or business endeavors. 130 hours of supervised responsibility are required per credit hour. A work journal, written/oral reports, company consent and evaluation must be on file. May be repeated for a maximum of twelve credits. To be taken Pass/Fail only. Prereq: Consent of department.

AG M 402, 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. Prereq. or Coreq: AG M 301 or consent of instructor.

AG M 405, 605 Environmental Control in Animal Structures 3(2,3) Design of environmental control systems for animal production facilities. Topics include effects of the thermal and chemical environment on animals, ventilation system design, thermal design of structural envelopes, design of heating, cooling, and lighting systems. Emphasis is on practical, energy-efficient applications to modern animal production facilities. Prereq: AG M 303, or AV S 301 or consent of instructor.

AG M 406, 606 Mechanical and Hydraulic Systems 3(2,3) Study of power transmission systems for agricultural production emphasizing 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, PHY S 200 or 207, or consent of instructor.
AG M 410, 610 Precision Agriculture Technology 3(2,3) Includes principles and hands-on application of technologies supporting precision agriculture. Topics include global positioning system (GPS), geographic information system software, variable rate technologies, collection of spatial data, automated guidance of equipment, spatial data mapping and analysis, remote sensing, and economic considerations. Prereq: Junior standing.

AG M 419 Agribusiness Innovation and Entrepreneurship 3(3,0) Emphasis on assessing students' abilities as agribusiness entrepreneurs, evaluating the feasibility of a business idea, creating strategies for organizing and marketing the agricultural business, exploring pricing for products or services, developing capital needs and sound financial statements, and researching, developing, and writing a comprehensive plan for the business. Prereq: Introductory Agribusiness Management course.

AG M 452, 652 Mobile Power 3(2,3) Study of tractors, emphasizing internal combustion engines and support systems necessary for their proper functioning. Also considers application of power, maintenance, adjustment, and general repair. Prereq: PHYS 200, 207, or consent of instructor.

AG M 460, 660 Electrical Systems 3(2,3) Students in agriculture and related curricula study electric and other utilities on the farm and in the home. Emphasizes selection, installation, and maintenance of wiring systems, lighting systems, motors, controls, water systems, and waste disposal systems. Prereq: Junior standing.

AG M 472 Capstone 3(2,3) Covers professional conduct, ethics, oral and written communication, and financial matters. Each student completes a comprehensive project on a technical subject. The results are given in a written report and oral presentation. Students use digital portfolio technology to assess their education.

AG M 473 Special Topics in Agricultural Mechanization 1-3(1-3,0) Comprehensive study and application of new technologies and methods not covered in existing courses. Emphasizes independent study using innovative approaches to problem solving. May be repeated for a maximum of six credits. Prereq: Consent of instructor.

AGRICULTURE

Professors: L.L. Bauer, D.E. Linvill, V.L. Quisenberry; Associate Professor: W.C. Stringer

AGRIC 104, H104 Introduction to Plant Sciences 3(0) Fundamental course in plant sciences, including agronomic and horticultural crops of the major agricultural areas of the world and emphasizing the crops of South Carolina.

AGRIC (EN SP) 315, H315 Environment and Agriculture 3(3,0) Survey of the interrelationships of the environment and current agriculture and agricultural practices to include both the environmental impacts of agriculture and the role of agriculture in conservation and improving the environment. Prereq: Sophomore standing and two semesters of biology or chemistry.

AGRIC 355 Team and Organizational Leadership in Food and Fiber System 3(3,0) Principles and practices in planning, developing, conducting, and evaluating leadership programs for agricultural groups. Focuses on helping students better understand themselves and others, improving group communications; becoming effective leaders and members of groups; improving leadership and personal development skills, assessing leadership situations, determining and administering appropriate leadership strategies.

AGRIC 412 Senior Agriculture Leadership Seminar 1(1,0) Emphasizes leadership techniques and policies that affect agriculture. Students conduct research and make presentations on issues which influence agricultural policy. Prereq: AP EC 202, 302.

AGRIC 416 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. Examines the major social, political, economic, and ethical issues that arise in connection to the food and fiber system and considers potential solutions.

AGRIC H491 Senior Honors Research 3(1,0) Senior division honors research in an agricultural sciences curriculum. In consultation with and under the direction of a professor, students select a research topic, conduct experiments, record data, and make oral presentations of results to the College Honors Program Committee. Open to approved Honors Program students only.

AGRIC H492 Senior Honors Research 3(1,0) Continuation of AGRIC H491. Senior division honors research in an agricultural sciences curriculum. Upon termination of the research project, students submit formal written reports and make final oral presentations of results to the College Honors Program Committee. Professor/student discussions of additional topics are arranged.

AGRICULTURE, FORESTRY AND LIFE SCIENCES

AFLS 191 Directed Research 1-3(0,3-9) Research projects, supervised by faculty in the College of Agriculture, Forestry and Life Sciences introducing research methods. Restricted to outstanding high school students, selected using Governor's School for Science and Mathematics ranking criteria. May be repeated for a maximum of six credits. Prereq: Entering high school junior or senior status and consent of faculty research supervisor and department in which research is conducted.

AMERICAN SIGN LANGUAGE

Associate Professor: W.A. Brant; Lecturer: T. Bateson

A S L 101 American Sign Language I 4(3,1) Introduction to the basics of American Sign Language, its history, and culture. Visual-gestural communicative techniques are used.

A S L 102 American Sign Language I 4(3,1) Continuation of A S L 101 and culture to develop further communicative competencies. Proficiency oriented with the use of visual-gestural communication skills. Prereq: A S L 101 or consent of instructor.

A S L 201 American Sign Language II 3(3,0) Continuation of A S L 102. Covers additional vocabulary, sentences, and grammar structures. Main focus is on conversational and receptive skills as well as a better understanding of Deaf culture. Prereq: A S L 102 or consent of instructor.

A S L 202 American Sign Language II 3(3,0) Continuation of A S L 201, concentrating on intermediate conversational and discourse skills using American Sign Language, more complex American Sign Language grammar, reading comprehension, and composition of short stories, narratives, and dialogues with an emphasis on topics related to the Deaf community. Class is conducted totally in American Sign Language using visual-gestural communicative techniques. Prereq: A S L 201 or consent of instructor.

A S L 297 Creative Inquiry—American Sign Language 1,4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. Arrangements with faculty members must be established prior to registration.

A S L 300 Fingerspelling and Numbers in American Sign Language 1,4(1,0) Advanced study of the manual alphabet (fingerspelling) and the numerical system in American Sign Language, with extensive practice in both expressive and receptive skills. Prereq: A S L 201 or consent of instructor.

A S L 301 Advanced American Sign Language I 3(3,0) Focuses on American Sign Language fluency, vocabulary development, grammatical structures of American Sign Language, use of classifiers, conversational skills, translating written texts into American Sign Language, and vice versa. Emphasis is on making formal presentations in American Sign Language. Prereq: A S L 202 or consent of instructor.

A S L 302 Advanced American Sign Language II 3(3,0) Continuation of A S L 301. Focuses on American Sign Language fluency, vocabulary development, grammatical structures of American Sign Language, use of classifiers, conversational skills, translating written texts into American Sign Language, and vice versa. Emphasis is on making formal presentations in American Sign Language. Prereq: A S L 301 or consent of instructor.

A S L 304 Internship in American Sign Language 3,0(4) Minimum 60 contact hours in an environment exclusively using American Sign Language. Frequent opportunities to converse with native signers in classroom settings, dormitory settings, meals, excursions, sporting events, cultural events, and meetings. Prereq: A S L 202 or consent of instructor.

A S L 305 Deaf Studies in the United States 3(3,0) In-depth look into language, culture, and daily lives of approximately one million people who use American Sign Language as their primary language. Traces the roots of American Sign Language from pre-revolutionary times to current science and knowledge and how it applies to professional fields. Prereq: A S L 202 or consent of instructor.
Courses of Instruction

A S L 315 Survey of Interpreting in Public Schools 3(3,0) Overview of the ASL/English interpreting profession in public schools. Includes discussions about the role, function, and aptitudes of educational interpreters, the bilingual and bicultural context, history of interpreting, principles of professional practice, laws that affect educational interpreting, and analysis of the impact of classroom variables on accessibility and interpretability. Preq: A S L 201 or consent of instructor.

A S L 320 American Sign Language–English Interpreting in Elementary Schools I 3(3,0) ASL–English interpreting in the high school classroom. Includes analysis of the discursive features of elementary classrooms; translation of materials encountered in elementary classrooms; rendering of interpretations of elementary classroom discourse, both consecutively and simultaneously; and assessment of the effectiveness of interpreted products. Preq: A S L 315 or consent of instructor.

A S L 325 American Sign Language–English Interpreting in Secondary Schools I 3(3,0) ASL–English interpreting in the elementary classroom. Includes analysis of the discursive features of several high school courses; translation of materials encountered in high school classrooms; rendering interpretations, both consecutively and simultaneously; and assessment of the effectiveness of interpreted products. Preq: A S L 315 or consent of instructor.

A S L 345 American Sign Language for Health Care Practitioners I 3(3,0) Intermediate instruction of specific health care and medical terminology in Intermediate instruction of Practitioners I 3(3,0) Continuation of A S L 230. Further analysis of elementary school curricular discourse; rendering interpretations of elementary school classroom discourse simultaneously; preparation and interpretation or presentations from second language into first language; and assessment of the effectiveness or interpreted products. Preq: A S L 320 or consent of instructor.

A S L 420 American Sign Language–English Interpreting in Elementary Schools II 3(3,0) Continuation of A S L 320. Further analysis of elementary school curricular discourse; rendering interpretations of elementary school classroom discourse simultaneously; preparation and interpreting presentations from second language into first language; and assessment of the effectiveness of interpreted products. Preq: A S L 401 or consent of instructor.

A S L 425 American Sign Language–English Interpreting in Secondary Schools II 3(3,0) Continuation of A S L 325. Further analysis of high school curricular discourse; rendering interpretations of high school classroom discourse simultaneously; preparing and interpreting presentations from second language to first language; and assessment of the effectiveness of interpreted products. Preq: A S L 325 or consent of instructor.

A S L 445 American Sign Language for Health Care Practitioners II 3(3,0) Continuation of A S L 345. Expands health care and medical terminology in American Sign Language. Topics relate to specific body systems, ASL medical terminology, and medications. Preq: A S L 345 or consent of instructor.

A S L 460 Deaf Literature and Folklore 3(3,0) Designed for advanced-level students in American Sign Language. Primary goal is to further develop students’ understanding of Deaf literature, folklore, and the community at large. Includes introductions to deaf authors, literary works, plays, poetry, painting, and sculpture. Preq: A S L 302 or consent of instructor.

A S L 497 Creative Inquiry–American Sign Language 1-4(1-4,0) Students focus on a special research area under the guidance of a faculty member. After acquiring the requisite background, students formulate hypotheses for a group project, develop a critical framework, and initiate research on a specific topic.

A S L 498 Independent Study 1-3(1-3,0) Supervised research and study on topics related to the origins and growth of American Sign Language and the Deaf Community in the United States (1800–present). May be repeated for a maximum of six credits. Preq: A S L 202 or consent of instructor.

ANIMAL AND VETERINARY SCIENCES


AVS 100 Orientation to Animal and Veterinary Sciences 1(2,0) Study of the role of animal agriculture in the world today emphasizing supply and demand of end products and careers available in the animal industry.

AVS 150 Introduction to Animal Science 3(3,0) Survey of animal industries and their role in society. Examines the relationship between man and animals in both a current and historical context.

AVS 151 Introduction to Animal Science Laboratory 1(0,2) Examines the basic principles in the handling of livestock and techniques of farm animal production as well as orientation to animal production units. Coreq: AVS 150.

AVS 200 Beef Cattle Techniques 2(1,2) Examines basic principles in the techniques and management associated with production of both beef cattle and sheep. Students may take only one techniques course per semester. Coreq: AVS 150, 151.

AVS 201 Poultry Techniques 2(1,2) Basic principles of the production of poultry are discussed and demonstrated. Students receive hands-on experience in the production and processing of poultry. Students may take only one techniques course per semester. Preq: AVS 151.

AVS 203 Dairy Science Techniques 2(1,2) Introduction to dairy production and processing. Laboratories include hands-on opportunities for management of dairy cattle, quality control of milk, and processing of milk and dairy products. Students may take only one techniques course per semester. Preq: AVS 151.

AVS 204 Horse Care Techniques 2(1,2) Basic principles of equine behavior, handling, and management are discussed and demonstrated. Students receive hands-on experience with various management techniques, including handling and all aspects of health care. Students may take only one techniques course per semester.

AVS 205 Horsemanship I 2(0,4) Designed for beginner to intermediate riders. The mechanics of safety, longing, basic position, cues, and rider’s aids for both western and English disciplines are covered. Preq: AVS 151.

AVS 206 Swine Techniques 2(1,2) Examines the basic principles in the techniques and management associated with production of swine. Students may take only one techniques course per semester. Preq: AVS 150, 151.

AVS 207 Horsemanship II 2(0,4) Designed for intermediate to advanced riders to enhance basic horsemanship and develop specific skills for advanced maneuvers in both western and English disciplines. Students concentrate on individual work and establish finesse and subtlety of aids. Training and artificial aids are discussed and/or implemented in riding sessions. Preq: AVS 205 and consent of instructor.

AVS 208 Techniques of Teaching Horsemanship 3(2,2) Discusses teaching techniques and theory and handling of large mounted groups. Trains beginner through advanced levels. Preq: AVS 205.

AVS 209 Livestock Exhibition Techniques 2(1,2) Students learn techniques associated with exhibition and evaluation of beef, dairy, equine, poultry, and swine.

AVS 301 Anatomy and Physiology of Domestic Animals 4(3,3) Study of physiology and associated anatomy of the body systems, including nervous, skeletal, muscular, respiratory, digestive, circulatory, urinary, reproductive, and endocrine systems. Designed primarily for students in Animal and Veterinary Sciences. Preq: BIOL 104/106 or 111.
AVS 302 Livestock Selection and Evaluation I 2(1,2) Selection and evaluation of the meat species of livestock with application of theory applied in multiple field exercises.

AVS 309 Principles of Equine Evaluation 2(0,4) Discusses the selection and evaluation of equines for various disciplines. Emphasizes current industry standards with regard to "form to function." Students place classes of four horses and develop oral reasons to defend their placing. Opportunities for competitive horse judging teams are available.

AVS 310 Animal Health 3(3,0) Discusses basic principles of animal health. Emphasizes disease prevention in beef cattle, dairy cattle, goats, horses, poultry, and swine. The most common and important diseases and zoonosis of farm animals are explained. Prag: AVS 150.

AVS 311 Dairy Cattle Selection 2(1,2) Dairy selection and evaluation methods are studied, including evaluation according to the Purebred Dairy Cattle Association scorecard, linear evaluation, pedigrees, and Dairy Herd Improvement Association records. Emphasizes presentation of oral reasons.

AVS 315 Animal Welfare 3(3,0) Discussion of past, present, and future human/animal interaction. Topics include wild animals, domestication, animal welfare organizations, animal rights organizations, welfare assessment, animal agriculture, animal research, and other current topics. Prag: Junior standing.

AVS 323 Poultry and Poultry Products Evaluation 2(0,4) Selection of layers, broilers, and turkeys. Grading of poultry products according to USDA grade standards is also studied. Students are eligible to compete in intercollegiate poultry judging contests. May be repeated for a maximum of four credits.

AVS 360 Internship 1-12(0,3-36) Off-campus, preplanned, reviewed, approved, and supervised educational experience in an area related to animal and veterinary sciences. Based on a multifaceted work experience in a highly structured professional environment. Students submit periodic written reports and a final written and oral report. To be taken Pass/Fail only. Prag: Junior standing in Animal and Veterinary Sciences and consent of instructor.

AVS 370, H370 Principles of Animal Nutrition 3(3,0) Familiarizes students with nutrients and feeds used in livestock and specialty animal production. Methods of evaluating common feedstuffs are covered along with a survey of the functioning of the various digestive systems. Practical aspect to feeding each species is covered. Prag: AVS 150, CH 102.

AVS 375, H375 Applied Animal Nutrition 3(2,2) Students learn procedures for formulating diets that meet nutrient requirements of livestock and poultry, utilizing traditional mathematical approaches and computerized formulation. Computerized least-cost formulation of diets is covered along with familiarization with feeding systems and approaches. Prag: AVS 370.

AVS 385 Equine Behavior and Training 2(0,6) Introduces students to the initial processes in gentling and riding young horses. Students work with two- and three-year-old horses to desensitize them to stimuli in preparation for riding. Students do groundwork and put the initial rides on the horses. Prag: AVS 205 or 207.

AVS 386 Advanced Equine Behavior and Training 2(0,6) Students train young horses advanced skills in western or English disciplines. Students actively prepare horses for show or sale and participate in a show or marketing/sale of their assigned horse. Develops students' negotiation and communication skills, industry insight, and industry-specific jargon. May be repeated for a maximum of four credits. Prag: AVS 385.

AVS 390 Practicum 1-3(0,3-9) On-campus, pre-planned, supervised learning experience in an area related to animal and veterinary sciences. Gives experience not covered in other coursework. May be repeated for a maximum of four credits. To be taken Pass/Fail only. Prag: Consent of instructor supervising practicum.

AVS 400 Animal and Veterinary Sciences Professional Development 1(1,0) Career development in the animal and veterinary sciences field by resume and interview preparation, learning about career opportunities and interaction with industry professionals. Prag: Senior standing.

AVS 401, H401, 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. Prag: AVS 370.

AVS 405 Advanced Selection and Evaluation 2(0,4) Special and advanced training in selection and evaluation of breeding, performance, and market animals or their products. Species used are beef and dairy cattle, sheep, swine, and horses. Prag: AVS 302 or 303 or 305 or FD SC 304; 309 or 311 and consent of instructor.

AVS 406 Seminars and Related Topics 2(3,0) Students conduct in-depth library research on current topics related to animal science and give formal presentations using multimedia technology. Students also prepare scientific posters, learn interviewing skills, prepare résumés, and observe professional speakers. Prag: Senior standing.

AVS 409 Selected Topics 1-3(1-3,0) Topics of interest to students at the undergraduate, graduate, and professional levels. Provides experience with problems not covered in other courses or on thesis research. May be repeated for a maximum of six credits, but only if different topics are covered.

AVS 410, 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. Prag: AVS 150, 151 and Junior standing.

AVS 411, 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). Prag: AVS 301.

AVS 412, H412, 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. Prag: AVS 370.

AVS 413, 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) 414, H414, 614 Basic Immunology 3(3,0) See MICRO 414.

AVS 415, 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. Prag: Junior standing in Animal and Veterinary Sciences.

AVS 416, 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. Prag: AVS 301.

AVS 417, 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. Prag: ACCT 201 and AP EC 202 or consent of instructor.

AVS 420, 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 422 Special Problems 1-3(0,3-9) Laboratory, library, or field study of problems related to animal and veterinary sciences, emphasizing development and testing of hypothesis and reporting of results. May be repeated for a maximum of four credits. Prag: Junior standing and consent of instructor supervising study.

AVS (BIOSC, MICRO) 424, H424, 624 Immunology Laboratory 10(3) See MICRO 424.

AVS 441 Animal and Veterinary Sciences Teaching Experience 1-3(1-3,0) Formal teaching experience related to animal and veterinary sciences supervised by a faculty member. May involve classroom instruction, educational material development, and/or student evaluation and assessment. Students submit periodic written reports and a final written and oral report. May be repeated for a maximum of four credits. To be taken Pass/Fail only. Prag: Consent of instructor.
Courses of Instruction

AVS 442 Animal and Veterinary Sciences Extension Experience 1-3(1-3,0) Formal experience in extension education. Students are involved in development, implementation, or assessment of adult or youth educational programs related to animal and veterinary sciences, under supervision of extension professionals. Students submit periodic written reports and a final written and oral report. May be repeated for a maximum of four credits. To be taken Pass/Fail only. Prerequisite: Consent of instructor.

AVS 443, 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. Prerequisite: Consent of instructor.

AVS 444 AVS Animal Agribusiness Travel Experience 2(1,2) Classroom and travel course to expose students to animal production operations, agribusiness, and industry leaders across various geographical areas. Travel is conducted during spring break and includes visits to farms, universities, and agribusinesses. Additional fee is required. To be taken Pass/Fail only. Prerequisite: Junior standing in Animal and Veterinary Sciences, consent of instructor.


AVS 451, H453, 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. Prerequisite: AVS 150, 301.

AVS 455, 655 Animal Reproductive Management 2(1,3) Physiology and endocrinology of pregnant and nonpregnant cows are discussed. Emphasizes methods of artificial insemination, pregnancy detection, and computer record keeping to achieve a high level of reproductive efficiency in cattle. Prerequisites: AVS 150, 301; AVS 453 (or concurrent enrollment).

AVS 465, 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. Prerequisite: Introductory physiology and biochemistry.

AVS 467, 667 Animal Physiology II 3(3,0) Advanced course extending coverage of major and current topics in animal physiology across species not previously covered in AVS 465. Major topics include digestive physiology in nonruminant and ruminant species, reproductive physiology, muscle physiology, and general aspects of avian physiology. Prerequisite: Introductory course in physiology and biochemistry.

AVS 470, H470, 670 Animal Genetics 3(3,0) Fundamental principles related to the breeding and improvement of livestock, including variation, heredity, selection, linebreeding, inbreeding, crossbreeding, and other related subjects. Prerequisites: AVS 150, AVS (BIOSC) 480, 680 Vertebrate Endocrinology 3(3,0) See BIOSC 480.

AVS 491 Animal and Veterinary Sciences Undergraduate Research Experience 1-3(1-3,0) Formal laboratory, library, or field study of problems related to animal and veterinary sciences, emphasizing hypothesis development, testing, and reporting results. Projects are preplanned, reviewed, and approved. Students submit periodic written reports and final written and oral reports. May be repeated for a maximum of four credits. Prerequisite: Consent of instructor.

ANTH 201 Introduction to Anthropology 3(3,0) Offers a four-field overview: primates and human biological origins; the development of agriculture and complex societies in the archaeological record; contemporary human societies cross-culturally; and the relationship between languages and cultures. An anthropological perspective on contemporary human problems is also presented.

ANTH 301 Cultural Anthropology 3(3,0) Explores human cultural diversity and current global issues. Examines food production and economic distribution, political organization, marriage and family, and religious systems in contemporary cultures. Prerequisite: ANTH 201 or consent of instructor.

ANTH 320 North American Indian Cultures 3(3,0) Discusses the prehistory of Native peoples, their cultural diversity at European contact, and the history and impact of that contact. Also examines contemporary issues facing Native Americans. Prerequisite: ANTH 201 or consent of instructor.

ANTH 331 Archaeology 4(3,2) Overview of anthropological archaeology emphasizing the scientific analyses, methodologies and theoretical approaches used by anthropological archaeologists to study the human past. Students learn about the origins and development of complex society and explore individual case studies.

ANTH 332 World Archaeology 3(3,0) Global survey of the earliest complex societies focusing on the origins of “pristine states” from the perspective of archaeological anthropology. Following a brief overview of archaeological methods and approaches, students learn about the origins of complex societies and explore various cultural contexts. Prerequisite: ANTH 201 or consent of instructor.

ANTH 451 Biological Variation in Human Populations 3(3,0) Comparative anthropological study of women and their status in developing countries around the world. A survey of women’s daily lives in a global context, emphasizing education, economics, and the environment. Case studies include microfinance, literacy, reproductive rights and practices, and the impact of religious fundamentalism on women. Prerequisite: Sophomore standing.

ANTH 452 Field Studies 1-6(1-2,2-12) Group field project in settings selected by the instructor to provide students with a variety of exposures to various cultural contexts. Archaeological digs are included. Project progress and student interpretations of findings are monitored by periodic group meetings and shared experiences. May be repeated for a maximum of six credits. Prerequisite: ANTH 301 or equivalent consent of instructor.

ANTH 496 Creative Inquiry—Cultural Anthropology 1-3(1-3,0) Investigates topics in cultural anthropology selected by faculty and students. Goals, research, and outcomes vary from semester to semester and project to project. May be repeated for a maximum of 12 credits. Prerequisite: ANTH 201.

ANTH 498 Independent Study 1-3(1-3,0) Individual readings or projects in anthropological areas not covered in other courses. May be repeated for a maximum of six credits with advisor’s approval. Prerequisite: ANTH 201.

APPLIED ECONOMICS

Prerequisites: M. Espey, D.W. Hughes, W.M. Smathers Jr., W.M. Ward; Associate Professors: R.D. Lamie, S.R. Templeton, D.B. Willis; Assistant Professors: K.A. Boys, C.E. Carpio, O. Isengildina-Massa

AP EC 202 Agricultural Economics 3(3,0) Analytical survey of the various subdivisions of agricultural economics, including farm organization, enterprise, land economics, marketing, farm prices, governmental farm policies, and the relation of agriculture to the national and international economy.
AP EC 205 Agriculture and Society 3(3,0) Introduction to the development of world society focusing on food production, from early hunting and gathering to modern biotechnology. Covers factors driving societal growth with a global perspective.

AP EC 257 Natural Resources, Environment, and Economics 3(3,0) Economic principles applied to resource allocation problems related to environmental and natural resource issues.

AP EC 302 Economics of Farm Management 3(3,0) Economic principles underlying the organization and operation of agricultural firms and related business enterprises. Particular emphasis is placed on management aspects of the farm as a production unit. Prereq: AP EC 202 or ECON 211.

AP EC 308 Quantitative Applied Economics 3(3,0) Basic quantitative relationships in applied economics are examined and interpreted. Emphasizes the mathematical aspects of applied economics. Microcomputer software is utilized for problem solving.

AP EC 309, H309 Economics of Agricultural Marketing 3(3,0) General course in marketing agricultural commodities with particular emphasis upon food products. Analyzes efficiency criteria, consumer behavior, market organizations and institutions, and marketing functions. Prereq: AP EC 202.

AP EC 313 Principles of Real Estate Appraisal 3(3,0) Introduction to basic principles and procedures of real estate appraisal. Topics include the real estate market, principles of valuation, legal concepts, and the application of the comparable sales, cost, and income approaches to real estate valuation. Prereq: FIN 307 or consent of instructor.

AP EC 319 Agribusiness Management 3(3,0) Study of the principles used in making management decisions and the application of these principles in agribusiness. Emphasizes the analysis of agribusiness enterprises, and current farm price and income problems. Prereq: AP EC 302 or 309.

AP EC 351 Principles of Advertising 3(3,0) Introduction to the various functions of advertising; research and audience analysis; various media formats; planning, research, and production necessary to create an advertising campaign; social effects, economic effects, and ethical considerations of advertising.

AP EC 352 Public Finance 3(3,0) Principles of financing government, sources of public revenue, objects of public expenditures, problems of fiscal administration, and the application of fiscal policies in stabilizing the national economy. Prereq: Junior standing.

AP EC (C R D) 357 Natural Resources Economics 3(3,0) See C R D 357.

AP EC (C R D, HLTH) 361 Introduction to Health Care Economics 3(3,0) See C R D 361.

AP EC 402, 602 Production Economics 3(3,0) Economic analysis of agricultural production involving the concept of the farm as a firm; principles for decision making; the quantitative nature and use of production and cost functions and the interrelations and applications of these principles to resource allocation in farms and among areas. Prereq: AP EC 308, ECON 314.

AP EC 409, 609 Commodity Futures Markets 3(3,0) Introduction to the economic theory, organization, and operating principles of agricultural commodity futures markets in the United States. Emphasizes speculating, hedging, and investing in agricultural commodity futures contracts from the standpoint of the agribusiness entrepreneur. Prereq: AP EC 202 or ECON 211.

AP EC (C R D) 411, 611 Regional Impact Analysis 3(3,0) See C R D 411.

AP EC (C R D) 412, 612 Regional Economic Development Theory and Policy 3(3,0) See C R D 412.

AP EC 413, 613 Advanced Real Estate Appraisal 3(3,0) Topics include highest and best use analysis, data collection, and analyses. Stresses advanced appraisal procedures for income, cost, and comparable sales approach to real estate valuation. Covers eminent domain, the appraisal of property in transition, and specialized property. Prereq: AP EC 411, FIN 307, or consent of instructor.

AP EC 421, 621 Globalization 3(3,0) Utilizes basic principles of international economics (comparative advantage, free trade versus 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. Prereq: ECON 310 or 412 or 413 or consent of instructor.

AP EC (CSENV) 426, 626 Cropping Systems Analysis 3(2,2) See CSENV 426.

AP EC 452, H452, 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.

AP EC 457, 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 economy standards. Prereq: MTHSCI 102; and C R D (AP EC) 357 or ECON 314.

AP EC 460, 660 Agricultural Finance 3(3,0) Study of the principles and technique 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. Prereq: ACCT 201, AP EC 202.

AP EC (W F B) 475, 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 490 Selected Topics I-150, 2-30 Study of topics in applied economics. Topics may include classroom and/or field experience not normally covered in other classes. May be repeated for credit, but only if different topics are covered. Prereq: Junior standing or consent of instructor.

AP EC (C R D) 491 Internship, Agribusiness, and Community and Rural Development 1-6(0,2-12) See C R D 491.

AP EC (C R D) 494 Creative Inquiry—Community and Rural Development 1-3(1-3,0) See C R D 494.

ARABIC

ARAB 101 Elementary Arabic I 4(3,1) Introductory course for beginners emphasizing acquisition of the Arabic alphabet and writing, basic grammar, vocabulary, speaking and listening skills, and developing strategies for the successful longterm acquisition of Arabic.

ARAB 102 Elementary Arabic II 4(3,1) Continuation of ARAB 101 consisting of three hours a week of classroom instruction and one hour a week in the language laboratory. Prereq: ARAB 101.

ARAB 201 Intermediate Arabic I 3(3,1) Continuation of ARAB 102, emphasizing grammar, vocabulary, writing, reading, and acquisition of intermediate language skills. Prereq: ARAB 102.

ARAB 202 Intermediate Arabic II 3(3,1) Continuation of ARAB 201, emphasizing grammar, vocabulary, writing, reading, and acquisition of advanced intermediate language skills. Prereq: ARAB 201.

ARCHITECTURE

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<th>Course Title</th>
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<td>Introduction to Architecture</td>
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<tr>
<td>ARCH 102</td>
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<td>ARCH 251</td>
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<td>ARCH 252</td>
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<tr>
<td>ARCH 253</td>
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<td>ARCH 451</td>
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<td>3(1,1)</td>
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**Courses of Instruction**

Architectural problems with varied scales, programs, and locations. Emphasizes the relationship between architecture and context. Projects include analysis, conceptual development, and architectural resolutions. Continued development of graphic and oral communication skills. Design problems vary every semester according to current issues. May be repeated for a maximum of 12 credits. Preq: ARCH 252.

Architectural design problems with a focus on structural and construction principles and their relationship to contextual situations. Instruction in oral communication skills and computer graphics support the design discussions. Preq: ARCH 251.

The study of statically determinate structural elements and systems including load tracing through physical modeling and theoretical and analytical analysis, the interaction between stress and strain, stability and the implication of tension, compression, shear, torsion, and bending. Preq: MTHSC 106, PHYS 207 and PHYS 209.

The study of force distributions and behavior in building structures constructed of reinforced concrete, steel and wood. Exploration of typical building components including beams, slabs, columns and foundations and how they are used in high-rise and long span structural design. Preq: ARCH 270 or CSM 201.

Addresses architectural problems with varied scales, programs, and locations. Emphasizes the relationship between architecture and context. Projects include analysis, conceptual development, and architectural resolutions. Continued development of graphic and oral communication skills. Design problems vary every semester according to current issues. May be repeated for a maximum of 18 credits. Preq: ARCH 252.
ARCH 452 Synthesis Studio 6(1,11) Integrates acquired skills, abilities, and interests from previous architecture studies. Projects emphasize the accumulation of architectural experiences and knowledge. Coreq: ARCH 401, 453; Graduating Senior status.

ARCH 471 Architectural History of Place 3(3,0) Survey of urban design and architectural history using examples viewed in a particular locale. Emphasizes an overview survey of design movements identifying specific design elements and understanding how they are used in shaping place. Course is offered only during the summer at study abroad locations. Prereg: ARCH 101 or consent of instructor. Coreq: ARCH 472 and DSIGN 370 or consent of instructor.

ARCH 472 Architectural Field Studies 3(1,6) Students develop diagramming and writing skills and use them to document and analyze existing works of urban design and architecture observed during field trips. Course is only offered during the summer at study abroad locations. Prereg: ARCH 101 or consent of instructor. Coreq: ARCH 471 and DSIGN 370 or consent of instructor.

ARCH 477, 677 Introduction of Craft 1-3(1,2,6) 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. Prereg: Consent of instructor.

ARCH 485, 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. Prereg: Consent of instructor.

ARCH 488, 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 relevant goals, facts, issues, needs, and concepts. Students develop an architectural program. Prereg: Consent of instructor.

ARCH 489 Internship 1-6 Practicum 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. Prereg: Consent of instructor and acceptance by sponsor.

ARCH 490, H490 Directed Studies 1-5 Comprehensive studies and research of special topics not covered in other courses. Emphasis is on field studies, research activities, and current developments in architecture. May be repeated for a maximum of ten credits. Prereg: Consent of department chair.

ARCH 499, H499 Selected Topics in Architecture 1-3(1-3,0) Study of selected topics in architecture. May be repeated for a maximum of nine credits, but only if different topics are covered. Prereg: Junior standing or consent of instructor.

ARCH 557 Architecture Studio 60(0,18) City planning design and the development of complex building solutions.

ART Professors: S.A. Cross, D.M. Detrich, W.W. Lew, M.V. Vatalaro, Chair; Associate Professors: A.V. Feerer, J.B. LeBlanc, H.J. Jensen; Assistant Professors: D. Donar, C.N. Hung, T. McDonald, A. Wrangle; Lecturers: S. Grier, L. House, J.R. Manson, A. Plotek, D.C. Woodward-Detrich

ART 103 Visual Arts Studio 3(0,6) Studio projects in basic visual elements and principles. The development of creative design process, visual organization, and design skills are introduced as a foundation for further study in visual arts.

ART 105 Foundation Drawing I 3(0,6) Introduction to drawing. Presents exploration of observational drawing practices with an emphasis on structural investigations of form and application of spatial systems. Basic materials and approaches associated with drawing are studied and applied. Prereg: Visual Arts major or consent of instructor.

ART 106 Foundation Drawing II 3(0,6) Further exploration of introductory drawing. Emphasizes use of tone and color. Students work primarily with representational categories, developing comprehension of complex forms and spaces in relation to the 2-D planes. Includes use of rigorous observational drawing practices in conjunction with thematic effects. Prereg: ART 105 or 151 or consent of instructor.

ART 151 Foundations in Visual Art I 3(0,6) Intensive introduction to the fundamentals of visual art. Studio projects, lectures, and discussions introduce topics and projects relative to foundation-level art students. Explores historical and contemporary applications of the elements and principles of design. Prereg: Visual Arts major.

ART 152 Foundations in Visual Art II 3(0,6) Intensive introduction to the fundamentals of visual art. Studio projects, lectures, and discussions introduce topics and projects relative to foundation-level art students. Explores historical and contemporary applications of the elements and principles of design. Prereg: Visual Arts major.

ART 153 Orientation to Visual Arts I 1(1,0) Introduction to the visual arts profession focusing on issues related to various career opportunities, creativity, problem-solving methodologies, and current thinking in contemporary art. Prereg: Visual Arts major.

ART 205 Beginning Life Drawing 3(0,6) Primary emphasis is on drawing from the live model. Students’ drawing skills and fundamental understanding of the structure and form of the human figure are reviewed through studio practice, augmented by lectures, discussions, demonstrations, and critiques. Addresses historical and contemporary use of the human figure in visual arts. Prereg: ART 106, 151, 152, or consent of instructor.

ART 207 Beginning Painting 3(0,6) Introduction to basic materials, methods, and techniques of painting. Primary medium used is acrylic, and other painting media may also be introduced. Emphasizes basic skills in painting plus individual creative development. Prereg: ART 151, 153, 205 (Visual Arts majors); ART 103 (non-Art Majors); ARCH 152 (Architecture majors); LARCH 152 (Landscape Architecture majors); or consent of instructor.

ART 209 Beginning Sculpture 3(0,6) Studio course investigating the meaning of sculpture through traditional and nontraditional approaches. Establishes a working knowledge of material and process in several media. Personal expression is encouraged and enhanced by employment of problem-solving techniques. Static, temporal, installation, and site specific sculpture is explored. Prereg: ART 151, 152, 153, 154, 205 (Visual Arts majors); ART 103 (non-Art majors); ARCH 152 (Architecture majors); LARCH 152 (Landscape Architecture majors); or consent of instructor.

ART 211 Beginning Printmaking 3(0,6) Studio course introducing basic techniques of relief printing, intaglio, lithography, silkscreen, and papermaking. Each semester concentrates on two or three of these techniques. Coursework integrates print-making processes and creativity. Prereg: ART 151, 152, 153, 154, 205 (Visual Arts majors); ART 103 (non-Art majors); ARCH 152 (Architecture majors); LARCH 152 (Landscape Architecture majors); or consent of instructor.

ART 213 Beginning Photography 3(0,6) Introduction to the use of photography as an art medium. Lectures and studio work cover the utilization of the camera, processing, and printing in black and white, with emphasis on perception and creative expression. Prereg: ART 151, 152, 153, 154, 205 (Visual Arts majors); ART 103 (non-Art majors); ARCH 152 (Architecture majors); LARCH 152 (Landscape Architecture majors); or consent of instructor.

ART 215 Beginning Graphic Design 3(0,6) Introduction to fundamental techniques, concepts, and principles of visual communication. Through a series of projects and studio work, students explore techniques of communication through the use of type design, typography, photography, illustration, symbolism, and product design. Individual creative development is stressed. Prereg: ART 151, 152, 153, 154, 205 (Visual Arts majors); ART 103 (non-Art majors); ARCH 152 (Architecture majors); LARCH 152 (Landscape Architecture majors); or consent of instructor.

ART 217 Beginning Ceramics 3(0,6) Basic studio course introducing ceramic arts through its various processes and techniques. Hand-building methods as well as throwing on the potter’s wheel are developed. Weekly projects emphasize imagination, self-expression, and skill development. Ceramic history is introduced through slide lectures. Prereg: ART 151, 152, 153, 154, 205 (Visual Arts majors); ART 103 (non-Art majors); ARCH 152 (Architecture majors); LARCH 152 (Landscape Architecture majors); or consent of instructor.

ART 221 Beginning New Media 3(0,6) Explores new media art practices and ideas. Digital tools and processes are explored relative to drawing, painting, printing, bookmaking, and photography. Introduces new media as a context of new collective, interactive, and social modes of art production. Prereg: ART 106, 152, 151, or consent of instructor.
ART 223 Woodworking Studio 3(0,6) Introduces woodworking explorations in sculpture and furniture design emphasizing technical understanding and creative application of woodworking processes and methodologies. Students experiment with wood as a vehicle for personal expression and thematic development and conduct research on the historical impact of woodworking in the visual arts. Prq: ART 151, ART 152 or ARCH 152, or LARCH 152, or consent of instructor.

ART 305 Intermediate Drawing 3(0,6) Presents drawing problems and processes directed toward the production of thematically driven projects. Exploration of diverse drawing media. Emphasizes further development of drawing skills, relationships of materials/techniques to subject matter, and the study of contemporary issues in drawing. Prq: ART 205 or consent of instructor.

ART 307 Painting 3(0,6) Continuation of ART 207 with increased emphasis on personal expression and growth in technical competence. Some study of painting history is included in studio activity. Prq: ART 207 or consent of instructor.

ART 309 Sculpture 3(0,6) Continuation of ART 209 with increased emphasis on personal expression and content of work. Further exploration of materials and processes, including an introduction to foundry casting and advanced welding techniques. Individual investigation in current and historical aspects of sculpture is required. Prq: ART 209 or consent of instructor.

ART 311 Printmaking 3(0,6) Continuation of processes in beginning printmaking emphasizing expanding the range and depth of technique. The relationship of technique and process to creative idea development is emphasized. Prq: ART 211 or consent of instructor.

ART 312 Printmaking Research I 1-3(0,2-6) Continuation of ART 311. Technical and conceptual research in printmaking to develop self-expression. Special projects are constructed in consultation with instructor. May be repeated for a maximum of five credits. Prq: ART 311 or consent of instructor.

ART 313 Photography 3(0,6) Continuation of ART 213. Advanced techniques and more diverse types of film and paper are used in making images of personal and expressive nature. The design and construction of a view camera, printing in color, and multiple imagery may also be included. Prq: ART 213 or consent of instructor.

ART 315 Graphic Design 3(0,6) Continuation of concepts and techniques introduced in ART 215 with emphasis on more applied projects. Individual creative solutions are emphasized. Prq: ART 215 or consent of instructor.

ART 317 Ceramic Arts 3(0,6) Continuation of skill development leading to more challenging projects and independent efforts. Further exposure to ceramic history and ceramic technology is presented. Prq: ART 217 or consent of instructor.

ART 318 Ceramics Research I 1-3(0,2,6) Continuation of ART 317. Technical and conceptual research in ceramics for the purpose of self-expression. Projects are constructed in consultation with instructor. May be repeated for a maximum of five credits. Prq: ART 317 or consent of instructor.

ART 321 New Media Art II 3(0,6) Intermediate-level course that introduces students to time-based art practices such as video art, installation, and performance art forms. Through regularly scheduled studio projects, readings, and screenings, students develop video, installation, and motion graphic techniques, and receive a historical overview of time-based art practices. Prq: ART 221 or consent of instructor.

ART 323 Digital Sculpture 3(0,6) Studio course covering digital processes applied to making sculpture. Explores digital media as a resource for creative development, creating digital renderings of sculptures, and the fabrication of models and sculptures using CNC technology. Prq: ART 209 and 321 or consent of instructor.

ART 405, 605 Advanced Drawing 3(0,6) Advanced level studies of drawing which explore the synthesis of refined drawing skills and philosophies of art. Students’ understanding of drawing as a form of art is developed through studio practice augmented by critiques, demonstrations, lectures, field trips, and independent research. Prq: ART 305 or consent of instructor.

ART 407, 607 Advanced Painting 3(0,6) Advanced studio course in painting. Students select painting media and develop a strong direction based on prior painting experience. Includes study of contemporary painters and directions. Prq: ART 307 or consent of instructor.

ART 409, 609 Advanced Sculpture 3(0,6) Intensive independent studio concentration to further develop personal direction and content. Emphasizes continued investigation of sculptural context, materials and processes, and relativistic research. Prq: ART 309 or consent of instructor.

ART 411, 611 Advanced Printmaking 3(0,6) Cullmination 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 413, 613 Advanced Photography 3(0,6) Continuation of ART 313. Advanced problems in photography. Prq: ART 313 or consent of instructor.

ART 415 Advanced Graphic Design 3(0,6) Continuation of ART 315. Personal expression through communication techniques is further explored. Individual projects are emphasized. Prq: ART 315 or consent of instructor.

ART 416 Advanced Media Arts Interactive Objects and Environments 3(0,6) Students apply advanced media art production skills to create objects and environments that respond to user input or interaction. Tools used may include, but are not limited to, microcontrollers, sensors, RFID systems and electronic circuits, as well as traditional input devices. Prq: ART 321.

ART 417, 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 420, 620 Selected Topics in Art 1-3(0,6-9) Intensive 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 421 Two-Dimensional Digital Animation 3(0,6) Exposes students to the principles of animation with traditional techniques, while incorporating the latest 2-D digital tools. Students also develop interactive animations and showcase their work via the Internet. Prq: ART 321 or consent of instructor.

ART 471 Bachelor of Fine Arts Senior Studio I 3(0,6) Individual studio project directed by an instructor and determined by the student in consultation with the instructor. Focuses on a particular studio area, concept, or theme. May be repeated for a maximum of six credits. Prq: Senior standing and completion of 300/400 sequence in the chosen studio area, minimum grade-point ratio of 3.0 in focus studio area, participation in senior studio interview. Coreq: ART 473.

ART 472 Bachelor of Fine Arts Senior Studio II 5(0,15) Individual studio project directed by an instructor and determined by the student in consultation with the instructor. Usually focuses upon a particular studio area, concept, or theme. Prq: ART 471 with a B or better.

ART 473 Senior Seminar in Professional Career Preparation 3(3,0) Seminar and practical guide to prepare students for entry into the professional art world. Focuses on issues concerning visual artists in the early years of their professional activities. Presents career options and practical information for the graduating senior, including portfolio development. Coreq: ART 471.

ART 474 Travel Seminar 1(1,0) Students travel with faculty to museums, galleries and festivals that directly affect studio practice, art history knowledge and engagement in historical and contemporary art practice. Students plan trips, conduct research, keep a journal and make presentations on works and sites visited and matters pertaining to professional practice. To be taken Pass/Fail only. May be repeated for a maximum of three credits. Prq: Junior standing or consent of department chair.

ART 489 Art and Art History Internship 1-3(0,2,6) Internship with an approved sponsoring art institution in support of professional development and best art practices. May be repeated for a maximum of six credits. Prq: Junior standing in Visual Arts, consent of instructor and acceptance by sponsor.

ART 490, H490, 690 Directed Studies 1-5(0,2-10) Study of areas in the visual arts not included in other courses or additional advanced work. Must be arranged with a specific instructor prior to registration. May be repeated for a maximum of 18 credits. Prq: Consent of instructor.
ART AND ARCHITECTURAL HISTORY

Professor: W.W. Lew; Associate Professors: A.V. Feaster, J.B. LeBlanc; Assistant Professor: K. Kourelis

A A H 101, H101 Survey of Art and Architectural History I 3(3,0) Comprehensive survey of art and architectural history of Western heritage as well as significant coverage of Asian, African, Native American, and South American art. The arts are studied within the contexts of history, geography, politics, religion, and culture. Survey includes Ancient through Gothic.


A A H 205, H205 History and Theory of Art I 3(3,0) First of a two-semester sequence on special topics and issues in the history of art. Emphasizes stylistic developments and specific art movements. Analyzes art within the larger context of social, political, and religious history. Examines art techniques and theory as they have developed. Preq: A A H 202.

A A H 206, H206 History and Theory of Art II 3(3,0) Second of a two-semester sequence on special topics and issues in the history of art. Continued emphasis on stylistic developments and art movements, with specific attention directed toward post-Renaissance art. Analyzes the influence of past history on modern. Preq: A A H 205.

A A H 210, H210 Introduction to Art and Architecture 3(3,0) One-semester lecture course that introduces the nonmajor to an overview of art and architecture from different time periods and cultures. Students are encouraged to appreciate the contribution of art made by the great masters and to discern different styles, art techniques, and creative traditions.

A A H 305 Contemporary Art History 3(3,0) Study of contemporary art from World War II to the present, exploring forces that have shaped various movements and directions. Preq: A A H 206.

A A H 330 Honors Colloquium 3 Undergraduate honors colloquium emphasizing interdisciplinary interpretations. Focuses on an integration of art, architecture, landscape, and city planning. Preq: A A H 204 or 206 or consent of instructor.

A A H 395 Special Topics in Visual Studies Abroad I 3(3,0) On-site exposure to art and architecture in foreign countries, coupled with lectures and study problems. Different countries may be selected for study at faculty discretion. May be taught as a compact course during the academic year with a short stay in a foreign country or during summer with extended foreign experience. May not be taken Pass/Fail. Preq: A A H 204 or 206 or consent of instructor.

A A H 411, 611 Directed Research in Art History II 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 412, 612 Directed Research in Art History II 3(3,0) Continuation of A A H 411.

A A H 423, 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. Preq: A A H 204 or 206 or consent of instructor.

A A H 424, 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. Preq: A A H 423.

A A H 430, 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). Preq: Consent of instructor.

A A H 432, 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 modernist to a post-modern perspective. Preq: Consent of instructor.

ASTRONOMY

Professors: D.H. Hartmann, M.D. Leising, B.S. Meyer; Associate Professors: P.J. Flower, J.R. King; Assistant Professor: S. Britain

ASTR 101 Solar System Astronomy 3(3,0) Descriptive survey of the universe, with emphasis on basic physical concepts and the objects in our solar system. Related topics of current interest are included. For nonscience majors.

ASTR 102 Stellar Astronomy 3(3,0) Descriptive survey of the universe, with emphasis on basic physical concepts and galactic and extragalactic objects. Related topics of current interest are included. For nonscience majors. May not be taken by students who have completed ASTR 302.

ASTR 103 Solar System Astronomy Laboratory 1(0,2) Optional laboratory to accompany ASTR 101. Demonstrations, laboratory exercises, and planetarium visits supplement the lecture course. Coreq: ASTR 101.

ASTR 104 Stellar Astronomy Laboratory 1(0,2) Optional laboratory to accompany ASTR 102. Demonstrations, laboratory exercises, and planetarium visits supplement the lecture course. Coreq: ASTR 102.

ASTR 105 Physics of the Universe 3(3,0) Basic physics principles of Newtonian mechanics, special and general relativity, quantum mechanics, atomic structure, thermal physics, optics, and radiation physics are qualitatively and quantitatively presented. These principles are then applied to demonstrate their usefulness in understanding fundamental astrophysical objects and processes in the cosmos. Preq: MTHSC 105 or equivalent.

ASTR (GEOL) 220 Planetary Science 3(3,0) See GEOL 220.

ASTR 302 Stellar Astrophysics 3(3,0) Study of the basic physical concepts necessary for understanding the sun, other stars, and their evolution. Topics include star formation, stellar structure and evolution, binary stars, and observational techniques. Preq: PHYS 221 or consent of instructor.

ASTR 303 Galactic Astrophysics 3(3,0) Study of basic physical concepts necessary for understanding the structure of the galaxy, the motions of the stars within it, the nature of the interstellar matter, other galaxies, the large-scale structure of the universe, and the origin of the solar system. Preq: PHYS 221 or consent of instructor.

ASTR 475 Selected Topics in Astrophysics 1-3(0,0) Comprehensive study of an area of astrophysics. Topics may include nucleosynthesis and stellar evolution, extragalactic distance scale, structure and evolution of galaxies, and large-scale structure of the universe. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: ASTR 302 or consent of instructor.

ATHLETIC LEADERSHIP

Lecturer: D. J. Cadorette

A L 349 Principles of Coaching 3(3,0) Investigation into the scientific basis of the coaching profession, middle and high school levels. Topics include developing a coaching philosophy, sport psychology, sport pedagogy, sport physiology, athletic administration, and risk management. Current issues regarding sportsmanship, gender equity compliance, and cultural diversity are researched and synthesized. Preq: Athletic Leadership minor or consent of Athletic Leadership coordinator.

A L 350 Scientific Basis of Coaching I: Exercise Physiology 3(3,0) Increases understanding of basic scientific information concerning athletic performance by using the conceptual approach. Focuses primarily on an in-depth investigation into the physiological principles that can enhance athletic performance. Includes phases of physical training as well as comprehensive evaluative techniques. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 352 Scientific Basis of Coaching II: Kinesiology 3(3,0) Increases understanding of basic scientific information concerning athletic movement by utilizing the conceptual approach. Deals with the basic laws of human motion necessary in evaluation of athletic movement, utilizing joint structure and anatomic landmarks as a basis for motion. Preq: A L 349.
A L 353 Theory of Prevention and Treatment of Athletic Injuries 3(2,3) Increases understanding of principles involved in the prevention and treatment of athletic injuries. Deals with basic anatomy, first aid, and diagnostic techniques necessary for the understanding of basic athletic training procedures. 

Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 360 High School Athletics Ethical and Legal Issues 3(3,0) Investigates ethical and legal issues specific to high school athletic program administration as identified by the National Interscholastic Athletic Administrators Association (NIAAA) Leadership Program and addressed by the National Association for Sport and P.E. (NASPE) National Standards for Sport Coaches. Preq: A L 349.

A L 361 Administration and Organization of Athletic Programs 3(3,0) Study of modern techniques and practices used in administering athletic programs. Emphasizes areas such as practice and game organization, purchase and care of equipment, budget and finances, public relations, and legal liability in athletic programs. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 362 Psychology of Coaching 3(3,0) Study of psychological techniques utilized to promote maximum athletic performance. Emphasizes motivation, coaching philosophy, athletic personality, mental preparation, and goal-oriented behavior. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 371 Coaching Baseball 1(0,3) Increases understanding of basic technical and practical information concerning the coaching of baseball by utilizing the conceptual approach. Students study basic principles of coaching, competitive organization, and proper technical skills needed to improve athletic performances. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 372 Coaching Basketball 1(0,3) Increases understanding of basic technical and practical information concerning the coaching of basketball by utilizing the conceptual approach. Students study basic principles of coaching, competitive organization, and proper technical skills needed to improve athletic performances. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 373 Coaching Cross Country 1(0,3) Increases understanding of technical and practical information concerning the coaching of cross country by utilizing the conceptual approach. Students study basic principles of coaching, competitive organization, and proper technical skills needed to improve athletic performances. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 374 Coaching Football 1(0,3) Increases understanding of basic technical and practical information concerning the coaching of football by utilizing the conceptual approach. Students study basic principles of coaching, competitive organization, and proper technical skills needed to improve athletic performances. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 375 Coaching Soccer 1(0,3) Increases understanding of basic technical and practical information concerning the coaching of soccer by utilizing the conceptual approach. Students study basic principles of coaching, competitive organization, and proper technical skills needed to improve athletic performances. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 376 Coaching Strength and Conditioning 1(0,3) Increases understanding of basic technical and practical information concerning the coaching of strength and conditioning by utilizing the conceptual approach. Students study basic principles of coaching, training programs, and equipment appraisal as a means to improve athletic performance. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 377 Coaching Track and Field 1(0,3) Increases understanding of basic technical and practical information concerning the coaching of track and field by utilizing the conceptual approach. Students study basic principles of coaching, competitive organization, and proper technical skills needed to improve athletic performances. Also covers total program development as it pertains to specific levels of competition. Preq: A L 349 or consent of Athletic Leadership coordinator.

A L 400 Athletic Leadership Internship 0 Athletic coaching and administration internship for a minimum of 60 hours. To be taken concurrently with any other Clemson University course. To be taken Pass/Fail only. Preq: Current CPR certification and consent of Athletic Leadership coordinator.

A L 453, 653 Athletic Injuries: Prevention, Assessment and Rehabilitation 3(3,0) Gives students an understanding of prevention, treatment, and rehabilitation procedures of injured athletes. Preq: A L 349.

AUDIO TECHNOLOGY

Associate Professor: B.A. Whisler; Assistant Professor: H. Altstatt; Lecturer: K.W. Moore

AUDIO 185 Introduction to Audio Technology 3(2,2) Introduction to MIDI sequencing, analog and digital recording, digital processing and related audio production technologies. Not open to students who have taken MUSIC 180. Preq: Performing Arts major or consent of instructor.

AUDIO 279 Audio Practicum 3(1,5) Practical work in audio providing technical services to the broader university and surrounding community. Projects include recording live performances, sound support for public events, and audio support for film and animation projects. May be repeated for a maximum of six credits. Preq: AUDIO 380 with a C or better, or consent of instructor.

AUDIO 280 Sound Reinforcement 3(2,2) Theory and practice of using audio equipment for amplifying sound in venues ranging from conference rooms to concert halls and sports arenas. Preq: Performing Arts major or consent of instructor.

AUDIO 285 Acoustics and Music 3(3,0) Study of the relationship between the laws of physics and the production of music from an audio engineering perspective. Topics include mechanical and acoustical laws, harmonic analysis, musical scales, sound production in instruments, and the physiology of hearing. Preq: Performing Arts major.

AUDIO 380 Audio Engineering I 3(2,2) Intermediate-level course in music technology focusing on digital hard-disk recording and acoustical considerations in audio engineering. Preq: MUSIC 180 with a C or better, or Audio 185 with a C or better, or consent of instructor.

AUDIO 385 Advanced Live Sound Reinforcement 3(2,2) Advanced course in live sound reinforcement focused on digital consoles and sound system design. Preq: AUDIO 280 with a C or better, or consent of instructor.

AUDIO 386 Electronic Composition and Sound Design 3(2,2) Intermediate- to advanced-level course covering techniques, methods and issues associated with electronic music composition and production. Topics include advanced MIDI/sequencing techniques, electronic orchestral arrangements, scoring/sound design, and picture and audio processing. Preq: AUDIO 185; MUSIC 180, or consent of instructor.

AUDIO 480, 680 Audio Engineering II 3(2,2) Advanced course in music technology focused on music production integrating digital audio and virtual instruments. Preq: AUDIO 285 and 380 with a C or better, or consent of instructor.

AUDIO 485 Production Workshop 3(2,2) Project-based course focused on music production. Students produce an audio CD that includes recorded audio tracks and/or newly-created sequenced material with creative and appropriate packaging. Preq: AUDIO 480 with a C or better, or consent of instructor.

BIOCHEMISTRY


BIOCH 103 Careers in Biochemistry and Genetics 1(1,0) Introduces students to biochemistry and genetics career paths, professional organizations, ethical issues, and requirements for advanced study. Also gives students training in design of a professional portfolio. Credit toward a degree will be given for only one of BIOCH 103, GEN 103. Preq: Freshman or Sophomore standing in Biochemistry or Genetics or consent of instructor.
BIOCH 301, H301 Molecular Biochemistry 3(3,0)
Introduces the nature, production, and replication of biological structure at the molecular level and its relation to function. Preq: BIOL 110 and CH 223 with C or better.

BIOCH 302 Molecular Biochemistry Laboratory 2(0,4)
Laboratory to accompany BIOCH 301. Introduction to fundamental laboratory techniques in biochemistry and molecular biology and a demonstration of some of the fundamental principles of molecular biology discussed in BIOCH 301. Preq: BIOCH 301 and GEN 300 with C or better. Coreq: BIOCH 301.

BIOCH 305 Essential Elements of Biochemistry 3(3,0)
Introduction to structure, synthesis, metabolism, and function of biomolecules in living organisms. Preq: CH 201 or equivalent and BIOL 103 or 110; or consent of instructor.

BIOCH 306 Essential Elements of Biochemistry Laboratory 1(0,3)
Introduces students to fundamental techniques associated with tissue extraction and analysis of biomolecules. Students learn both principles and practical applications. Preq or Coreq: BIOCH 305.

BIOCH 406, 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. Preq: BIOCH 305 or organic chemistry.

BIOCH 423, 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. Preq: CH 224 or equivalent.

BIOCH 431, H431, 631 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. Preq: BIOCH 301 with C or better or consent of instructor. Coreq: Physical chemistry.

BIOCH 432, H432, 632 Biochemistry of Metabolism 3(3,0)
Study of the central pathway of carbohydrate, lipid, and nucleotide metabolism. Emphasizes bioenergetics, limiting reactions, and the regulation and integration of the metabolic pathways. Preq: BIOCH 301 and 431 with C or better or consent of instructor.

BIOCH 433, 633 General Biochemistry Laboratory I 2(0,4)
Experiments to illustrate current methods used in biochemical research. Coreq: BIOCH 431.

BIOCH 434, 634 General Biochemistry Laboratory II 2(0,4)
Continuation of BIOCH 433. Preq: Concurrent enrollment in BIOCH 432.

BIOCH 436, H436, 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. Preq: BIOCH 301 and GEN 302 with C or better, or consent of instructor.

BIOCH (GEN) 440, H440, 640 Bioinformatics 3(3,0)
See GEN 440.

BIOCH 443, 643 Molecular 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. Preq: BIOCH 301 or 305 and GEN 300 or 302 with C or better, or consent of instructor.

BIOCH 490 Selected Topics in Biochemistry 1-4(1-4)
Comprehensive study of selected topics not covered in other courses. May be repeated for a maximum of eight credits, but only if different topics are covered. Preq: Junior standing or consent of instructor.

BIOCH 491, H491 Directed Research in Biochemistry 1-8(0,3-24)
Orientation in biochemical research (i.e., experimental planning, execution, and reporting). May be repeated for a maximum of eight credits. Preq: By consent of instructor.

BIOCH 493, H493 Senior Seminar 2(2,0)
Analysis and discussion of topics from the primary literature in the life sciences particularly in biochemistry. Students find pertinent articles in the primary literature and present and analyze the selected reading. Preq: BIOCH 301, GEN 302, and at least one 400-level BIOCH course with C or better.

BIOENGINEERING


BIO E 101 Biology for Bioengineers 1(1,0)

BIO E 201 Introduction to Biomedical Engineering 3(3,0)
Provides basic introduction to fundamental principles of cellular and molecular biology. Preq: CH 101.

BIO E 201 Biomedical Engineering 3(3,0)
Provides engineering, biological, and physical science students with an overview of the replacement of human body parts and the problems related to artificial devices. Preq: BIO E 101 or BIOL 103 or 110; CH 102; or consent of instructor.

BIO E 302 Biomedical Materials 3(2,3)
Study of metallic, ceramic, and polymer materials used for surgical and dental implants; materials selection, implant design, physical and mechanical testing; corrosion and wear in the body. In addition, physical and mechanical properties of tissue as related to microstructure are studied. Preq: BIO E 201, MS&E 210, CH 201, or consent of instructor.

BIO E 320 Biomechanics 3(3,0)
Study of relation between biological and mechanical functions of musculoskeletal tissues such as bone, ligaments, muscles, cartilage, etc.; mechanics of human joints; analysis of implants and implant failure. Preq: C E 201, MTHSC 208.

BIO E 321 Biofluid Mechanics 3(3,0)
Introduces mechanics of biological fluids (e.g., blood, synovial fluid and physiological solutions) with an emphasis on the formation of biological problems within the context of (1) kinematics, (2) the concept of stress, (3) linear momentum balance, (4) constitutive relations and (5) boundary conditions. Preq: BIO E 320.

BIO E 370 Bioinstrumentation and Bioimaging 3(2,3)
Introduction of fundamental topics in bioinstrumentation and bioimaging focused on the acquisition and monitoring of vital signals. Basic principles for the selection and appropriate use of instruments for solving bioengineering and medical problems such as microscopy, magnetic resonance imaging, and ultrasonography, among others, are addressed. Preq: E C E 202 or 307; and MTHSC 208; or consent of instructor.

BIO E 400 Senior Seminar 1(1,0)
Addresses problems to be encountered by bioengineering graduates in professional practice. Invited lecturers and faculty provide lectures and demonstrations. Pertinent information on job interview skills, career placement and guidance, professional registration, professional ethics in bioengineering, entrepreneurship and patents, and business management are provided. To be taken Pass/Fail only. Preq: Senior standing in Bioengineering.

BIO E 401 Bioengineering Design Theory 3(3,0)
Introduces principles of engineering design and applies them to the design of medical devices. Covers materials selection, fabrication processes, performance standards, cost analysis, and design optimization. Students defend a design project proposal in written and oral form before a faculty jury. Preq: BIO E 302 or consent of instructor.

BIO E 402 Biocompatibility 3(2,3)
Guides students through the theory and practice of determining compatibility of biomaterials and medical devices as required by the FDA. Hands-on experiments emphasize host-implant interactions such as toxicity towards tissues using specific techniques, including cell culture, implantation of biomaterials in experimental animals and histopathology. Preq: BIO E 302 and BIOSC 461 or consent of instructor.

BIO E 403 Applied Biomedical Design 3(1,6)
Creative application of bioengineering and design principles to solving clinically relevant design problems. Team-based development, construction and evaluation of design prototypes in accordance with design theory. Students present results to faculty jury and external collaborators through written reports and oral presentations. Preq: BIO E 401, or consent of instructor.

BIO E 412, 612 Orthopaedic Engineering and Pathology 3(3,0)
Interdisciplinary study of clinical orthopaedic cases (bone growth, bone remodeling, osteoarthritis, implant fixation and joint replacements); biomechanical, biomaterials, tribology and clinical diagnosis of failed implants (total joint replacements, fracture fixation and spinal instrumentation); basic concepts of orthopaedic pathology for engineers. Preq: BIO E 302, 320, BIOSC 315.

BIO E 415, H415, 615 Research Principles and Concepts 1(1,0)
Introduces seniors and graduate students to principles and practices of scientific research. Topics include developing scientific concepts, developing projects, pursuing research, collaborating in multidisciplinary teams, patenting and publishing technical and scientific information, and reviewing professional and ethical standards of performance.

BIO E 420 Sports Engineering 3(3,0)
Study of engineering principles involved in sports: body systems in human motion, analysis of gait, basic performance patterns in athletic movements, performance improvements, design of sports equipment. Preq: BIO E 302 and 320 or consent of instructor.
Courses of Instruction

BIO E 423, 623 Cardiovascular Engineering and Pathology 3(3,0) Medical and bioengineering aspects of artificial cardiovascular and vascular devices; physiology and pathological aspects of patients with need for such devices; diagnostic techniques and surgical management of diseases and pathology; design aspects of current devices and selection; state of the art in experiments and human clinical trials. Preq: BIO E 302, 320, 370, BIOSC 315.

BIO E 431, 631 Medical Imaging 3(3,0) Introduction to the history, physics, and basis of medical imaging devices; including X-ray, Computed Tomography, Magnetic Resonance Imaging, and Ultrasound. Students will understand imaging from both an engineering and clinical prospective. Students will have the opportunity to work with real medical-images, to understand the trade-offs between modalities. Preq: BIO E 370 or equivalent or consent of instructor.

BIO E 435, 635 Computer Modeling of Multiphysics Problems 3(3,0) This course will introduce students to a holistic way to deal with complicated engineering problems using a computer modeling approach. For example, a real-world problem governed by combined mechanical, electrical, thermal, electrochemical and mass-transport phenomena will be dealt with in an integrated and multidisciplinary way rather than the conventional piece-wise single-discipline way. Preq: MTHSC 208.

BIO E 440, 640 Biotechnology for Bioengineers 3(3,0) Explores the principles necessary to use microorganisms, tissue culture, and enzymes in bioengineering applications, including molecular techniques, fermentation, process scale-up, purifica-
tion processes, and FDA regulations. Emphasizes production of biopharmaceuticals derived from recombinant systems, including uses in medical systems. Preq: BIOCH 305 or consent of instructor.

BIO E 448 Tissue Engineering 3(2,3) Explores the application of engineering principles toward the development of biologically based substitutes that restore, maintain, or improve tissue function. Topics include biodegradable scaffolds, wound healing and tissue repair, cell-matrix interactions, immunology and biocompatibility, stem cells. Preq: BIO E 302, BIOSC 315 and 461, or consent of instructor. BIO E 449 Drug Delivery 3(3,0) Fundamental principles of controlled drug delivery including drug re-
lease mechanisms, physiological barriers, and various types of delivery routes. Specific emphasis is placed on understanding drug delivery technologies and processes to scale up the fabrication of drug delivery systems. Preq: BIO E 302 or consent of instructor.

BIO E 450, 650 Special Topics in Bioengineering 1-4(1-4,0) Comprehensive study of a topic of cur-
current interest in the field of biomedical engineering under the direct supervision and guidance of a faculty member. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: Consent of instructor.

BIO E 451 Creative Inquiry—Bioengineering 1-3(1-3,0) Disciplinary and multidisciplinary team research projects with the goal of developing the students’ skills in literature research, engineering design, and data analysis. May be repeated for a maximum of six credits. Preq: Consent of instructor.

BIO E 460, 660 International Bioengineering Research Topics 1-6(0,3-18) Comprehensive study and research exposure relating to bioengineering research topics at an international institution through the Bioengineering study abroad program. Students are exposed to laboratory and research methods while under the direct supervision and guidance of approved international mentors. May be repeated for a maximum of six credits. Preq: Consent of instructor.

BIO E 461 International Study in Bioengineering 3(3,0) Introduction to selected bioengineering topics through participation in international study abroad summer programs. Offers an international study experience to undergraduates through lectures, guest speakers, tours, and/or laboratory exposure on a selected bioengineering topic chosen annually by the department. Preq: Consent of instructor.

BIO E 469 International Bioengineering Internship 1-3(1-3,0) Observation and assignment in an international medical school, dental school, hospital, regulatory agency, or industrial department. Course is affiliated with the bioengineering study abroad program and students are under the direct supervision and guidance of approved international mentors. May be repeated for a maximum of six credits. Preq: Consent of instructor.

BIO E 471, 671 Biophotonics 3(3,0) Biophotonics is an interdisciplinary subject of applying photonics to study biological samples from individual cells to the entire body. Introduces fundamental and frontier topics in optical imaging aspects of biophotonics for senior-level undergraduates and graduate students to gain the ability to solve biomedically-related biophysical problems. Preq: MTHSC 208; PHYS 221; E C E 320; or consent of instructor.

BIO E 476 Biosurface Engineering 3(2,3) Study of how surface design influences the interactions of biomolecules with biomaterials and how this in turn influences implant biocompatibility. Labora-
tory addresses both the theory and application of various analytical instruments commonly used in bioengineering to characterize biomaterial surfaces and investigate biomolecule-surface interactions. Preq: Senior standing in Bioengineering, BIOCH 305.

BIO E 482, 682 Biomaterial Implantology 3(2,3) Provides training in the planning and conduct of experimental surgery, including laws and regulations; institutional requirements; selection of animal models; ethical considerations of animal research; preparation of animals for surgery; general and special surgical techniques; aseptic surgical techniques and basic and applied instrumentation. Preq: Junior standing in Bioengineering.

BIO E 490 Internship 1(0,3) Observation and assign-
ment in a medical school, dental school, hospital, regulatory agency, or industrial department. May be repeated for a maximum of two credits. Preq: Senior standing in Bioengineering, consent of department chair.

BIO E 491, 691 Mentored Research in Bioen-
gineering 1-6(0,3-18) Mentored research training for undergraduate students working with a faculty advisor, including literature review, experimental design, research documentation, and presentation of results. May be repeated for a maximum of six credits. Honors students must take six credits under a single advisor and write an honors thesis. Preq: Consent of instructor.

BIOL 101 Frontiers in Biology 1 (1,0) Introduces Biological Sciences majors to University career and library services, evaluation of computer program proficiency, Web page development, Biological Sciences emphasis areas, and Biological Sciences faculty. Students initiate their own Web-based student portfolios, which showcase their skills and experiences (e.g., résumés, accomplishments, and work samples) during their undergraduate programs. Coreq: BIOL 103/105 or 110 or consent of course coordinator.

BIOL 102 Frontiers in Biology II 1 (1,0) Introduces Biological Sciences majors to recent advances in organismal and evolutionary biology. Topics include ecology, evolution, behavior, and organismal biology. Preq: BIOL 103/105 or 110 or consent of course coordinator.

BIOL 200 Biology in the News 3(3,0) For non-
science majors. Students examine current topics of biology appearing in newspapers and other current media. Uses a problem-based learning approach, with students working as teams and individually on areas of interest identified by the class. Preq: ENGL 103, General Education Natural Science Requirement.

BIOS 204 Environment, Energy, and Society 3(3,0) Examines energy and power generation, the resultant environmental effects, and the relationship between this technology and society. Introduces historical and contemporary sources of energy and power; the economic, social, and political forces important for type and patterns of development; and the resultant impacts to ecosystems and the environment.

BIOS 205 Plant Form and Function 3(3,0) Intro-
ductive course for students majoring in plant sciences. Integrates lecture and laboratory and emphasizes fundamental structures and functions of higher plants. Preq: BIOL 103/105 or consent of instructor.

BIOS 206 Plant Form and Function Laboratory 1(0,3) Laboratory for BIOSC 205. Preq or Coreq: BIOSC 205 or consent of instructor.
BIOSC 222 Human Anatomy and Physiology I 4(3,2) Basic introductory course in integrated human anatomy and physiology covering cells and tissues; integumentary, skeletal, muscular, and nervous systems; sensory organs. Physiology is stressed. Structured primarily for Nursing and other health-related curricula. Preq: BIOL 103/105 or 110; CH 101 and 102, or 105 and 106.

BIOSC 223 Human Anatomy and Physiology II 4(3,2) Continuation of BIOSC 222 covering endocrine, reproductive, cardiovascular, lymphatic, respiratory, urinary, and digestive systems; fluid and electrolyte balance. Physiology is stressed. Preq: BIOSC 222 or consent of instructor.

BIOSC (ENT) 301 Insect Biology and Diversity 4(3,3) See ENT 301.

BIOSC 302, H302 Invertebrate Biology 3(3,0) In-depth survey and comparison of free-living invertebrate animals emphasizing functional anatomy, development, and evolutionary relationships. Preq: Introductory two-semester biology sequence with laboratory. Coreq: BIOSC 306.

BIOSC 303, H303 Vertebrate Biology 3(3,0) Comprehensive survey of vertebrate animals, including their taxonomy, morphology, evolution, and selected aspects of the natural history and behavior. Preq: Introductory two-semester biology sequence with laboratory.

BIOSC 304, H304 Biology of Plants 3(3,0) Survey of the major groups of plants, their biology, diversity, and evolution. Preq: BIOL 104/106 or 111 or BIOSC 205. Coreq: BIOSC 308.

BIOSC 306 Invertebrate Biology Laboratory 1(0,3) Survey and comparison of the biology of living invertebrates, examples of which are drawn primarily from the southeastern coast of the United States. Preq: Introductory two-semester biology sequence with laboratory. Coreq: BIOSC 302.

BIOSC 307 Vertebrate Biology Laboratory 1(0,3) Comparative and phylogenetic study of the gross morphology of vertebrates. Preq or Coreq: BIOSC 303.

BIOSC 308 Biology of Plants Practicum 1(0,3) Laboratory exercises that explore the major groups of plants, their biology, diversity, and evolution. Preq or Coreq: BIOSC 304.

BIOSC (W F B) 313 Conservation Biology 3(3,0) See W F B 313.

BIOSC 315 Functional Human Anatomy 4(3,3) Introduction to the anatomical structures associated with all organ systems found in the human body at both the gross and microscopic level. Basic physiology is integrated to assist with understanding the function of the anatomical systems. Preq: BIOL 103/105 or 110 or consent of instructor.

BIOSC 316 Human Physiology 4(3,3) Study of the functional processes associated with the various organ systems in the human body. Students develop a basic understanding of the important and fundamental concepts in human physiology and how organ systems maintain homeostasis. Preq: One year of introductory biology and introductory chemistry or consent of instructor.

BIOSC 320 Field Botany 4(2,4) Introductory study of the taxonomy, ecology, and evolution of plants in their natural environment with an emphasis on identification and characteristics of representative species and plant communities in the Carolinas. Includes one or two required Saturday field trips. Preq: BIOL 104/106, 111, or BIOSC 205, or consent of instructor.

BIOSC 335 Evolutionary Biology 3(3,0) Introduction to basic concepts and underlying principles of modern evolutionary biology. Topics include a historical overview of evolutionary theories, elementary population genetics, principles of adaptation, speciation, systematics and phylogenetic inference, fossil record, biogeography, molecular evolution, and human evolution. Preq: GEN 302 or equivalent.

BIOSC (PL PH) 340 Plant Medicine and Magic 3(3,0) See PL PH 340.

BIOSC (ANTH) 351 Biological Anthropology 3(3,0) See ANTH 351.

BIOSC (ANTH) 353 Forensic Anthropology 3(3,0) See ANTH 353.

BIOSC 394, H394 Selected Topics in Creative Inquiry 1(1,6) Disciplinary and multidisciplinary group research projects develop the student's ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOSC 394, BIOSC 494 or both. Preq: Consent of instructor.

BIOSC (ENT) 400, H400, 600 Insect Morphology 4(3,3) See ENT 400.

BIOSC 401, H401, 601 Plant Physiology 3(3,0) Relations and processes pertaining to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products and liberation of energy. Preq: BIOL 104/106 or 111 or BIOSC 205 and CH 102. Coreq: BIOSC 402.

BIOSC 402, 602 Plant Physiology Laboratory 1(0,3) Laboratory exercises and experiments designed to indicate the relations and processes which pertain to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products, and liberation of energy. Coreq: BIOSC 401.

BIOSC (GEN) 405, 605 Molecular Genetics of Eukaryotes 3(3,0) See GEN 405.

BIOSC 406, H406, 606 Introductory Plant Taxonomy 3(3,0) Introduction to the basic principles and concepts of plant systematics with emphasis on the plants of South Carolina. Preq: BIOL 104/106 or 111 or BIOSC 205. Coreq: BIOSC 407.

BIOSC 407, 607 Plant Taxonomy Laboratory 1(0,3) Introduction to basic techniques of plant taxonomy with laboratory and field emphasis on the flora of South Carolina. Coreq: BIOSC 406.

BIOSC 408, H408, 608 Comparative Vertebrate Morphology 3(3,0) Phylogeny and diversity of vertebrates and study of their comparative morphology, leading to an understanding of the relationships and functioning of living organisms. Preq: BIOL 104/106 or 111. Coreq: BIOSC 409.

BIOSC 409, H409, 609 Comparative Vertebrate Morphology Laboratory 2(0,5) Comparative anatomy of representative vertebrates; methods used in preparing specimens for study and display. Coreq: BIOSC 408.

BIOSC 410, 610 Limnology 3(3,0) Detailed introduction to the physical, chemical, and biological interrelationships that characterize inland water environments. A fundamental approach to the interactions of components of the environment is developed at a theoretical level. Preq: Junior standing in a life science or consent of instructor.

BIOSC 411, H411, 611 Limnological Analyses 2(1,2) Examines a broad range of topics covered with both standing and running fresh waters. About one-third of the laboratory exercises address the major physical components of lakes and streams. The remainder provides rationale and methods for quantitative analyses of biota, as well as some integrated analyses of whole ecosystems. Preq or Coreq: BIOSC 410 or 443.

BIOSC (EN R) 413, 613 Restorations Biology 3(3,0) See E N R 413.

BIOSC (AVS, MICRO) 414, H414, 614 Basic Immunology 3(3,0) See MICRO 414.

BIOSC (ENT) 415, 615 Insect Taxonomy 3(1,6) See ENT 415.

BIOSC 417, 617 Marine Biology 3(3,0) Survey of the organisms that live in the sea and their adaptations to the marine environment. Emphasizes characteristics of marine habitats, organisms, and the ecosystems. Preq: BIOL 104/106, 111, or consent of instructor.

BIOSC 420, H420, 620 Neurobiology 3(3,0) Broad background in neurobiology. Topics include neuroanatomical structure-function; conduction in the neuron; neurite growth and development; neuromuscular junction; chemistry, physiology, and pharmacology of specific neurotransmitters and receptors; visual process; axoplasmic transport; hypothalamic-pituitary regulation; theories of behavior; theories of learning and memory. Preq: BIOSP 301 or 305 or consent of instructor.

BIOSC (AVS, MICRO) 424, H424, 624 Immunology Laboratory 1(0,3) See MICRO 424.

BIOSC (PL PA) 425, 625 Introductory Mycology 3(3,0) Introduction to the biology of all the groups of fungi and some related organisms, with considerations of the taxonomy, morphology, development, physiology, and ecology of representative forms. Preq: BIOL 104/106 or 111 or BIOSC 205. Coreq: BIOSC (PL PA) 426.

BIOSC (PL PA) 426, 626 Mycology Practicum 2(1,3) Application of the principles of mycological techniques, microscopic study of fungi. Examples from all major groups of fungi are included. Coreq: BIOSC (PL PA) 425.
BIOSC 428, 628 Quantitative Biology 4(3,3)
Applies quantitative methods to a wide range of biological problems. Main focus is on building modeling skills using population, physiological, genetic, and evolutionary problems. Also includes a review of statistical principles and introduces basic bioinformatics techniques. Prereq: BIOL 103/104, 111, or equivalent; and MTHTSC 108 or equivalent.

BIOSC 432, H432, 632 Animal Histology 3(3,0)
Structural and functional study of the basic tissues of animals and tissue makeup of organs. Emphasizes light microscopy level with selected tissue studied at the electron microscope level. Prereq: BIOSC 303 or consent of instructor. Coreq: BIOSC 433.

BIOSC 433, H433, 633 Animal Histology Laboratory 2(1,2)
Microscopic examination of basic animal tissue types and the tissue makeup of organs which comprise systems. Coreq: BIOSC 432.

BIOSC 434 Biological Chemistry Laboratory Techniques 2(1,3)
Theory and application of some of the routine tools and techniques used in biological chemistry. Lectures introduce laboratory theory and provide additional laboratory instructions; discuss results; and conduct student evaluations. Laboratory periods are used to conduct each activity. Prereq: BIOCH 305 or equivalent, or consent of instructor.

BIOSC (ENT) 436, 636 Insect Behavior 3(2,3) See ENT 436.

BIOSC 440, H440, 640 Developmental Animal Biology 3(3,0) Events and mechanisms responsible for the development of multicellular animals. Gametogenesis, fertilization, embryonic development, cellular differentiation, morphogenesis, larval forms and metamorphosis, sexual reproduction, regeneration, malignancy, and aging are analyzed in terms of fundamental concepts and control processes. Prereq: BIOCH 301 or 305 or consent of instructor. Coreq: BIOSC 440.

BIOSC 441, H441, 641 Ecology 3(3,0) Study of basic ecological principles underlying the relationships between organisms and their biotic and abiotic environments. Includes physiological, population, and community ecology, with applications of each to human ecological concerns. Prereq: BIOL 104/106, 111, BIOSC 205, or consent of instructor.

BIOSC 442, H442, 642 Biogeography 3(3,0) Study of patterns of distribution of plants and animals in space and time. Prereq: BIOSC 302 or 303 and 304 or 305 or consent of instructor.

BIOSC 443, H443, 643 Freshwater Ecology 3(3,0) Study of basic ecological principles and concepts as they apply to freshwater environments: rivers and streams, wetlands, lakes and ponds, and reservoirs. Prereq: Junior standing in a life science or consent of instructor.

BIOSC 444, H444, 644 Freshwater Ecology Laboratory 2(1,2) Laboratory-based course providing a synthesis of major components of freshwater ecosystems. Activities are hypothesis driven and relate to each other to form an overall synthesis of the field. Handson experience allows engagement in creative inquiry. Prereq or Coreq: BIOSC 443 or equivalent or consent of instructor.

BIOSC 445, H445, 645 Ecology Laboratory 2(1,2) Modern and classical approaches to the study of ecological problems discussed in BIOSC 441. Students are introduced to field, laboratory and computer-based analyses of plant and animal populations and communities. Prereq or Coreq: BIOSC 441.
Courses of Instruction

BIOSC 473, 673 History of Modern Biology 3(3,0)
Examines the intellectual and social factors defining the study of life from the scientific revolution of the 1600's to the modern biological sciences. Investigates the historical origins of biological disciplines and explores the differing cultures, methodologies, and philosophical commitments of these communities. Prereq: Introductory course in biology or consent of instructor.

BIOSC (ANTH) 474, 674 Primateology 4(3,3)
Biological and human primates, including their evolution, taxonomy, physiology, life history, behavioral ecology and conservation. Three field trips are required, during which students conduct behavioral observations and later analyze their data and present it in report format. Prereq: ANTH 351, BIOSC 303, 335.

BIOSC 475, H475, 675 Comparative Physiology 3(3,0)
Physiological systems of invertebrates and vertebrates emphasizing environmental adaptation. Physiological principles as they relate to metabolism, thermoregulation, osmoregulation, respiration, and neural and integrative physiology. Prereq: One year each of biology, chemistry, and physics or consent of instructor.

BIOSC 476, H476, 676 Comparative Physiology Laboratory 2(1,2)
Modern classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOSC 475. Introduces students to computerized data acquisition and manipulation as well as computer simulations of physiological function. Prereq or Coreq: BIOSC 475.

BIOSC 477, 677 Ichthyology 3(2,3)
Systematics, life history, distribution, ecology, and current literature of fish. Laboratory study of morphology and identification of U.S. genera, as well as all southeastern species. Field trips are required. Prereq: BIOSC 303 or consent of instructor.

BIOSC 478 Exercise Physiology 3(3,0)
Introduction to the physiology of exercise. Focuses on the function and adaptations of body systems in response to exercise. Structured primarily for students interested in Prehabilitation Sciences. Prereq: BIOSC 222/223 or 315/316 or consent of instructor.

BIOSC 479 Kinesiology 3(3,0)
Introduction to the study of human movement. Focuses on the application of biomechanical and motor control principles to human motion, including daily living, sport, and work activities. Structured primarily for students interested in Prehabilitation Sciences. Prereq: BIOSC 222 or 315 or consent of instructor.

BIOSC (AVS) 480, 680 Vertebrate Endocrinology 3(3,0)
Introduction to the basic principles of neuro-endocrine integration and homeostatic maintenance in vertebrates. Comparative morphology and physiology of various endocrine tissues and hormone chemistry and modes of action are considered. Prereq: BIOSC 303, organic chemistry, or consent of instructor.

BIOSC 481, 681 Web Design for the Life Sciences and Agriculture 3(2,2)
Addresses basic principles and theories of Web design and site construction, including usability and accessibility considerations. Web and graphics design software are used to develop sites suitable for life science and agricultural organizations. Service-learning is used with student projects. Prereq: AG ED 200, CP SC 120, or consent of instructor.

BIOSC 482 Laboratory Techniques for Teaching Science 3(1,6)
Focuses on basic lab skills needed to plan, prepare, and conduct inquiry-based laboratories and to familiarize pre-service teachers with a variety of scientific equipment and their methodologies. Topics include ways to integrate technology into the classroom, lab safety, and the development of inquiry-based classroom activities. Prereq: BIOL 106 or 101.

BIOSC 484, H484, 684 Human and Comparative Vertebrate Embryology 3(3,0)
Study of human and comparative embryology with an introduction to related clinical correlations. Students develop an understanding of normal and abnormal human and comparative vertebrate embryonic development. Prereq: BIOL 111 or consent of instructor.

BIOSC 486 Natural History 3(3,0)
Interdisciplinary examination, through readings and critical discussion, of concepts of nature and biodiversity in relation to human endeavors. Course seeks to achieve a balanced perspective from which to seek compromises between conflicting views of nature. Prereq: BIOSC 441, 443, or 446, or equivalent, or consent of instructor.

BIOSC 487, 687 Electron and Optical Microscopy Theory 3(2,2)
Offers a theoretical and practical introduction to light and electron microscopy. Topics include Koehler illumination, polarization, interference, phase contrast, DIC epifluorescence, laser scanning light microscopy, SEM, TEM, EDS, ultramicrotomy, tomography, and digital imaging. Prereq: Consent of instructor.

BIOSC 489 Clinical Applications and Medical Practice 3(2,2)
Explores the various fields, specialties, and subspecialties in medicine. Provides students with the opportunity to shadow physicians in a hospital and/or office setting and to discuss current issues and advances in medicine with practicing physicians and other health care professionals. Prereq: Junior standing and consent of instructor.

BIOSC 491, H491 Undergraduate Research in Biological Sciences 1-4(3,0-12)
Mentored research problems introduce undergraduate students to the planning and execution of research and the presentation of research findings. May be repeated for a maximum of eight credits. Honors students must take at least six credits under a single research advisor over two semesters and must write an honors thesis. Prereq: Consent of instructor.

BIOSC 492 Internship in Biological Sciences 1-4(3,12)
Preapproved internship at an advisor-approved facility to give students learning opportunities beyond their classroom experiences. Students submit a Student Internship Contract and a two-page study plan before the internship and a comprehensive report within one week of the end of the internship. May be repeated for a maximum of six credits. To be taken Pass/Fail only. Prereq: Consent of advisor.

BIOSC 493 Senior Seminar 2(2,0)
Capstone course engaging students in analysis and discussion of publications from the technical and non-technical literature in biological sciences and from current topics of biology appearing in other media. Students complete their undergraduate online digital portfolios. Emphasis is placed on ethical issues that arise as a result of biological research. Prereq: Senior standing; COMM 150 or ENGL 314; or consent of instructor.

BIOSC (MICRO) 494, H494 Selected Topics in Creative Inquiry II 2-3(1,3-6)
Disciplinary and multidisciplinary group research projects with the goal of developing the students' ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOSC 394, BIOSC 494 or both. Prereq: Consent of instructor.

BIOSC 495 Service Learning in Biology 2-4(1,2-3-9)
Combines service and academic learning while helping pre-college or college students learn about the fundamental aspects of science. Provides lecture and laboratory experiences as students learn to prepare and participate in supervised laboratory teaching for pre-college or college students. May be repeated for a maximum of six credits. Prereq: Consent of instructor.

BIOSC 496 Selected Topics 1-4(1,4-0)
Lecture coverage of selected topics in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics in the biological sciences. May be repeated for a maximum of nine credits, but only if different topics are covered. Prereq: Junior standing or consent of instructor.

BIOSC 497 Special Topics Laboratory 1-3(0,2-9)
Specialized laboratory experiences in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics of interest in the biological sciences. May be repeated for a maximum of nine credits, but only if different topics are covered. Prereq: Junior standing or consent of instructor.

Biology

Profs.: J.L. Dickey, R.J. Kosinski, M.B. Ptaszek, W.M. Surver; Associate Professors: W.S. Baldwin, R.A. Garcia, K.D. Layfield, A.D. Smith, S.A. Sparace; Assistant Professor: N.R. Espinosa; Senior Lecturers: T. Kaisa, V.C. Minor; Lecturer: K.L. Ickes.

BIOL 103, H103 General Biology I 3(3,0)
First in a two-semester sequence. Includes an evolutionary approach to cells, cellular activities, genetics, and animal diversity emphasizing the processes of science. Credit toward a degree will be given for BIOL 103 or 110 only.

BIOL 104, H104 General Biology II 3(3,0)
Continuation of BIOL 103. Includes an evolutionary approach to human anatomy and physiology, plant diversity, morphology, and physiology and principles of ecology. Credit toward a degree will be given for BIOL 104 or 111 only.

BIOL 105 General Biology Laboratory I 3(0,3)
Laboratory to accompany BIOL 103. Emphasizes developing laboratory techniques, becoming familiar with biological instrumentation, and performing investigations and interpreting results in the areas of biochemistry, cell biology, and molecular biology. Coreq: BIOL 103.
BIOL 106 General Biology Laboratory II 1(0,3) Laboratory to accompany BIOL 104. Emphasizes developing laboratory techniques, becoming familiar with biological instrumentation, and performing investigations and interpreting results in the areas of organismal structure, physiology, and ecology. Coreq: BIOL 104.

BIOL 109 Introduction to Life Science 4(3,3) Survey of topics in botany, zoology, microbiology, and ecology emphasizing comprehension and practical application of life-sciences concepts to experiments and activities for the elementary school classroom. Enrollment priority will be given to Early Childhood and Elementary Education majors.

BIOL 110, H110 Principles of Biology I 5(4,3) Introduction to human biology, the study of plants and animals as functional organisms, and the principles of ecology. Credit toward a degree will be given for BIOL 110 or 103 only. Coreq: CH 101.

BIOL 111, H111 Principles of Biology II 5(4,3) Continuation of BIOL 110, emphasizing fundamentals of organismal structure, physiology, and the brain. Applications employ scientific methodology in a laboratory environment as well as critical analysis of biological problems in a small group context. Coreq: BIOL 112, 122, 123, or 124.

BIOL 121 Keys to Human Identity 3(3,0) Introduc- tion to scientific inquiry that emphasizes the biological aspects of human identity, including genetics, development, and the brain. Applications employ scientific methodology in a laboratory environment as well as critical analysis of biological problems in a small group context. Coreq: BIOL 121, 122, 123, or 124.

BIOL 122 Keys to Biodiversity 3(3,0) Introduction to scientific inquiry through analysis of biodiversity. Biological foundations for life are studied, including evolution, ecology, genetics, cells, and molecules. Also includes discussion of ethical issues related to biodiversity. Credit toward a degree will be given for only one of BIOL 121, 122, 123, or 124.

BIOL 123 Keys to Human Biology 3(3,0) Introduction to scientific inquiry through human biology. Considers biological processes occurring within humans and human impact on global biological processes. Interrelationships ultimately affecting evolution and diversity are explored. Credit toward a degree will be given for only one of BIOL 121, 122, 123, or 124.

BIOL 124 Keys to Reproduction Cells, Organisms, Populations, Ecosystems 3(3,0) Introduction to scientific inquiry through analysis of the process of reproduction. The ethics of human reproduction and the evolution and ecological impact of population growth and extinction are emphasized. Credit toward a degree will be given for only one of BIOL 121, 122, 123, or 124.

BIOL 201 Biotechnology and Society 3(3,0) Introduction to the theories, fields, and applications of biotechnology, including the structure and function of genes and their manipulation to improve plant and animal productivity and human health. Individual case studies are examined, including social and ethical issues surrounding biotechnology-based research and development. Not open to Genetics majors. Coreq: BIOL 120 and 121, 122, 123, or 124; or equivalent; or consent of instructor.

BIOL 203 Human Disease and Society 3(3,0) Focuses on the basic biology underlying human disease, how disease is understood, and current methods of prevention and treatment of disease. The economics as well as the social and ethical issues surrounding human disease are a common thread throughout the course. Coreq: BIOL 104/106; 111; 121, 122, 123, or 124; or consent of instructor.

BIOL 210 Evolution and Creationism 3(3,0) Critical review of the scientific and technological basis for evolutionary theory compared to creationist explanations for the origin and diversity of life. Includes a historical survey of the impact that the evolution/creation debate has had on law, politics, education, and other important aspects of society. Credit toward a degree will be given for only one of BIOL 210 or PHIL 210. Coreq: BIOL 104/106; 111; 121, 122, 123, or 124; or consent of instructor.

BIOL 220 Biology: Concepts, Issues, and Values 3(3,0) Develops a thorough knowledge of basic biological concepts and issues and explores how these can be incorporated into a system of human values affecting technology, society, and life.

BIOMOLECULAR ENGINEERING

BMOLE 403, 603 Biotransport Phenomena 3(3,0) Analysis of single and multidimensional steady-state and transient problems in momentum, mass, and energy transfer in biological systems. Mathematical similarities and differences in these mechanisms are stressed, and mathematical descriptions of physiological and engineering systems are formulated. Coreq: CH E 330, MTHSC 208.

BMOLE 423, 623 Bioseparations 3(3,0) Study of principal methods of separation and purification of bioproducts, such as proteins, amino acids, and pharmaceuticals. Topics include analytical bioseparations, membrane separations, sedimentation, cell disruption, extraction, adsorption, chromatography, precipitation, crystallization, and drying. Coreq: BIOCH 301, 305, or 423; CH E 330; or consent of instructor.

BMOLE 425, 625 Biomolecular Engineering 3(3,0) Introduction to basic principles of biomolecular engineering: the purposeful manipulation of biological molecules and processes applied to problems and issues in the life sciences, biotechnology, and medicine. Topics include carbohydrates, proteins, nucleic acids, and lipids with emphasis on their structure-property-function relations; molecular recognition; biochemical pathway engineering and cell growth. Coreq: CH E 230 and 319 or consent of instructor.

BMOLE 426, 626 Biosensors and Bioelectronic Devices 3(3,0) Development of methodologies used to design, fabricate, and apply biosensors and bioelectronic devices for the environmental, medical, and chemicals industries. Application of the fundamentals of measurement science to optical, electrochemical, mass, and thermal means of signal transduction. Use of the fundamentals of surface science to interpret bio-immobilization and biomolecule-surface interactions. Coreq: CH E 330, and BIOCH 301 or 305, or consent of instructor.

BMOLE 427, 627 Membranes for Biotechnology and Biomedicine 3(3,0) Students learn principles of membrane science and technology and study membrane applications in the biotechnology and biomedical industries. Advanced topics include surface modification of membranes, synthesis of porous membranes for biomedical applications such as tissue engineering, environmentally responsive membranes, and membrane-based biomedical devices. Coreq: CH E 330 or equivalent or consent of instructor.

BIOSYSTEMS ENGINEERING

Professor: T.H. Walker; Associate Professors: C.M. Drapcho, T.O. Owino; Assistant Professor: C.V. Privette

B E 199 Creative Inquiry—Biosystems Engineering I 1-3(1-3,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be taken twice for a maximum of six credits. To be taken Pass/Fail only.

B E 210 Introduction to Biosystems Engineering 2(1,3) Overview of topics and engineering application areas that comprise the biosystems engineering profession. Significant emphasis is also given to development of oral and written communication skills needed by the engineering professional, introduction to design methodology, and application of engineering fundamentals to biological systems. Coreq: ENGR 130, MTHSC 106.

B E 212 Fundamentals of Biosystems Engineering 2(1,3) Introduction to fundamental concepts in biosystems engineering, including mass, energy, and momentum balances; mass, heat, and momentum transfer; biological response to environmental variables, biological materials, biological kinetics, and techniques of measurement and analysis of engineering and biological data. Laboratory includes hand-on exercises, problem solving and computer sessions, and oral presentations. Coreq: ENGR 130, MTHSC 108.

B E 222 Geomeasurements 2(1,3) Fundamentals of land measurement and traverse calculations. Leveling, earthwork, area, and topographic measurements using levels, total stations, and GPS. Application of mapping via GIS. Coreq: MTHSC 106.

B E 299 Creative Inquiry—Biosystems Engineering II 1-3(1-3,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be taken twice for a maximum of six credits. To be taken Pass/Fail only.
Courses of Instruction

B E H300 Biosystems Engineering Honors Seminar 0(0,1) Introduces undergraduate students to current faculty research. Project ideas are then developed to prepare students in choosing a research topic for the senior honors thesis. Students are required to attend senior honors thesis presentations. To be taken Pass/Fail only. Prq: Junior standing in departmental honors program.

B E H301 Biosystems Engineering Honors Thesis Research 3(0,6) Honors thesis project proposal, initial research, report, and presentation of biosystems engineering project for completion of junior requirements of the Biosystems Engineering Honors program. Prq: B E H300.

B E 314 Biosystems Engineering Mechanical Design 3(3,0) Study of basic mechanical design of biosystems. Includes an introduction to biomechanics and biomaterial properties. Studies applications of machine components and their selection related to specific types of biosystems. Team design project is required. Prq: C E 206 or M E 302.

B E 322 Small Watershed Hydrology and Sedimentology 3(3,0) Fundamental relationships governing rainfall disposition are used as bases for defining the hydrology of watersheds. Emphasizes application of modeling techniques appropriate for runoff and sediment control. Coreq: C E 341 or consent of instructor.

B E 370 Practicum 1-3 Preplanned internship with an approved employer involved with biosystems engineering endeavors. A minimum 130 hours of supervised responsibility is required per credit hour. Evaluation is based on activity journal, written/oral report, and an evaluation from the supervisor. May be repeated for a maximum of three credits. To be taken Pass/Fail only. Prq: Junior standing and departmental consent.

B E 399 Creative Inquiry--Biosystems Engineering III 1-3(1-3) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be taken twice for a maximum of six credits. To be taken Pass/Fail only. Prq: B E H300, H301.

B E (CSENV) 408, 608 Land Treatment of Wastewater and Sludges 3(3,0) See CSENV 408.

B E 410, 610 Biological Kinetics and Reactor Modeling 3(2,3) Fundamentals of microbial and biochemical kinetics used in analysis and design of biological systems. Topics include mathematical and computer modeling of biological kinetics and systems, estimating model coefficients, and development of microbial kinetic models as basis for batch and continuous reactor design. Prq: B E 212, MTHSC 208, or consent of instructor.

B E 412, 612 Heat and Mass Transport in Biosystems Engineering 3(3,0) Fundamentals of heat and mass transport used in engineering design and analysis of biological systems; principles of steady state and transient energy and mass balances, including chemical and biological generation terms. Prq: B E 410, MTHSC 208. Coreq: M E 310 or consent of instructor.

B E 414, 614 Biosystems Engineering Unit Operations 3(2,3) Applies the basic principles of statics, dynamics, and thermodynamics to design of mechanical and electrical systems supporting biological operations and processes. Prq: B E 314, M E 310.

B E 415, 615 Instrumentation and Control for Biosystems Engineers 4(3,3) Overview of modern instrumentation techniques and digital electronic components and subsystems to integrate them into digital data acquisition and control systems for biosystems. Laboratory use of equipment is emphasized. Topics include characteristics of instruments, signal conditioning, transducer theory and applications, programmable logic controllers, and digital data acquisition and control. Prq: E C E 307.

B E 417, 617 Applied Instrumentation and Control for Biosystems 2(1,3) Hardware and software implementation of digital data acquisition and control systems for application to agriculture, aquaculture, biotechnology, and other biosystems. Topics include digital electronic circuits and components, microcomputer architecture, interfacing, and programming. Prq: B E 415 or consent of instructor.


B E 422, 622 Hydrologic Modeling of Small Watersheds 3(3,0) Design of structures and development of best management practices for runoff, flood, and sediment control from rural and urban areas, including natural and disturbed watersheds. Topics include modeling of prismatic and non-prismatic channels, culverts, and detention/retention ponds. Prq: B E 322 or consent of instructor.

B E 424 Ecological Engineering 3(3,0) Focuses on engineering solutions to environmental and socioeconomic problems using ecological design principles. Explores ecosystem processes as they pertain to sustainable development, natural resource protection, food and energy production, waste management, and environmental restoration. Engineering fundamentals and ecological modeling are integral components of this course. Prq: Senior standing in Engineering.

B E 428, 628 Biochemical Engineering 3(3,0) Use of microorganisms and enzymes for the production of chemical feedstocks, single-cell protein, antibiotics, and other fermentation products. Topics include kinetics and energetics of microbial metabolism, design and analysis of reactors for microbial growth and enzyme-catalyzed reactions, and considerations of scale-up, mass transfer, and sterilization during reactor design. Prq: B E 410 or CH E 330 or consent of instructor.

B E 435, 635 Applications in Biotechnology Engineering 3(2,3) Bioengineering principles applied to the expanding fields of agricultural biotechnology, ecotechnology, and biomedical technology. Specific applications include waste treatment and ecological engineering, bioreactor propagation of plant and animal cells and tissues, applied genomics and synthetic seed production, biosensors and biomonitoring, biological implants and materials biocompatibility. Prq: B E (CH E) 428.

B E 438, 638 Bioprocess Engineering Design 3(2,2) Design and analysis of systems for processing biological materials. Topics include biotechnology, thermodynamics, transport processes, and biological properties related to bioprocess design and computational simulation. Unit operations include basic bioreactor operation, bioseparations, and preservation techniques. Prq: B E (CH E) 428.

B E 440, 640 Renewable Energy Resource Engineering 3(2,2) Investigation into merging renewable energy resources, including detailed study of solar, wind, and bioenergy alternatives. Also includes principles, technologies, and performance evaluation of components for these technologies and an introduction to tidal, hydro, geothermal, and other energy; energy conservation; cogeneration; financial, economical, and other issues related to alternative energy sources. Prq: Science or engineering major, consent of instructor.

B E (EE&S, FOR) 451, H451, 651 Newman Seminar and Lecture Series in Natural Resources Engineering 10(0,2) Topics dealing with development and protection of land, air, water, and related resources are covered by seminar with instructor and invited lecturers. Current environmental and/or resource conservation issues are addressed. Prq: Senior standing, consent of instructor.

B E 464, 664 Non-Point Source Management in Engineered Ecosystems 3(2,3) Fundamentals of non-point source pollution, including quantification of environmental impact and ecosystem management related to contaminants and nutrients and to planning and design of ecological systems. Prq: MICRO 305, Senior standing in engineering, or consent of instructor.

B E 473 Special Topics in Biosystems Engineering 1-3(1-3) Comprehensive study of special topics not covered in other courses. Emphasizes independent pursuit of detailed investigations. May be repeated for a maximum of six credits, but only if different topics are covered. Prq: Senior standing and consent of department.

B E 474 Biosystems Engineering Design/Project Management 2(1,3) Study of biological systems design using hydrology principles, fluid mechanics, bioprocessing, heat/mass transfer, instrumentation, mechanical unit operations, and structural principles for project design, scheduling, and cost estimation. Topics also include engineering ethics, professional development, written and oral communication, and job skills. Senior portfolios are also developed. Prq: B E 410 and 412.

B E 475 Biosystems Engineering Capstone Design 2(0,4) Applications of hydrology, fluid mechanics, bioprocessing, heat/mass transfer, instrumentation, mechanical unit operations, and structural principles in design; project scheduling; cost estimation; ethics; environmental and social impacts; design drawings; and report documentation. Prq: B E 474, CH E 230.

B E (EE&S) 484, 684 Municipal Solid Waste Management 3(3,0) See EE&S 484.
BUS H392 International Business Honors Thesis Proposal 1(1,0) Students work with a Clemson advisor and an international advisor to complete a proposal for the senior thesis. Students work and conduct research while participating in an approved study abroad. To be taken Pass/Fail only. Preq: BUS H391.

BUS 399 Creative Inquiry—Business 141(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits. Preq: BUS H391.

BUS H491 International Business Honors Thesis 1(3,0) Students work with an advisor to conduct literature review and research on a senior thesis topic and prepare presentations and thesis drafts based on this work. Preq: BUS H392.

BUS H492 International Business Honors Thesis II 3(3,0) Students work with an advisor to complete a senior thesis. They prepare and present a seminar on the topic for presentation to faculty and other International Business Honors students. Preq: BUS H491.

BUS 499 Creative Inquiry—Business 141(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.

CARDIOVASCULAR TECHNOLOGY

Lecturer: E.J. Walker

CVT 225 Ultrasound Physics 3(3,0) Explanation of the basic principles and characteristics associated with diagnostic ultrasound.

CVT 226 Introduction to Cardiovascular Sonography 3(3,0) Introduces students to patient care, patient confidentiality, blood components, lymphatics, cardiovascular pharmacology, heart embryology, cardiovascular anatomy and physiology, standard sonography views, and Doppler/instrumentation. Coreq: BIOC 223.

CVT 325 Echocardiography Principles 4(3,2) Study of two-dimensional, m-mode, Doppler echocardiography and left ventricular systolic function. Includes discussion of various pathologies, the resulting echocardiographic findings and treatments. Preq: CVT 225 and 226.

CVT 326 Echocardiography Methods 4(3,2) Study of two-dimensional, Doppler echocardiography and transesophageal echocardiography. Includes discussion of various pathologies, the resulting echocardiographic findings and treatments. Preq: CVT 325.

CVT 335 Vascular Sonography Principles 4(3,2) Study of two-dimensional, color Doppler, spectral Doppler and other testing modalities in peripheral arterial, abdominal vascular and intracranial cerebrovascular disease. Includes discussion of various pathologies, the resulting sonographic findings and treatments. Preq: CVT 226.

CVT 336 Vascular Sonography Methods 4(3,2) Study of two-dimensional, color Doppler, spectral Doppler and other testing modalities in peripheral arterial, abdominal vascular and intracranial cerebrovascular disease. Includes discussion of various pathologies, the resulting sonographic findings and treatments. Preq: CVT 335.

CVT 424 CVS Field Experience I 6(0,30) Students complete 440 hours of uninterrupted, supervised work in a clinical care setting. Under direct supervision of GHs registered sonographers, students are introduced to scanning protocols and techniques, instructed in principles, techniques and applications of multiple diagnostic modalities, including echocardiography, vascular duplex imaging, Doppler, and plethysmography. Preq: CVT 326 and 336.

CVT 425 CVS Field Experience II 6(0,30) Intermediate level course expands on introductory skills learned in CVT 424. Students apply scanning protocols and techniques, and improve their use of multiple diagnostic modalities, including echocardiography, vascular duplex imaging, Doppler, and plethysmography. Students become proficient with all aspects of paperwork and communications within the health care organization. Preq: CVT 424.

CVT 426 CVS Field Experience III 6(0,30) In this advanced course, students complete 440 hours in a clinical setting under the supervision of registered sonographers. Students are tested in all aspects of fundamental principles, techniques and applications of multiple diagnostic modalities, including echocardiography, vascular duplex imaging, Doppler and plethysmography. Preq: CVT 425.

CAREER AND TECHNOLOGY EDUCATION

Professors: W.L. Havice, W.D. Paige; Associate Professor: C.E. Poston; Lecturer: H.L. Harrison

CTE 115 Contemporary Technological Problems 3(3,0) Provides students with an understanding of the problems and contributions of technology. Examples are taken from historical accounts and from analyses of contemporary technological intervention both in industrialized and nonindustrialized countries.

CTE 221 Exploring Technology 3(3,0) Covers a wide range of technological concepts along with familiar examples of how technology impacts our lives as individuals, a society, and a global community.

CTE 310 Designing Creative Instruction 3(2,2) Provides preservice teachers with opportunities to develop skills in technological literacy, design, inquiry-based instruction, and problem solving using a variety of media, with emphasis on their applications in the elementary curriculum. Preq: Junior standing in Early Childhood or Elementary Education or consent of instructor.

CHEMICAL ENGINEERING

CH E 330 Mass Transfer and Separation Processes 4(3,2) Study of mass transport fundamentals and application of these fundamentals to separation technologies, with emphasis on gas absorption, stripping, distillation, and liquid-liquid extraction. Prereq: CH E 230. Coreq: CH E 321.


CH E H395 Honors Research I 3(0,9) Individual research under the direction of a Chemical Engineering faculty member. Prereq: CH E H300 or consent of department honors coordinator.

CH E 399 Creative Inquiry—Chemical and Biomolecular Engineering I (1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

CH E 405 Fluids/Heat Transfer 4(3,2) General principles of chemical engineering and study of fluid flow, fluid transportation, and heat transmission. Special emphasis is placed on theory and its practical application to design. Prereq: CH E 211. Coreq: CH E 220, MTHSC 206.

CH E C300 Chemical Engineering Thermodynamics I 3(3,0) Topics include first and second laws of thermodynamics, ideal gases, PVT properties of real fluids, energy balances with chemical reactions, and thermodynamic properties of real fluids. Prereq: CH E 211, MTHSC 206.

CH E H401, H402, H403 Special Projects in Chemical Engineering I, II, III 3(1-3,0) Topics requested by students or offered by faculty as the need arises. Topics may include review of current research in an area, technological advances, and national engineering goals. May be repeated for a maximum of six credits, but only if different topics are covered.

CH E H405 Honors Research II 3(0,9) Individual research under the direction of a chemical engineering faculty member. Prereq: CH E H395.

CH E H407 Honors Thesis I 1(0,0) Preparation of honors thesis based on research conducted in CH E H395 and H495. Prereq: CH E H405.

CH E H499 Creative Inquiry—Chemical and Biomolecular Engineering I (1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

CHEMISTRY


CH 101, H101 General Chemistry 4(3,3) Introduction to the elementary concepts of chemistry through classroom and laboratory experience. Emphasizes chemical reactions and the use of symbolic representation, the mole concept and its applications and molecular structure. Credit toward a degree will be given for only one of CH 101 and 105. Prereq or Coreq: CMPT score of 3 or higher; or MTHSC 101, 102, 103, or 105.

Courses of Instruction
Courses of Instruction

CH 102, H102 General Chemistry 4(3,3)  
Continuation of CH 101, treating solutions, rates of reactions, chemical equilibrium, electrochemistry, chemistry of selected elements, and an introduction to organic chemistry. Credit toward a degree will be given for only one of CH 102 or 106. Preq: CH 101 with a C or better.

CH 105 Chemistry in Context I 4(3,3)  
The chemistry of societal issues, including air quality, global warming, acid rain, and alternative energy sources is discussed in the context of their impact on society. May not be taken as a prerequisite for organic chemistry. Credit toward a degree will be given for only one of CH 101 or 105.

CH 106 Chemistry in Context II 4(3,3)  
Continuation of CH 105. Topics include the chemistry of nuclear energy, new energy sources, nutrition, medicines, new materials, and genetic engineering. May not be taken as a prerequisite for organic chemistry. Credit toward a degree will be given for only one of CH 102 or 106. Preq: CH 101 or 105. 

CH 141 Chemistry Orientation 1(1,0)  
Lectures, discussions, and demonstrations devoted to health and safety in chemistry laboratories; use of the chemical literature; and career planning. Preq: Concurrent enrollment in CH 101.

CH 152 Chemistry Communication I 2(2,0)  
Methods for scientific communication, including oral, written, and electronic formats. Service-learning projects engage participants with community needs pertaining to chemistry issues.

CH 199 Creative Inquiry—Chemistry I 1-4(1-4,0)  
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

CH 201 Survey of Organic Chemistry 4(3,3)  
Introduction to organic chemistry emphasizing nomenclature, classes of organic compounds, and chemistry of functional groups. For students needing a one-semester course in organic chemistry. Credit toward a degree will be given for only one of CH 201 or 223. Preq: CH 102 or consent of instructor.

CH 205 Introduction to Inorganic Chemistry 3(3,0)  
One semester treatment which emphasizes the properties and reactions of the more common chemical elements. Preq: CH 102.

CH 206 Inorganic Chemistry Laboratory 10(3)  
Introduction to laboratory synthesis and characterization of inorganic compounds. Laboratory sessions consist of a set of six landmark inorganic experiments for which the original authors have been awarded Nobel prizes. Coreq: CH 102, 205.

CH 223 Organic Chemistry 3(3,0)  
Introductory course in the principles of organic chemistry and the derivation of these principles from a study of the properties, preparations, and interrelationships of the important classes of organic compounds. Credit toward a degree will be given for only one of CH 201 or 223. Preq: CH 102 or consent of instructor.

CH 224 Organic Chemistry 3(3,0)  
Continuation of CH 223. Preq: CH 223.

CH 227 Organic Chemistry Laboratory 10(3)  
Synthesis and properties of typical examples of the classes of organic compounds. Credit toward a degree will be given for only one of CH 227 or 229. Preq: CH 223 or concurrent enrollment.

CH 228 Organic Chemistry Laboratory 10(3)  
Continuation of CH 227. Preq: CH 224 (or concurrent enrollment) and 227.

CH 229 Organic Chemistry Laboratory 10(3)  
One-semester laboratory for Chemical Engineering students. Credit toward a degree will be given for only one of CH 227 or 229. Preq: CH 223.

CH 299 Creative Inquiry—Chemistry II 1-4(1-4,0)  
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

CH 313 Quantitative Analysis 3(3,0)  
Fundamental principles of volumetric, gravimetric, and certain elementary instrumental chemical analyses. Preq: Concurrent enrollment for credit in CH 315 or 317.

CH 315 Quantitative Analysis Laboratory 2(0,6)  
Laboratory techniques of volumetric, gravimetric, and elementary instrumental chemical analyses. Credit toward a degree will be given for only one of CH 315 or 317. Coreq: Concurrent enrollment for credit in CH 313.

CH 317 Quantitative Analysis Laboratory 10(3)  
Standard techniques of analytical chemistry—gravimetric, volumetric, and instrumental. Credit toward a degree will be given for only one of CH 315 or 317. Coreq: Concurrent enrollment for credit in CH 313.

CH 330 Introduction to Physical Chemistry 3(3,0)  
One-semester treatment of physical chemistry emphasizing topics that are especially useful in the life sciences, agriculture, and medicine: chemical thermodynamics, equilibrium, solutions, kinetics, electrochemistry, macromolecules, and surface phenomena. Credit toward a degree will be given for only one of CH 330 or 331. Preq: MTHSC 106.

CH 331 Physical Chemistry 3(3,0)  
Includes the gaseous state, thermodynamics, chemical equilibria, and atomic and molecular structure, from both experimental and theoretical points of view. Credit toward a degree will be given for only one of CH 330 or 331. Preq: MTHSC 206, PHYS 221.

CH 332, H332 Physical Chemistry 3(3,0)  
Continuation of CH 331, including chemical kinetics, liquid and solid state, phase equilibria, solutions, electrochemistry and surfaces. Preq: CH 331 or consent of instructor.

CH 339 Physical Chemistry Laboratory 10(3)  
Experiments are selected to be of maximum value to Chemistry and Chemical Engineering majors. Coreq: CH 331 or CH E 220.

CH 340 Physical Chemistry Laboratory 10(3)  
Continuation of CH 339. Preq: Concurrent enrollment in CH 332.

CH 360 Chemical Biology 3(3,0)  
Introduction to the chemical foundations of biological phenomena, focusing on bioorganic, biophysical, bioinorganic, and bioanalytic chemistry principles. Preq: CH 201 or 223.

CH 399 Creative Inquiry—Chemistry III 1-4(1-4,0)  
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

CH 400 Selected Topics in Chemistry 1-3(1-3,0)  
Comprehensive study of topics of current interest in chemistry. May be repeated for a maximum of twelve credits, but only if different topics are covered.

CH 402, H402, 602 Inorganic Chemistry 3(3,0)  
Basic principles of inorganic chemistry are discussed with special emphasis on atomic structure, chemical bonding, solid state, coordination chemistry, organometallic chemistry, and acid-base theories. The chemistry of certain selected elements is treated. Preq: CH 331, 332.

CH 403 Advanced Synthetic Techniques 2(0,6)  
Introduction to advanced laboratory techniques in synthesis and characterization of inorganic and organic compounds. Laboratory sessions consist of a set of eight experiments in modern fields of chemistry, including superconductivity, buckminsterfullerene, bioinorganic chemistry, medicinal chemistry, asymmetric synthesis, and polymer chemistry. Preq: CH 227, 228, 402, or consent of instructor.

CH 404, H404, 604 Bioinorganic Chemistry 3(3,0)  
Covers fundamentals of bioinorganic chemistry with review of necessary inorganic and biochemical concepts. Topics include metal uptake, transport, and storage in biological systems; functions of metals in proteins; metal ion interactions with nucleic acids; physical methods used in bioinorganic chemistry; heavy element toxicity, radiopharmaceuticals and other metalloids. Preq: BIOC 301 or CH 205.

CH 411, 611 Instrumental Analysis 3(3,0)  
Principles of operation and application of modern chemical instrumentation in the field of analytical chemistry. Topics include basic electronics, statistics, optical, mass, magnetic resonance, electron and x-ray spectroscopies, radiochemistry, and separation science. Preq: CH 331, 332.

CH 412 Instrumental Analysis Laboratory 2(0,5)  
Reinforces principles of chemical instrumentation described in CH 411 by practical, hands-on experience. Aspects of sample preparation, standardization, data acquisition and interpretation, and report formulation procedures common in chemical analyses are considered for a range of modern instrumental methods. Coreq: CH 411.

CH 413, H413 Chemistry of Aqueous Systems 3(3,0)  
Study of chemical equilibria in aqueous systems, especially natural waters; acids and bases, dissolved CO2, precipitation and dissolution, oxidation-reduction, adsorption, etc. Preq: CH 102 or 106.
CH 414, 614 Bioanalytical Chemistry 3(3,0) Survey of selected areas of importance in bioanalytical chemistry. Fundamental principles, advanced topics, and applications of analytical measurements of biomolecules, bioassays, immunassays, separations, mass spectrometry, method validation, macromolecular crystallography, microscopy, and imaging. Preq: CH 213, 411, or consent of instructor.

CH 421, H421, 621 Advanced Organic Chemistry 3(3,0) Survey of modern organic chemistry emphasizing synthesis and mechanisms. Preq: CH 224, 332, or equivalent.

CH 425, 625 Medicinal Chemistry 3(3,0) Survey of the pharmaceutical drug discovery process. Covers discovery of candidate compounds, bio assay methods, and associated regulatory and commercial issues. Case studies are selected from the current literature. Preq: CH 224 or equivalent or consent of instructor.

CH 427, H427, 627 Organic Spectroscopy 3(2,3) Survey of modern spectroscopic techniques used in the determination of molecular structure. Emphasizes the interpretation of spectra: nuclear magnetic resonance, ultraviolet, infrared, mass spectrometry, optical rotatory dispersion, and circular dichroism. Preq: One year each of organic chemistry and physical chemistry.

CH 435, H435, 635 Atomic and Molecular Structure 3(3,0) Introduction to quantum theory and its application to atomic and molecular systems. Topics include harmonic oscillator, hydrogen atom, atomic and molecular orbital methods, vector model of the atom, atomic spectroscopy, and molecular spectroscopy. Preq: CH 332 or consent of instructor.

CH 443, H443 Research Problems 1-6(0,3-18) Original investigation of an assigned problem in a fundamental branch of chemistry. Work must be carried out under the supervision of a member of the staff. May be repeated for a maximum of six credits. Preq: Senior standing in Chemistry or consent of instructor.

CH 444, H444 Research Problems 1-6(0,3-18) Continuation of CH 443. Original investigation of an assigned problem in a fundamental branch of chemistry. Work must be carried out under the supervision of a member of the staff. May be repeated for a maximum of six credits. Preq: Senior standing in Chemistry or consent of instructor.

CH 450 Chemistry Capstone 3(1,6) Students undertake capstone projects in a team format. Projects necessitate the use of electronic and print resources, demonstrate expertise with a specific instrument or experimental technique, require strong collaboration within a team setting, and produce a peer-reviewed oral and written report. Preq: Senior standing or consent of instructor.

CH 451, 651 Frontiers in Polymer Chemistry 3(3,0) Survey of selected areas of current research in polymer science with particular emphasis on polymer synthesis. Although a text is required for review and reference, course is primarily literature based and focused on areas of high impact to multidisciplined technology. Preq: CH 223, 224, MS&E 415 or consent of instructor.

CH 452 Chemistry Communication II 1(1,0) Methods for scientific communication, including oral, written, and electronic formats. Student presentations focus on current chemical literature topics pertinent to their CH 443/444 undergraduate research or results of that work are appropriate. Preq: CH 152.

CH 471, 671 Teaching Chemistry 3(3,0) Study of topics in chemistry addressed in the context of constructivist methodologies. Also considers laboratory work and management, laboratory safety, and the use of technology in the chemistry classroom. Preq: 300-level chemistry course or high school teaching experience or consent of instructor.

CH 499 Creative Inquiry—Chemistry IV 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

CHINESE
Assistance, Professors: Y. An, Y. Zhang; Lecturer: S. Chen

CHIN 101 Elementary Chinese 4(3,1) Introductory course stressing speaking, listening, and writing. Attention is given to the sound system of Chinese to enable students to distinguish the four tones and to develop basic communication skills. Participation in cultural activities is encouraged.

CHIN 102 Elementary Chinese 4(3,1) Continuation of CHIN 101. Preq: CHIN 101 or consent of instructor.

CHIN 201 Intermediate Chinese 3(3,1) Intermediate course with more emphasis on communication skills and structure. Reading and writing practice without phonetic aids; oral practice in and outside the class, paying special attention to idiomatic usage; introduction to cultural perspectives through readings and cultural activities. Preq: CHIN 102 or consent of instructor.

CHIN 202 Intermediate Chinese 3(3,1) Continuation of CHIN 201. Preq: CHIN 201 or consent of instructor.

CHIN 297 Creative Inquiry—Chinese I 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. Arrangements with faculty members must be established prior to registration.

CHIN 305 Chinese Conversation and Composition I 3(3,0) Practice in the spoken language emphasizing vocabulary, word-combinations, pronunciation, and comprehension. Learning practical language skills and intercultural communication by studying various topics. Preq: CHIN 202, or consent of department chair.

CHIN 306 Chinese Conversation and Composition II 3(3,0) Continuation of CHIN 305. More practice in the spoken language emphasizing vocabulary, word combinations, pronunciation, and comprehension. Learning practical language skills and intercultural communication by studying various topics. Preq: CHIN 305 or consent of department chair.

CHIN (PHIL) 312 Philosophy in Ancient China 3(3,0) See PHIL 312.

CHIN (PHIL) 313 Philosophy in Modern China 3(3,0) See PHIL 313.

CHIN 316 Chinese for International Trade I 3(3,0) Study of spoken and written Chinese common to the Chinese-speaking business communities emphasizing business practices and writing/translation of business letters and professional documents. Cross-cultural references are provided for comparative analyses of American and Chinese business behavior. Classes are conducted in Chinese. Preq: CHIN 202, 305 (or concurrent enrollment) or consent of department chair.

CHIN 317 Chinese for Health Professionals I 3(3,0) Study of medical concepts and terminology emphasizing communicative competence in health-related settings in a Chinese-speaking community. Designed for students who plan to work in public health-related professions. Preq: CHIN 202, 305, or consent of instructor.

CHIN 397 Creative Inquiry—Chinese I 1-4(1-4,0) Students focus on a special research area under the guidance of a faculty member. After acquiring the requisite background, students formulate hypotheses for a group project, develop a critical framework, and initiate research on a specific topic.

CHIN 401 Pre-Modern Chinese Literature in Translation 3(3,0) Chinese literature from 8th century B.C.E. to 19th century C.E., including poetry, prose, drama, fiction, and literary criticism. All readings and discussions are in English.

CHIN 411 Studies in the Chinese Language I: Literature 3(3,0) Advanced training in the spoken and written language through readings in contemporary literature emphasizing vocabulary, syntax, and stylistics. All readings and discussions are in Chinese. Preq: CHIN 306 or consent of instructor.

CHIN 412 Studies in the Chinese Language II: Social Issues 3(3,0) In-depth study of terminology and syntax for specific subject areas in contemporary social issues. All readings and discussions are in Chinese. Preq: CHIN 306 or consent of instructor.

CHIN 416 Chinese for International Trade II 3(3,0) Study of language, concepts, and the environment of Chinese-speaking markets of the world. Considers sociocultural, political, and economic issues relevant to the Chinese-speaking business world and the ramifications of these issues in global marketing. Classes are conducted in Chinese. Preq: CHIN 316 or consent of department chair.

CHIN 417 Chinese for Health Professionals II 3(3,0) Continuation of CHIN 317 with increased emphasis on managerial aspects of the health-care system in China. Taught in Chinese. Preq: CHIN 317 or consent of instructor.

CHIN (ANTH) 418 Chinese Culture and Society 3(3,0) Examines basic cultural values and the patterns of Chinese social life. Focuses on Chinese social organization and interpersonal dynamics, including the family system, gender identities, social exchanges and networks. All readings and discussions are in English. May not be used to satisfy general foreign language requirements.
CHIN 497 Creative Inquiry—Chinese 1-4(1-4,0)
Continuation of research initiated in CHIN 397. Students complete their projects and disseminate their research results. Prereq: CHIN 397 or consent of instructor.

CHIN 498 Independent Study 1-3(1-3,0)
Supervised study and research on selected topics in Chinese studies. May be repeated for a maximum of six credits. Prereq: Junior standing and consent of department chair.

CHIN 499 Selected Topics in Chinese Culture 3(3,0)
Examination of various social and cultural topics, including art and literature, philosophical and religious traditions, health and healing, and folk and popular cultures. May be repeated for a maximum of six credits, but only if different topics are covered. Readings and discussions are in English. May not be used to satisfy general foreign language requirements.

CITY AND REGIONAL PLANNING

Professors: M. Lauria, J.B. London, D.J. Nadeniek, Chair; B.C. Noeck; Associate Professors: M.G. Cunningham, J.T. Farris, S.L. Sperry; Visiting Assistant Professor: C.A. Schively; Lecturer: R.W. Bainbridge; Adjunct Professor: G.A. Vander Mey

C R P 401, 601 Introduction to City and Regional Planning 3(3,0)
Introduces students from other disciplines to city and regional planning. Spatial and nontemporal areas of the discipline are explored through a wide-ranging lecture/ seminar program. Prereq: Consent of instructor.

C R P 403, 603 Seminar on Planning Communication 3(3,0)
In-depth analysis of methods to communicate planning and policy decisions effectively. Familiarizes students with the various communication skills needed by planners, policy makers, and other professionals to become successful practitioners. Prereq: Consent of instructor.

C R P (C E) 412, 612 Urban Transportation Planning 3(3,0) See C E 412.

CIVIL ENGINEERING


C E 199 Creative Inquiry—Civil Engineering 1-4(1-4,0)
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.

C E 201, H201 Statics 3(3,0) Forces and force systems and their external effect on bodies, principally the condition of equilibrium. The techniques of vector mathematics are employed, and the rigor of physical analysis is emphasized. Prereq: PHYS 122 with a C or better. Coreq: MTHSC 206.

C E 205 Statics Design 3(3,0) Introduction to fluid mechanics, including hydrostatics and fluid flow. Includes principles of mass, momentum, and energy conservation. Other topics include conduit flow, pump systems, and open channel flow. Laboratory experiments familiarize students with laboratory techniques and instrumentation. The Effective Technical Communications Laboratory is used to prepare a presentation for a lab assignment. Prereq: C E 208 or E M 202 with a C or better.

C E 207 Engineering Statics 3(3,0) Builds on statics to develop relationships between external loads on structural elements of civil engineering interest and the resulting internal loads and deformations. Students are exposed to the development of stress and deformation formulas and the identification and use of significant mechanical properties of civil engineering materials. Prereq: C E 201.

C E 208 Dynamics 2(2,0) Study of kinetics and kinematics of particles and rigid bodies, work and energy, impact and momentum. Prereq: C E 201 and PHYS 122 with C or better. Coreq: MTHSC 206.

C E 255 Geometrics 3(3,2) Spatial data collection methods, including surveying, digital photogrammetry and remote sensing, and global positioning systems. Methods and technologies used to manage, manipulate, and analyze spatial and associated attribute data, including geographic information systems. Coreq: E G 210.

C E 299 Creative Inquiry—Civil Engineering 1-4(1-4,0)
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.

C E 301 Structural Analysis 3(3,0) Calculation of design loads and load paths for buildings and other structures. Use of classical analysis techniques to determine support reactions, internal member forces, and structural displacements of statically determinate and indeterminate structural systems. Prereq: C E 206 or consent of instructor.

C E 311 Transportation Engineering Planning and Design 3(3,0) Covers planning, design, and operation of transportation facilities, including highways and airports. Includes economic, safety, and environmental considerations. Public transit systems are covered. Prereq: C E 225, Coreq: EX ST 301.

C E 321 Geotechnical Engineering 4(3,3) Mechanical and physical properties of soils and their relation to soil action in problems of engineering, such as classification, permeability, shearing strength, and consolidation: design of embankments and retaining walls with geotextiles. Prereq: C E 206 and ENGR 130.

C E 331 Construction Engineering and Management 3(3,0) Considers construction contracts, technical specifications, cost estimating, project scheduling, cost control, materials management, quality control, and quality assurance. Prereq: Junior standing.

C E 341 Introduction to Fluid Mechanics 4(3,3) Analysis of the matrix formulation of the direct stiffness method. Consideration is given to commonly faced computer modeling issues and the nonlinear analysis of structures. Prereq: C E 301 or consent of instructor.

C E 401, 601 Matrix Structural Analysis 3(3,0) Analysis of determinate and indeterminate structures using the matrix formulation of the direct stiffness method. Consideration is given to commonly faced computer modeling issues and the nonlinear analysis of structures. Prereq: C E 301 or consent of instructor.

C E 402 Reinforced Concrete Design 3(3,0) Design of reinforced concrete beams, slabs, columns and footings using ultimate strength design. An introduction to working stress analysis is also included. Prereq: C E 301 or consent of instructor.
Courses of Instruction

C E 404, 604 Masonry Structural Design 3(3,0)
Introduction to design of structural elements for masonry buildings, including lintels, walls, shear walls, columns, pilasters, and retaining walls. Reinforced and unreinforced elements of concrete or clay masonry are designed by allowable stress and strength design methods. Introduces construction techniques, materials, and terminology used in masonry. Prereq: C E 402 or consent of instructor.

C E 406 Structural Steel Design 3(3,0)
Introduction to the design of structural elements found in steel buildings, in particular the design of steel tension members, beams, columns, beam-columns, and connections. Emphasizes the AISC-LRFD Specifications for steel design, though reference is made to the ASD Specification with comparisons made where appropriate. Prereq: C E 301 or consent of instructor.

C E 407, 607 Wood Design 3(3,0)
Introduction to wood design and engineering; properties of wood and wood-based materials; design of beams, columns, walls, roofs, panel systems, and connections. Includes overview of various steel and concrete systems. Discusses practical selection and design issues and design of proprietary building materials and components such as steel joists, diaphragms, engineered wood products, etc. Prereq: C E 321 and CE 301, or consent of instructor.

C E 410, 610 Traffic Engineering: Operations 3(3,0)
Basic characteristics of motor-vehicle traffic, highway capacity, applications of traffic control devices, traffic design of parking facilities, engineering studies, traffic safety, traffic laws and ordinances, and public relations. Prereq: C E 311 or consent of instructor.

C E 411, 611 Roadway Geometric Design 3(2,3)
Geometric design of roadways, at-grade intersections, and interchanges in accordance with conditions imposed by driver ability, vehicle performance, safety, and economics. Prereq: C E 311 or consent of instructor.

C E (C R P) 412, 612 Urban Transportation Planning 3(3,0)
Consideration of urban travel characteristics, characteristics of transportation systems, transportation and land-use studies, trip distribution and trip assignment models, city patterns and subdivision layout. Prereq: C E 311 or consent of instructor.

C E 421, 621 Geotechnical Engineering Design 3(3,0)
Study of the relationship of local geology to soil formations, groundwater, planning of site investigation, sampling procedures, determination of design parameters, foundation design, and settlement analysis. Prereq: C E 321 or consent of instructor.

C E 424, 624 Earth Slopes and Retaining Structures 3(3,0)
Considers the principles of geology, groundwater and seepage, soil strength, slope stability, and lateral earth pressure and their application to the design of excavations, earth fills, dams, and earth-retaining structures. Prereq: C E 321 or consent of instructor.

C E 425, 625 Soil-Structure Interaction 3(3,0)
Study of the interaction between soil and structural elements such as pile foundations and retaining structures subjected to static and dynamic loads; application of general purpose finite element software for solving soil-structure interaction problems; introduction to the theory of finite element method, beams on elastic foundation, pry curves and advanced testing procedures. Prereq: C E 321 and C E 301 or consent of instructor.

C E 433, 633 Construction Planning and Scheduling 3(3,0)
Study of principles and applications of the Critical Path Method (CPM) and Project Evaluation and Review Techniques (PERT). Includes project breakdown and network graphics; identification of the critical path and resulting floats; definition and allocation of materials, equipment, and manpower resources; resource leveling, compression, and other network adjustments; and computer applications using packaged routines. Prereq: C E 331 or consent of instructor.

C E 434, 634 Construction Estimating and Project Control 3(3,0)
Instruction in specifications, contracts, and bidding strategies; purchasing and subcontracting policies; accounting for materials, supplies, subcontracts, and labor; procedural details for estimating earthwork, reinforced concrete, steel, and masonry. Also considers overhead and profit items. Prereq: C E 331 or consent of instructor.

C E 435, 635 Infrastructure Project Planning 3(3,0)
Covers concepts related to planning, cost estimating, financing and executing public works projects from the agency owner perspective. Advanced concepts of economic analysis, risk analysis and database management systems are addressed. Traditional and innovative project contracting strategies, including incentive contracts and public-private partnerships, are discussed. Prereq: C E 352.

C E 436, 636 Sustainable Construction 3(3,0)
Presents the "why," "what" and "how" for sustainable construction projects. Students gain a working understanding of how to minimize the negative impacts of buildings and other large construction projects. Prereq: C E 331 or consent of instructor.

C E 438, 638 Construction Support Operations 3(3,0)
Describes activities necessary for the completion of a construction job although not specifically recognized as direct construction activities: general conditions, safety, security, quality assurance, value engineering; organizational support features and typical implementation procedures. Prereq: C E 331 and EX ST 301, or consent of instructor.

C E 439, 639 Construction Equipment Selection and Maintenance 3(3,0)
Methodology of selecting the right equipment of the right size for each task of the construction job on the basis of powertrain characteristics, crew size, terrain conditions, and job requirements. Cycle time, cost, specifications, maintenance, replacement policy, monitoring. Prereq: C E 331 or equivalent.

C E 443, 643 Water Resources Engineering 3(3,0)
Extension of the concepts of fluid mechanics to applications in water supply, water resource assessment, water transmission, water distribution networks, pump and pipe selection, pipe networks, and analysis of open channel appurtenances. Prereq: C E 341.

C E 446, 646 Flood Hazards and Protective Design 3(3,0)
Study of flood hazards and methods of protective design of the built environment; floodplain mapping and delineation; methods for determining base flood elevations. Discusses flood-resistant construction, flood proofing, and governmental regulations. Includes case studies and design projects. Coreq: C E 342 or consent of instructor.

C E 447, 647 Stormwater Management 3(3,0)
Evaluation of peak discharges for urban and rural basins, design of highway drainage structures such as inlet and culverts; stormwater and receiving water quality; best management practices, detention and retention ponds, and erosion and sediment control. Prereq: C E 342; Coreq: EE&S 401 or consent of instructor.

C E 456, 656 Pavement Design and Construction 3(3,0)
Introduction to design methods, construction practices, maintenance strategies, and decision making process related to pavements. Other topics, such as environmental considerations and special pavement types and materials, are also covered. Prereq: C E 311 and 351 or equivalent; Coreq: C E 321 or equivalent.

C E 457, 657 Materials Testing and Inspection 3(3,0)
Introduction to the role of testing and inspection professionals in civil engineering projects. Uses a practical approach to applying concepts to real-world situations through the completion of several team projects such as material characterization, construction QC/QA, forensic evaluation, and proposal development. Prereq: C E 321 and 351 or equivalent.

C E 459 Capstone Design Project 3(1,6)
Students apply creativity with their engineering knowledge in the solution of open-ended civil engineering problems. Problems are formulated and solutions are evaluated by faculty and practicing engineers. Communication skills are developed through presentations, correspondence and project reports. Prereq: All required 300-level C E courses and a Technical Design Requirement.

C E 462, 662 Coastal Engineering I 3(3,0)
Introduction to coastal and oceanographic engineering principles, including wave mechanics, wave-structure interaction, coastal waterlevel fluctuations, coastalzone processes, and design considerations for coastal structures and beach nourishment projects. Prereq: C E 341 or consent of instructor.

C E 482, 682 Groundwater and Contaminant Transport 3(3,0)
Basic principles of groundwater hydrology and transport of contaminants in groundwater systems; groundwater system characteristics; steady and transient flow; well hydraulics, design, and testing; contaminant sources, movement and transformations. Prereq: C E 341. Coreq: EE&S 401.

C E H487 Senior Honors Project 1-3
Studies or laboratory investigations on special topics in civil engineering which are of interest to individual students and faculty members. Arranged on a project basis for a maximum of individual student effort under faculty guidance. May be repeated for a maximum of three credits. Prereq: Senior standing in Civil Engineering Senior Departmental Honors Program.

C E H488 Honors Research 1-2
Individual research under the direction of a Civil Engineering faculty member. Prereq: C E H389.
C E H489 Honors Research II 3(3,0) Individual research under the direction of a Civil Engineering faculty member. Prereq: C E H488.

C E 490 Special Projects 1-3(1-3,0) Studies or laboratory investigations on special topics in civil engineering which are of interest to individual students and staff members. Arranged on a project basis with a maximum of individual student effort and a minimum of staff guidance. May be repeated for a maximum of three credits. Prereq: Senior standing.

C E 491, 691 Selected Topics in Civil Engineering 1-6(1-6,0) Structured study of civil engineering topics not found in other courses. May be repeated for a maximum of six credits, but not for graduate credit. Prereq: Consent of instructor.

C E 499 Creative Inquiry—Civil Engineering I-I 1-4(1,4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.

CLEFTON UNIVERSITY

C U 101 University Success Skills 2(3,0) Introduction to a variety of topics critical to students’ success. Topics include time management, goal setting, test taking, campus resources and policies, critical thinking, and diversity. Students are given opportunities to discover and practice many procedures, techniques, and tips. Limited to freshmen and first semester transfer students.

COLLEGE OF ARCHITECTURE, ARTS AND HUMANITIES

CAAH 201 Cultural Literacies Across Media 3(3,0) Hands-on practicum course in which students reflect critically on the cultural, visual, and professional and technological literacies learned as a result of a semester-long study abroad experience. May be repeated for a maximum of six credits. Prereq: Enrollment in a study abroad program and ENGL 103, or consent of instructor.

COLLEGE OF ENGINEERING AND SCIENCE

CES 101 Engineering Disciplines and Skills with Recitation 3(2,3) Introduction to engineering disciplines. Students study spreadsheets and obtain graphical solutions. They complete team-based design projects. Provides a recitation for students who are not calculus-ready. Credit toward degree will be given for only one of CES 101 or 102. Coreq: MTHSC 103 or 105.

CES 102, H102 Engineering Disciplines and Skills 21,2) Provides solid foundation of skills to solve engineering problems. Students demonstrate problem solving techniques with spreadsheets, dimensions and units; use modeling techniques and interpret validity of experimental results. Students design projects on multi-discipline teams. Introduces professional and societal issues appropriate to engineering. Various forms of technical communication are emphasized. Coreq: MTHSC 104 or 106.

CES 190, H190 Creative Inquiry in Engineering and Science I 1-3(1-3,0) Individual or group projects in engineering and/or science. Projects may be interdisciplinary and involve analysis, design, and/or implementation. Instruction in methods, tools, and equipment will be provided when appropriate. Prereq: Consent of instructor.

CES 290, H290 Creative Inquiry in Engineering and Science II 1-3(1-3,0) Individual or group projects in engineering and/or science. Projects may be interdisciplinary and involve analysis, design, and/or implementation. Instruction in methods, tools, and equipment will be provided when appropriate. Prereq: Consent of instructor.

COMM 150 Introduction to Human Communication 3(2,2) Overview of theoretical approaches to the study of communication, including the theory and practice of interpersonal/small group/intercultural/public communication. Includes a laboratory.

COMM 162 Forensic Laboratory 1(0,3) Research, preparation, and practice leading to participation in on-campus and intercollegiate debate and individual events competition. May be repeated for a maximum of four credits.

COMM 163 Advanced Forensic Laboratory I 1(0,3) Advanced research, preparation, and practice leading to continued participation in on-campus and intercollegiate debate and individual events competition. May be repeated for a maximum of four credits.

COMM 201 Introduction to Communication Studies 4(3,2) Introduces Communication Studies majors to and prepares them for continued study in the discipline by providing them with an overview of important issues, areas of study, and approaches to the field. Includes a writing laboratory experience. Prereq: COMM 101.

COMM 250, H250 Public Speaking 3(1,1) Practical instruction in public speaking; practice in the preparation, delivery, and criticism of short speeches. Develops an understanding and knowledge of the process of communication. Includes a laboratory.

COMM 300 Communication in a World Context 3(3,0) In-depth examination of differences in communication practices and meanings seen through a global perspective. Prereq: COMM 201 with a C or better or consent of instructor.

COMM 301 Communication Theory 3(3,0) Students explore the breadth and depth of theories within the major frameworks of the communication studies discipline. Prereq: COMM 201 with a C or better.

COMM 302 Mass Communication Theory 3(3,0) Survey of the breadth and history of theories of mass communication and mass media from the 19th century to the present. Emphasizes contemporary schools of thought, theoretical debates, and the continuing controversies in the field. Prereq: COMM 201 with a C or better or consent of instructor.

COMM 303 Communication Law and Ethics 3(3,0) Major topics in communication law and free expression and in communication ethics. Prereq: COMM 201 with a C or better or consent of instructor.

COMM 304 Youth, Media, and Culture 3(3,0) Grounded in the cultural studies paradigm, examines the relationship among youth, mass media, and popular culture. Focuses on issues such as how youth are portrayed in media, how young people interpret the products of mass media/culture, and how youth creates its own media culture. Prereq: COMM 201 with a C or better or consent of instructor.

COMM 305 Persuasion 3(3,0) Study of the processes by which communication influences attitudes, beliefs, and behaviors in our personal, social, civic, and professional lives. After discussion of definitional and methodological issues, particular theories of persuasion are examined. Treatment of political, market-driven, and social persuasion concludes the course. Prereq: COMM 201 with a C or better or consent of instructor.

COMM 101 Communication Academic and Professional Development 1(1,0) Introduces students to General Education and Communication Studies major requirements, explains connections between general education and major courses, explores careers in communication, and prepares students to develop digital portfolios, résumés, and interview skills specific to communication professions and/or graduate school. To be taken Pass/Fail only.

COMM 107 Media Representations of Science and Technology 3(3,0) Examines mediated representations of science and technology from a communication perspective. Attention is paid to portrayals/covers of science and technology in popular film, television, Internet, journalism, and other media. Students examine an array of theoretical issues and case studies in this area.
COMM 306 Discourse, Criticism, and Society 3(3,0) Students explore theoretically-grounded methods of critical and cultural description, analysis, interpretation, and evaluation of public discourse. Preq: COMM 201 with a C or better.

COMM 307 Public Communication of Science and Technology 3(3,0) Examines the role of science and technology in society from a communication perspective. Particular attention is paid to this dynamic in public culture. Students examine an array of theoretical issues and case studies in this area. Preq: COMM 201 with a C or better or consent of instructor.

COMM 308 Public Communication and Popular Culture 3(3,0) Examines artifacts of popular culture, paying particular attention to their relationship to politics and public life. Explores the structures and constraints of the culture industry. Students apply communication principles to various examples. Preq: COMM 201 with a C or better or consent of instructor.

COMM 309 Visual Discourse and the Public 3(3,0) Examines the role of visuality in society and the cultural implications for ways of seeing. Using visual artifacts of various types, students learn the logic of visual representation. Preq: COMM 201 with a C or better or consent of instructor.

COMM 310 Quantitative Research Methods in Communication Studies 3(3,0) Explores methods of quantitative communication inquiry, including theory/research relationship, conducting studies, and utilizing statistical software. Methods may include experiments, surveys, and content analysis. Preq: COMM 201 with a C or better.

COMM 311 Qualitative Research Methods in Communication Studies 3(3,0) Explores methods of qualitative communication inquiry, including theory/research relationship and conducting studies. Methods may include interviewing, focus groups, textual analysis, and ethnography. Preq: COMM 201 with a C or better.

COMM 315 Critical Discourse Theory 3(3,0) Introduction to a variety of theoretical concepts associated with the critical study of public discourse. Students analyze theories related to the strategic use of language and its epistemological characteristics. Theoretical topics may include critical/cultural studies, visual communication, ideology, persona, social change, and identity studies. Preq: COMM 201 with a C or better.

COMM (W S) 316 Girlhood, Media, and Popular Culture 3(3,0) Explores how the mass media and popular culture contribute to social constructions of girlhood. Employing the critical lens of feminist and communication theories, students examine mediated depictions of girls as well as how girls actively produce and negotiate media and popular culture. Preq: COMM 201 with a C or better or W S 301 or consent of instructor.

COMM 320 Broadcast Production 3(2,2) Explores the broadcast side of journalism. Students produce broadcast video packages, as well as newscasts. Students learn news writing, filming and video editing.

COMM 325 Sports Communication 3(3,0) Covers fundamentals of communicating in a sports environment. Includes the basics of communicating for print and broadcast news, as well as communicating for public relations and sports information. Also covers ethical considerations and the role of sports in American culture. Preq: COMM 201 with a C or better or consent of instructor.

COMM 326 Public Relations in Sports 3(3,0) Focuses on the preparation of professional sports communication materials for both internal and external audiences. Topics include the mechanics of creating press releases and other materials, as well as techniques in managing crises. Preq: COMM 201 with a C or better or consent of instructor.

COMM 327 Sports Media Criticism 3(3,0) Students gain in-depth understanding of sports communication issues through critically analyzing actual media coverage of sporting events, addressing social issues involved in college and professional sports, and developing an understanding of sports promotion and advertising. Preq: COMM 201 with a C or better or consent of instructor.

COMM 330 Nonverbal Communication 3(3,0) Develops a knowledge of the functions of nonverbal behaviors in human interaction. This includes the study of gesture and movement, physical appearance, vocal behavior, immediacy, time and space, and intercultural differences. Promotes understanding of nonverbal rules. Preq: COMM 201 with a C or better or consent of instructor.

COMM 348 Interpersonal Communication 3(3,0) Survey of the theories and research in interpersonal communication with emphasis on the application of research findings and developmental strategies for intra- and intercultural relationships. Preq: COMM 201 with a C or better or consent of instructor.

COMM 350 Small Group and Team Communication 3(3,0) Examines the principles and skills involved in effective small-group communication. Preq: COMM 201 with a C or better or consent of instructor.

COMM 355 Principles of Public Relations 3(3,0) Students learn the principles, theories, process, history and contexts of public relations. Preq: COMM 201 with a C or better or consent of instructor.

COMM 356 Stakeholder Communication 3(3,0) Focuses on external stakeholders such as the media, the community, and the government. Students learn theory- and research-based communication tactics to manage various stakeholder relationships. Preq: COMM 355 or consent of instructor.

COMM 361 Argumentation and Debate 3(3,0) Basic principles of argumentation with emphasis on developing skills in argumentative speech. The role of the advocate in contemporary society with an emphasis on and an appreciation of formal debate. Preq: COMM 250 or consent of instructor.

COMM 362 Communication and Conflict Management 3(3,0) Introduces the study of communication practices in conflict situations within various personal and professional settings. Emphasis is on the central role of communication in the understanding and management of conflict. Preq: COMM 201 with a C or better or consent of instructor.

COMM 364 Organizational Communication 3(3,0) Examination of the process, theories, and techniques of communications within small groups and other organized bodies. Preq: COMM 201 with a C or better or consent of instructor.

COMM 366 Special Topics in Communication Studies 3(3,0) Consideration of select major areas of study in the field. With consent of department chair, may be repeated for a maximum of 15 credits, but only if different topics are covered.

COMM 368 Applied Communication 3(3,0) Students apply communication theory, research and processes to understanding a variety of practical situations and communication contexts. Addresses the history, purpose, practices and ethics of applied communication research. Preq: COMM 301 with a C or better and at least one of COMM 306, 310, or 311 with a C or better or consent of instructor.

COMM 369 Political Communication 3(3,0) Examination of American political rhetoric after 1900, focusing on such notable speakers as Franklin D. Roosevelt, John F. Kennedy, and Martin Luther King Jr. Preq: COMM 201 with a C or better or consent of instructor.

COMM 390 Communication Studies Internship 3(0,0) Preplanned, preapproved, faculty-supervised internship provides Communication Studies majors with field experience in areas related to their curriculum. May be repeated for a maximum of six credits. To be taken Pass/Fail only. Preq: Junior standing, consent of faculty advisor.

COMM 399 Creative Inquiry in Communication Studies 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue small group work on a particular research topic or practical problem. Arrangements with mentors must be established prior to registration. Content varies. May be repeated for a maximum of nine credits. Preq: COMM 201 with a C or better or consent of instructor.

COMM 402 Mass Communication: History and Criticism 3(3,0) Critical examination of mass communication in America, including discussions of history, theory, and current issues in television, film, popular music, telecommunications, and other media. Preq: COMM 201 with a C or better or consent of instructor.

COMM 405 Public Contest and Change 3(3,0) Examines the role of public communication in the process of contesting social values and practices and in the subsequent change that sometimes occurs. Students explore the public’s relationship with mass media as well as other forms of communication practices that can produce cultural change. Preq: COMM 201 with a C or better and 305 or consent of instructor.

COMM 425 Advanced Sports Communication 3(3,0) Combination seminar and primary research class that explores contemporary sports communication issues. Students write position papers on seminar topics and conduct primary research on sports communication topics of their choice. Preq: COMM 325 or consent of instructor.

COMM (ENGL) 451, 651 Film Theory and Criticism 3(2,3) See ENGL 451.

Courses of Instruction
COMM 492 Communication and Negotiation 3(3,0) Building on the concepts and practices of conflict management, students develop knowledge and skills for distributive bargaining and integrative negotiation climates. Focuses on the objectives, goals, positions, interests, tactic, and other elements to negotiate successfully in a variety of situations. Prereg: COMM 362 or consent of instructor.

COMM 497, 697 Communication and Health 3(3,0) Considers institutional and health care communication issues as well as the relationship between social issues, communication, and health. Prereg: COMM 201 with a C or better or consent of instructor.

COMM 498 Communication Academic and Professional Development II 1(1,0) Students reflect upon curricular relationships among general education, major, and minor courses. They complete and revise digital portfolios for presentation to the major, University, graduate schools, or potential employers. Students participate in resume building, job seeking, and interviewing activities. Prereg or Coreq: COMM 495 or H496.

COMM 499 Independent Study 1-3(1-3,0) Tutorial work for students with special interests or projects in communication studies outside the scope of existing courses. May be repeated for a maximum of nine credits. Prereg: Consent of department chair.

COMMUNITY AND RURAL DEVELOPMENT
See also courses listed under Applied Economics.

Professors: C.E. Curtis Jr., M. Espey, D.W. Hughes; Associate Professors: R.D. Lamie, S.R. Templeton; Assistant Professors: K.A. Boys, K.L. Robinson

C R D (SOC) 235 Introduction to Leadership 3(3,0) See SOC 235.

C R D 335 Leadership in Organizations and Communities 3(3,0) Students present leadership models, principles, skills, negotiation techniques, and practices to improve effectiveness in organizations and communities; use current theory and research findings to evaluate effective leadership; demonstrate the role of effective leadership in shaping future organizations and social structures in public and private sectors. Prereg: Introductory course in a social science (sociology recommended).

C R D 336 Community Development Methods 3(3,0) Research methodology is applied to community, leadership, and economic development. Steps include problem identification, data collection, analysis, and interpretation. Special attention is given to case study approach, applied research design, data collection options, and computer-based analysis of community-based data to generate findings and implications for policy change. Prereg: C R D 335, EXST 301 or equivalent.

C R D (AP EC) 357 Natural Resources Economics 3(3,0) Principles and problems involved in the use of soil, water, forest, and mineral resources, with special emphasis on economic aspects of alternative methods of resource utilization. Prereg: AP EC 202, ECON 200 or 211.

C R D (AP EC, HLTH) 361 Introduction to Health-Care Economics 3(3,0) Introductory course in which students learn the basic economics of the institutions comprising the health-care industry. Topics include the underlying supply, demand, and institutional factors impacting health-care availability and cost of health care.

C R D (AP EC) 411, 611 Regional Impact Analysis 3(3,0) Techniques for analysis of the growth and decline of regions, including economic-base theory, shift share, regional input-output, regional economic models, and fixed impact models. Prereg: AP EC 202 or ECON 211 and 212.

C R D (AP EC) 412, 612 Regional Economic Development Theory and Policy 3(3,0) Development of rural economic activity in the context of historical, theoretical, and policy aspects of friction associated with spatial separation. Considers location factors, transfer costs, location patterns, and regional growth policy. Prereg: AP EC 202 or ECON 211 or equivalent.

C R D (AP EC) 491 Internship, Agribusiness, and Community and Rural Development 1-6(0,2-12) Internship under faculty supervision in an approved agency or firm. Internships provide students with work experience in agribusiness and community and rural development. Students submit a comprehensive report within one week of the end of the internship. A maximum of six internship credits may be earned. Prereg: Junior standing and/or consent of instructor.

C R D 492, 692 Case Study Project 3(3,0) Capstone course engaging students in in-depth case study projects in community and economic development. Designed to enhance professional development, career interests, and practical experience. Students may participate in an internship, field experience, service learning activity, or investigation of a community, leadership, or economic development topic. Prereg: C R D 336 and consent of instructor.

C R D (AP EC) 494 Creative Inquiry—Community and Rural Development 1-3(1-3,0) Multisemester commitment to participate in agricultural and applied economics and community and economic development related research experience for students working in teams, mentored and directed by a faculty member. Students learn to collect, analyze, evaluate, and present information. Suitable for inclusion in the student’s e-portfolio. May be repeated for a maximum of 12 credits. Prereg: Consent of instructor.

COMPUTER SCIENCE


CP SC 101, H101 Computer Science I 4(3,2) Introduction to modern problem solving and programming methods. Special emphasis is placed on algorithm development and software life cycle concepts. Includes use of appropriate tools and discusses ethical issues arising from the impact of computing upon society. Intended for students concentrating in computer science or related fields. Prereg: MTHSC 105 or satisfactory score on the Clemson Mathematics Placement Test or consent of instructor.
Courses of Instruction

CP SC 102, H102 Computer Science II 4(3,2)
Continuation of CP SC 101. Continued emphasis on problem solving and program development techniques. Examines typical numerical, nonnumerical, and data processing problems. Introduces basic data structures. Credit may not be received for both CP SC 102 and 210. Preq: CP SC 101 with a C or better.

CP SC 104 Introduction to the Concepts and Logic of Computer Programming 2(1,2)
Introduction to the concepts and logic of computer programming. Simple models are used to introduce basic techniques for developing a programmed solution to a given problem. Problem solving techniques are considered. Not open to students who have received credit for CP SC 101, 111, 157, or 210.

CP SC 111 Introduction to Programming in C 3(2,2)
Introduction to computer programming in C and its use in solving problems. Intended primarily for technical majors. Basic instruction in programming techniques, algorithms and standard Unix software development tools and utilities. Credit may not be received for both CP SC 101 and CP SC 111.

CP SC 115 Introduction to Computational Science 3(3,0)
Introduction to systems thinking. Includes development of dynamical systems models using visual modeling tools and development of dynamical systems using agent based software. Class material investigates elementary science and engineering models.

CP SC 120 Introduction to Information Technology 3(3,2)
Investigation of ethical and societal issues based on the expanding integration of computers into our everyday lives. Considers historical background, terminology, new technologies and the projected future of computers. Includes practical experience with common computer software technologies. Will not satisfy Computer Science Requirements in any Computer Science major.

CP SC 161 Introduction to Visual Basic Programming 3(3,2)
Introduction to programming using the Visual Basic language. Topics include simple and complex data types, arithmetic operations, control flow, files, and database programming. Several projects are implemented during the semester.

CP SC 207 Discrete Structures for Computing 3(3,0)
Introduces ideas and techniques from discrete structures that are widely used in the computing sciences. Topics emphasize techniques of rigorous argumentation and application to the computing disciplines. Preq: CP SC 101 or 111; and MT HSC 102 or 106; or consent of instructor.

CP SC 210 Programming Methodology 4(3,2)
Introduction to programming techniques and methodology. Topics include structured programming, stepwise refinement, program design and implementation techniques, modularization criteria, program testing and verification, basic data structures, and analysis of algorithms. Credit may not be received for both CP SC 102 and 210. Preq: CP SC 111 or equivalent; satisfactory performance on a protest.

CP SC 212 Algorithms and Data Structures 4(3,2)
Study of data structures and algorithms fundamental to computer science; abstract data-type concepts; measures of program running time and time complexity; algorithm analysis and design techniques. Preq: CP SC 102 or 210 with a C or better.

CP SC 215 Software Development Foundations 3(2,2)
Intensive study of software development foundations. Advanced coverage of programming language primitives, function-level design principles, and standard development and debugging tools. Introductory coverage of module-level design principles, program specification and reasoning principles, and validation and verification techniques. Preq: CP SC 102 or 210 with a C or better.

CP SC 220 Microcomputer Applications 3(3,0)
Applications of microcomputers to formulate and solve problem models. Emphasizes applications development in database and spreadsheet environments. Current software products are used. Preq: CP SC 120 or MGT 218 or equivalent.

CP SC 231 Introduction to Computer Organization 4(3,2)
Study of the machine architectures on which algorithms are implemented and requirements of architectures that support high-level languages, programming environments, and applications. Preq: CP SC 102 or 210 with a C or better.

CP SC 281 Selected Topics in Computer Science 1(4-14)
Areas of computer science in which new trends arise. Innovative approaches to variety of problems in the use and understanding of basic computing concepts are developed and implemented. May be repeated for a maximum of eight credits, but only if different topics are covered. Preq: Consent of instructor.

CP SC 291 Seminar in Professional Issues 1(1,0)
Considers the impact of computer use on society. Discusses ethical use of software and protection of intellectual property rights. Professor is viewed historically; organizations important to the profession are discussed; the development process for standards is presented; and students are introduced to the professional literature. Preq: CP SC 102 or 210, or consent of instructor.

CP SC (E C E) 322 Introduction to Operating Systems 3(3,0)
Detailed study of management techniques for the control of computer hardware resources. Topics include interrupt systems, primitive level characteristics of hardware and the management of memory, processor, devices, and data. Credit may not be received for both CP SC 322 and 332. Preq: CP SC 212 and 231 with a C or better; or E C E 223 and 272 with a C or better.

CP SC 330 Computer Systems Organization 3(3,0)
Introduction to the structure of computer systems. Various hardware/software configurations are explored and presented as integrated systems. Topics include digital logic, basic computer organization, computer arithmetic, memory organization, input/output organizations, interrupt processing, multiprocessors, and cluster computers. Preq: CP SC 212 and 231 with a C or better.

CP SC 350 Foundations of Computer Science 3(3,0)
Development of the theoretical foundations of programming, algorithms, languages, automata, computability, complexity, data structures, and operating systems; a broad range of fundamental topics is consolidated and extended in preparation for further study. Preq: CP SC 207 and 212 with a C or better.

CP SC (E C E) 352 Programming Systems 3(3,0)
See E C E 352.

CP SC 360 Networks and Network Programming 3(3,0)
Introduction to basic concepts of computer network technologies and network programming. Topics include network programming, layered protocol architectures, local and wide area networks, internetwork and intranetwork concepts, security. Socket level programming is introduced and used throughout the course. Preq: CP SC 212, 215 with a C or better.

CP SC 362 Distributed and Cluster Computing 3(3,0)
Introduction to the basic technology of and programming techniques for distributed and cluster computing. Standard techniques for developing parallel solutions to problems are introduced and implemented. Software systems that provide high-level abstractions for data communications are considered. Preq: CP SC 360 with a C or better.

CP SC 371 Systems Analysis 3(3,0)
Incorporates a study of the decision-making process at all levels with the logical design of information systems. Extensive study of the system life cycle with emphasis on current as well as classical techniques for describing data flows, data structures, file design, etc. Preq: CP SC 360.

CP SC 372 Introduction to Software Engineering 3(3,0)
Intensive introduction to software engineering. Focuses on each major phase of the software lifecycle. Introductory coverage of requirements analysis, requirements modeling, design modeling, and project management. Intermediate coverage of module-level design principles, program specification and reasoning principles, and program validation and verification techniques. Preq: CP SC 212 and 215 with a C or better.

CP SC H395 Honors Seminar 1(1,0)
Research topics in various areas of computer science are presented. Methods for identifying and initiating research projects are considered. May be repeated for a maximum of two credits. Preq: Admission to Departmental Honors Program.

CP SC 404, 604 Computer Graphics Images 3(3,0)
Presents the theory and practice behind the generation and manipulation of two-dimensional digital images within a computer graphics context. Image representation and storage, sampling and reconstruction, color systems, affine and general warps, enhancement and morphology, compositing, morphing, and non-photorealistic transformations. Preq: CP SC 212 and MT HSC 311, or D P A 401, or consent of instructor.

CP SC 405, 605 Computer Graphics 3(3,0)
Computational, mathematical, physical and perceptual principles underlying the production of effective three-dimensional computer graphics imagery. Preq: CP SC 212 and MT HSC 311, or D P A 401, or consent of instructor.

CP SC 406, 606 General Purpose Computation on Graphical Processing Units 3(3,0)
Instructor in the design and implementation of highly parallel, GPU-based solutions to computationally intensive problems from a variety of disciplines. The OpenCL language with inter-operable OpenGL components is used. Applications to models of physical systems are discussed in detail. Preq: CP SC 212 and MT HSC 206; or consent of instructor.
CP SC 411, 611 Virtual Reality Systems 3(3,0) Design and implementation of software systems necessary to create virtual environments. Discusses techniques for achieving real-time, dynamic display of photorealistic, synthetic images. Includes hands-on experience with electromagnetically-tracked, head-mounted displays and requires, as a final project, the design and construction of a virtual environment. Preq: CP SC 405 with a C or better.

CP SC 412, 612 Eye Tracking Methodology and Applications 3(3,0) Introduction to the human visual system; visual perception; eye movements; eye tracking systems and applications in psychology, industrial engineering, marketing, and computer science; hands-on experience with real time, corneal-reflection eye trackers, experimental issues. Final project requires the execution and analysis of an eye tracking experiment. Preq: CP SC 360, MKT 431, or PSYCH 310.

CP SC 414, 614 Human and Computer Interaction 3(3,0) Survey of human and computer interaction, its literature, history, and techniques. Covers cognitive and social models and limitations, hardware and software interface components, design methods, support for design, and evaluation methods. Preq: CP SC 212 and 215 with a C or better, or equivalent.

CP SC 416, 616 2-D Game Engine Construction 3(3,0) Introduction to tools and techniques necessary to build 2-D games. Techniques draw from subject areas such as software engineering, algorithms, and artificial intelligence. Students employ techniques such as sprite animation, parallax scrolling, sound, AI incorporated into game sprites, and the construction of a game shell. Preq: CP SC 212 and 215 with a C or better.

CP SC 419, 619 Physically Based Animation 3(3,0) Physically based modeling and dynamic simulation techniques used for the automatic description of motion and geometry for animation and computer graphics. Explores a variety of topics with special emphasis on the use of particle-systems to represent complex phenomena. Preq: CP SC 405 or consent of instructor.

CP SC 420, 620 Computer Security Principles 3(3,0) Covers principles of information systems security, including security policies, cryptography, authentication, access control mechanisms, system evaluation models, auditing, and intrusion detection. Computer security system case studies are analyzed. Preq: CP SC (E C E) 322 and 360 with a C or better.

CP SC 424, 634 System Administration and Security 3(3,0) Covers topics related to the administration and security of computer systems. Primary emphasis is on the administration and security of contemporary operating systems. Preq: CP SC 360 and (E C E) 322 or 332 with a C or better.

CP SC 428, 628 Design and Implementation of Programming Languages 3(3,0) Overview of programming language structures and features and their implementation. Control and data structures found in various languages are studied. Also includes runtime organization and environment and implementation models. Preq: CP SC 231, 350, 360 with a C or better.

CP SC 455, 655 Computational Science 3(3,0) Introduction to the methods and problems of computational science. Uses problems from engineering and science to develop mathematical and computational solutions. Case studies use techniques from Grand Challenge problems. Emphasizes the use of networking, group development, and modern programming environments. Preq: MTHSC 108, 311, and previous programming experience in a higher level language.

CP SC 462, 662 Database Management Systems 3(3,0) Introduction to database/data communications concepts as related to the design of online information systems. Problems involving structuring, creating, maintaining, and accessing multiple-user databases are presented and solutions developed. Comparison of several commercially available teleprocessing monitor and database management systems is made. Preq: CP SC 360.

CP SC 463, 663 On-line Systems 3(3,0) In-depth study of the design and implementation of transaction processing systems and an introduction to basic communications concepts. A survey of commercially available software and a project using one of the systems are included. Preq: CP SC 462.

CP SC 472, 672 Software Development Methodology 3(3,0) Advanced topics in software development methodology. Techniques such as chief programmer teams, structured design and structured walkthroughs are discussed and used in a major project. Emphasizes the application of these techniques to large-scale software implementation projects. Also includes additional topics such as mathematical foundations of structured programming and verification techniques. Preq: CP SC 360 and 372.

CP SC 481, 681 Selected Topics 1-3(1-3,0) Areas of computer science in which nonstandard problems arise. Innovative approaches to problem solutions which draw from a variety of support courses are developed and implemented. Emphasizes independent study and projects. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: Consent of instructor.

CP SC 491 Seminar in Professional Issues II 3(2,2) Considers the impact of computing system development on society. Discusses ethical issues in the design and development of computer software. Students discuss standards for professional behavior, the professional's responsibility to the profession, and techniques for maintaining currency in a dynamic field. Preq: Senior standing.

CP SC H495 Senior Thesis Research 1-3(1-3,0) Directed individual research project for honors students supervised by departmental faculty. May be repeated for a maximum of six credits. Preq: Senior standing.

CONSTRUCTION SCIENCE AND MANAGEMENT

Professors: D.C. Bausman, R.W. Liska, C.A. Piper; Associate Professors: S.N. Clarke, R.K. Schneider; Senior Lecturer: J.A. Wintz

C S M 100 Introduction to Construction Science and Management 3(3,0) Introduction to the construction industry and the Construction Science and Management Department. Preq: Construction Science and Management major or consent of department chair.

C S M 150 Construction Problem Solving 3(3,0) Fundamentals and application of formal problem solving, critical thinking and ethics. Preq: C S M 100, Construction Science and Management major, or consent of department chair.

C S M 201 Structures I 3(3,0) Study of statically determinate structural components and systems, including force applications and distributions in structural elements and the resulting stress-strain patterns in axial, shear, and bearing mechanisms. Preq: MTHSC 102 or 106, PHYS 207; Construction Science and Management or Architecture major, or consent of department chair.

C S M 202 Structures II 4(3,2) Study of force distribution and behavior in statically determinate structural components and systems; analysis and design of basic reinforced concrete, steel, wood, and formwork components and systems, including shear and moment stress, combined loading/stress conditions, and deflections. Preq: C S M 201, Construction Science and Management or Architecture major, or consent of department chair.

C S M 203 Materials and Methods of Construction 1 3(3,0) Descriptive study of the materials and methods of construction, focusing on nomenclature, building materials, and assembly of building systems consisting primarily of wood, masonry, residential interior and exterior finishes, and building foundations. Preq: Construction Science and Management or Architecture major, or consent of department chair. Preq or Coreq: A A H 210, C S M 100 (Construction Science and Management majors).

C S M 204 Contract Documents 3(2,3) Introduction to working drawings, specifications, and the various documents required to carry out a typical construction project. Preq: Construction Science and Management major, or consent of department chair. Coreq: C S M 205.

C S M 205 Materials and Methods of Construction II 3(3,0) Descriptive study of materials and methods of construction, focusing on nomenclature, building materials, and assembly of building systems consisting primarily of steel and concrete, in addition to roofing assemblies and interior and exterior commercial finishes. Preq: C S M 203, Construction Science and Management or Architecture major, or consent of department chair.

C S M 303 Soils and Foundations 3(2,3) Study of various types of soils and foundations, including soil testing, reports, compaction, stability, and function, as they relate to the construction process. Preq: C S M 202, Construction Science and Management major, or consent of department chair.

C S M 304 Environmental Systems I 3(3,0) Theory and practice of heating, ventilating, air conditioning, and plumbing systems for buildings. Preq: C S M 205, PHYS 208, Construction Science and Management or Architecture major, or consent of department chair.

CSM 351 Construction Estimating 3(2,2) Study of basic estimating as applied to construction projects. Includes take-off of material quantities, assigning labor and equipment production rates, and applying material prices, wage rates, and equipment costs to derive a total job cost. Prereq: CSM 204, 205, CPSC 120, all required MTHSC courses, Construction Science and Management major, or consent of department chair. Prereq or Coreq: CSM 303.

CSM 352 Construction Scheduling 3(2,2) Analysis of construction projects emphasizing estimating, scheduling, and resource leveling. Prereq: CSM 304 (or concurrent enrollment), 351, Construction Science and Management major, or consent of department chair. Coreq: CSM 353.

CSM 353 Construction Estimating II 3(2,2) Continuation of basic construction estimating with the additional component of computerized estimating. Includes material, labor, and equipment costs, production rates, bid ethics, constructability analysis, and understanding of other types of estimating procedures. Prereq: CSM 304 (or concurrent enrollment), 351, Construction Science and Management major, or consent of department chair. Coreq: CSM 352.

CSM 411 Safety in Building Construction 3(3,0) Study of construction safety management and controls. Prereq: Construction Science and Management major or consent of department chair. Coreq: CSM 453.

CSM 420 Highway Construction and Contracting 3(3,0) Study of contracting and construction of highways, including selection and use of equipment, construction of pavements, bridges, and drainage structures, and related processes. Prereq: CSM 303, 352, 353.

CSM 450 Construction Internship 1(0,0) Documentation of 800 hours of approved experience in the construction industry with evaluation of student portfolio and preparation and sitting for the American Institute of Constructors CFC Level I examination. Prereq: Consent of department chair.

CSM 453 Construction Project Management 3(3,0) Study of construction business organization, methods of project delivery, field organization, policy, ethics, project management, control systems, labor management relations, and productivity. Prereq: CSM 352, 353, LAW 322 (or concurrent enrollment), MGT 307 (or concurrent enrollment), Construction Science and Management major, or consent of department chair. Coreq: CSM 411, 461.

CSM 454 Construction Capstone 6(5,3) Students develop a capstone project that entails the knowledge obtained in all previous courses in the Construction Science and Management Program. Students must take the capstone course at Clemson University. Prereq: CSM 453, Construction Science and Management major, or consent of department chair.

CSM 455, 456 Reducing Adversarial Relations in Construction 3(3,0) Focuses on the study of the delivery of projects and how adversarial relations can affect the successful completion of the venture. Topics include management of human resources, understanding the needs and processes of the participants, where problems lie, methods of avoiding and settling disputes. Prereq: Construction Science and Management or Architecture major, senior standing, or consent of department chair.

CSM 461 Construction Economics Seminar 3(3,0) Studies in the financial performance of construction companies. Prereq: ACCT 201, ECON 211, 212, Construction Science and Management major, or consent of department chair. Coreq: CSM 453.

CSM 490, H490 Directed Studies 1-3(1-3,0) Comprehensives studies and research of special topics not covered in other courses. Emphasizes field studies, research activities, and current developments in construction science. May be repeated for a maximum of six credits. Prereq: Consent of instructor.

CROP AND SOIL ENVIRONMENTAL SCIENCE


CSENV 202 Soils 4(3,2) Introduces world land resources, soil formation, classification, and mineralogy. Emphasizes basic chemical and physical properties of soil. Also discusses soil microorganisms, plant nutrients, and fertilization. Soil properties are related to growth. Prereq: CH 101, 102, or a geology sequence including GEOG 101; or consent of instructor.

CSENV (SSCS) 350 Practicum 1-6 Preplanned practical or research experience related to student-selected Soils and Sustainable Crop Systems concentration. Practicum is undertaken with an approved advisor or agency. May be repeated for a maximum of six credits. Prereq: Soils and Sustainable Crop Systems major or consent of department chair.

CSENV 406 Special Problems 1-3(0,3-9) Acquaints students with the scientific method. Literature investigation, planning, and execution of an experiment are integral parts of the course. Prereq: Open to students in AGRIC 491 and 492. May be repeated for a maximum of six credits. Open to students in AGRIC 491 and 492. May be repeated for a maximum of six credits. Prereq: Senior standing, minor in Crop and Soil Environmental Science, or consent of department chair.

CSENV (B E) 408, 608 Land Treatment of Waste-water and Sludges 3(3,0) Principles for designing environmentally acceptable land application systems using municipal and industrial wastewater and sludges are presented. Topics include land-limiting constituent analysis; soil-plant interactions; system equipment and design; system operation and management; public acceptance, social, and regulatory issues. Case studies and field trips are planned. Prereq: Senior standing in agriculture or engineering or consent of instructor.

CSENV 409, 609 Biology of Invasive Plants 3(3,0) Introductory course covering mechanisms of plant invasions. Emphasizes unique traits that confer invasiveness and/or weediness to plants, and how these plant traits interact with the environment to facilitate invasion of agricultural lands, forests, rangelands, and managed landscapes. Covers various cultural, chemical, and biological control aspects. Prereq: BIOL 104/106, or BIOSC 304, or consent of instructor.

CSENV 421, 621 Principles of Field Crop Production 3(3,0) Principles for production of field crops. Topics include botany and physiology, tillage, harvesting, storage, and crop quality. Principles are illustrated using examples from various crops. Prereq: AGRIC 104 or equivalent introductory plant science, CSENV 202.

CSENV 422, 622 Major World Crops 3(3,0) Examines the distribution, adaptation, production, and utilization of major agronomic crops of the world. Emphasizes crops important to U.S. agriculture. Specific crops discussed in more detail include corn, wheat, rice, sorghum, soybeans, cotton, tobacco, and peanuts. Prereq: AGRIC 104 or equivalent introductory plant science, CSENV 202.

CSENV 423, H423, 623 Field Crops—Forages 3(3,0) Establishment, management, and utilization of forage crops in a forage-livestock agroecosystem context. Discusses hay, silage, and pasture utilization. Uses computer models to study complexity of forage-livestock production systems. Prereq: AGRIC 104, CSENV 202, or consent of instructor.

CSENV (AP EC) 426, 626 Cropping Systems Analysis 3(2,2) Application of agronomic and economic principles in solving problems related to the production and marketing of agronomic crops. Major part of the course is a case study in which detailed analysis of a farm, agribusiness, or environmental situation is made with students making formal written and oral presentations of results. Prereq: AP EC 202, AGRIC 104, Junior standing.

CSENV (HORT) 433, 633 Landscape and Turf Weed Management 3(2,2) See HORT 433.
CSENV 446, 646 Soil Management 3(3,0) Basic soil properties are related to compaction, water and solute movement, and root growth. Considers practical management problems and develops solutions based on basic soil characteristics. Problems include erosion, nitrification, compaction, irrigation, leaching, waste application, golf green management, and orchard establishment. Preq: CSENV 202.

CSENV 452, 652 Soil Fertility and Management 3(3,0) Study of soil properties, climatic factors, and management systems in relation to soil fertility maintenance for crop production. Considers plant nutrition and growth in relation to crop fertilization and management. Preq: CSENV 202 or consent of instructor.

CSENV 453, H453, 653 Soil Fertility Laboratory 1(0,3) Evaluation and interpretation of soil fertility production. Preq: CSENV 202 or consent of instructor.

CSENV 455 Seminar 1(1,0) Students present current agronomic topics of special interest in crop production appearing in recent scientific journals and other publications.

CSENV (ENTOX, GEOL) 485, 685 Environmental Soil Chemistry 3(3,0) Study of soil chemical processes (sorption, desorption, ion exchange, precipitation, dissolution, and redox reactions) of nutrients and inorganic and organic contaminants in soils and organic matter. Chemical complex equilibria and adsorption phenomena at the solid (soil, sediment, and mineral) water interface are emphasized. Preq: CSENV 202, CH 102 or consent of instructor.

CSENV 490, 690 Beneficial Soil Organisms in Plant Growth 3(3,0) Aspects of biological nitrogen fixation, mycorrhizal fungi, microbial-pesticide interactions, bioremediation, nutrient cycles, and biological pest control related to plant growth, soil/ environmental quality, and sustainable agriculture are covered. Students who desire laboratory experience in these topics may register for CSENV 490 after consultation with instructor. Preq: CSENV 202, MICRO 305, PL PA 310, or consent of instructor.

DANCE 130 Tap Dance I 1(0,3) Introduces basic principles and fundamentals of tap dancing with opportunities to develop rhythmic patterns of various origins. May be repeated for a maximum of eight credits, with a maximum of 16 credits of dance applied toward a degree. Applied dance fee is assessed.

DANCE 140 Jazz Dance I 1(0,3) Introduces basic principles and fundamentals of jazz technique and explores flexibility and strength-building exercises. May be repeated for a maximum of eight credits, with a maximum of 16 credits of dance applied toward a degree. Applied dance fee is assessed.

DANCE 150 Modern Dance I 1(0,3) Introduces basic principles of dance movement and vocabulary, and actively explores and applies different methods of body alignment and theory. May be repeated for a maximum of eight credits, with a maximum of 16 credits of dance applied toward a degree. Applied dance fee is assessed.

DANCE 160 Ballet Dance I 1(0,3) Introduces basic principles and fundamentals of classical ballet, with emphasis on good technique, center work, and across the floor work. May be repeated for a maximum of eight credits, with a maximum of 16 credits of dance applied toward a degree. Applied dance fee is assessed.

DANCE 330 University Dance Company 1(0,3) Performance ensemble for advanced dance students. Provides opportunities to learn and develop choreographic skills as well as to improve personal dance techniques. Company is selected by audition. May include public recitals. May be repeated for a maximum of eight credits. Applied dance fee is assessed. Preq: Consent of instructor.

DESIGN STUDIES

DSIGN 370 Design Principles 6(1,0) Students develop graphic skills, including plans, sections, elevations, axonometric and perspective drawings, and develop creative problem solving skills incorporating precedent studies, contextual analysis, concept development, modeling and presentation skills. Course is offered only during the summer at study abroad locations. Preq: ARCH 101 or consent of instructor. Coreq: ARCH 471 and 472.

DIGITAL PRODUCTION ARTS
Professors: A.T. Duchowski, R.M. Geist III, D.H. House, J.A. Tessendorf, Director; Associate Professors: T.A. Davis, B.A. Malloy; Assistant Professors: D.S. Donar, A.M. Penna; Lecturer: L.J. House

D P A 307 Studio Methods for Digital Production 3(1,4) Exposes students to current studio practice in the development of 3-D computer graphics and animation for film, electronic games, and visualizations. Topics include modeling, rigging, animation, texturing, lighting, rendering, compositing and editing. Open source tools are used so methods are transportable to most computing environments. Preq: Consent of instructor.

D P A 400, 600 Technical Foundations of Digital Production I 3(3,0) The technical, conceptual, and algorithmic foundations of computer graphics. Covers the Unix operating system, scripting, C programming, and an interactive graphics API. Preq: Consent of instructor. Not open to Computer Science, Computer Engineering, or Computer Information Systems majors.


D P A 402, 602 Visual Foundations of Digital Production I 3(0,6) Presents the visual foundations underlying computer graphics production. Covers perspective, observational drawing, color and value, principles of composition and design, and storyboarding. Incorporates the studio method, involves students in hands-on work and the critique process, and stresses examples from the history of art, animation and film. Preq: Consent of instructor. Not open to Architecture or Visual Arts majors.

EARLY CHILDHOOD EDUCATION
Professor: D.A. Stiegelb; Assistant Professor: S.M. Linder; Clinical Faculty: R.S.N. Wilson

ED EC 220 Family, School, and Community Relationships 3(3,0) Historical trends, theoretical models, and strategies of effective family/school/community relationships are examined. Special emphasis is placed on multicultural issues and on programs that support collaborative interaction with families that benefit children. Preq: Sophomore standing.

ED EC 300 Foundations of Early Childhood Education 3(3,0) Philosophical and historical foundations of early childhood education, societal changes and influences, needs of young children and families, program differentiation, and future trends are examined through coursework and experiential activities. Preq: General Education requirements; ED EC 220, ED F 334, or consent of instructor.

ED EC 336, H336 Social Development of Infants and Young Children 3(3,0) Study of the behavior of the preschool child from infancy through age five. Theoretical concepts and observation of children’s behavior are integrated, analyzed, and evaluated to discover implications for teaching and guiding preschool children. Includes a minimum of 10 one-hour observation-participation visits in public kindergarten. Preq: ED F 334, minimum grade-point ratio of 2.0 or consent of instructor.
ED EC 400 Observation and Assessment in Clinical Settings 3(3,0) Clinical experiences in early childhood settings prior to student teaching provide opportunities for observing, guiding, and assessing young children, birth to age eight, in a variety of high quality preschool and primary settings. Practicum spans the entire semester. To be taken Pass/Fail only. Prereq: ED EC 336; concurrent enrollment in ED EC 420, 430, 440, 450, and EDLT 459.

ED EC 420 Early Childhood Science 3(3,0) Students develop knowledge, skills, and attitudes needed to foster science education among young children. Emphasizes teaching strategies and techniques appropriate for young children (birth to age eight), understanding the unique learning needs of special populations, and integrating science across the curriculum. Prereq: General Education requirements. Coreq: ED EC 400, 430, 450, EDLT 459.

ED EC 430 Early Childhood Mathematics 3(3,0) Examination of theories and methods of teaching mathematics in terms of how young children develop mathematical thinking. Topics include problem solving, current issues, diversity, current technologies, reflective teaching, and applications of math in everyday life. Prereq: General Education mathematics requirement; admission to the professional level. Coreq: ED EC 400, 420, EDLT 459.

ED EC 440 Integrated Language Arts and Social Studies in Primary Schools 3(3,0) Integrates social studies and language arts in a course that reflects recommended teaching practices for young children (birth to age eight). Uses language arts as an approach for teaching social studies content, techniques, and methods in primary schools. Prereq: Admission to the professional level. Coreq: ED EC 400.

ED EC 450 Early Childhood Curriculum 3(3,0) Constructivist approach is used to explore children’s thinking as it influences curriculum design in early childhood. Analyzes the educational needs of the young child in the cognitive realm and examines the implementation of activities, experiences, and play-based program models. Prereq: Admission to the professional level. Coreq: ED EC 400, 420, EDLT 459.

ED EC 460 Critical Issues in Early Childhood Education 3(3,0) In depth analysis of current and critical issues in early childhood education, with an emphasis placed on trends in prekindergarten through third grade. Topics include classroom and behavior management, early childhood assessment, working in diverse settings, and meeting the educational needs of all learners. Prereq: Admission to the professional level.

ED EC 484 Directed Teaching in Early Childhood Education 911,24 Supervised observation and teaching experiences in cooperation with nursery schools, kindergartens, and early elementary schools. Restricted to seniors or graduates who have completed prerequisite courses and have the cumulative grade-point ratio for graduation. Prereq: ED EC 400, 450, ED EL 321, 488, EDLT 459; admission to the professional level; consent of area committee chair.

ED EC 485 Early Childhood Capstone 3(3,0) Taken concurrently with student teaching. Students strengthen connections between theory and pedagogy; analyze and solve contemporary problems in early childhood education; and reflect upon their personal growth as educators.

EAST ASIAN STUDIES

EAS 123 Introduction to China 3(3,0) Introduction to various aspects of Chinese civilization, including geography, ethnic groups, language, history, philosophy, religion, literature, arts, architecture, and social customs. All readings and discussions are in English.

ECONOMICS


ECON 200 Economic Concepts 3(3,0) One-semester survey of basic economic concepts that offers an overview of both microeconomics and macroeconomics. Not intended for business majors or other students seeking a comprehensive introduction to economic analysis and its applications. Credit will not be given to students who have received credit for ECON 211 or 212.

ECON 211, H211 Principles of Microeconomics 3(3,0) Introduction to economic reasoning and its application to the study of the behavior of consumers and firms in everyday life. Prereq: General Education mathematics requirement; admission to the professional level. Coreq: ECON 211 or consent of instructor.

ECON 212, H212 Principles of Macroeconomics 3(3,0) Continuation of ECON 211 in which fundamental economic principles are applied to the study of aggregate economic performance. Topics include the forces determining the rates of inflation, unemployment, and economic growth, with particular emphasis on the influence of fiscal and monetary policies through financial markets. Prereq: ECON 211 or consent of instructor.

ECON 301 Economics of Labor 3(3,0) Introduces students to the economics of the labor market and labor relations. Considers the theories of wages and employment, determination, unemployment, and public policy toward the labor market. Also considers the role of labor unions. May not be used to satisfy requirements for a degree in Economics. Prereq: ECON 211 or consent of instructor.

ECON 302 Money and Banking 3(3,0) Considers the function of money and banking in both the product and financial markets. Special emphasis is placed on monetary theory and current problems of monetary policy. May not be used to satisfy requirements for a degree in Economics. Prereq: ECON 212 or consent of instructor.

ECON 303 Economics and Sports 3(3,0) Economic analysis of sports teams, leagues, and institutions. Analyzes basic economic issues using sports data. May not be used to satisfy requirements for a degree in Economics. Credit will not be given to students who have completed ECON 426. Prereq: Sophomore standing. ECON 211.

ECON (MGT) 306 Managerial Economics 3(3,0) Uses tools of economic analysis in classifying problems in organizing and evaluating information, and in comparing alternative courses of action. Bridges the gap between economic theory and managerial practices. May not be used to satisfy requirements for a degree in Economics. Prereq: ECON 211 or consent of instructor.

ECON 307 Arbitration 3(3,0) Analyzes dispute settlement procedures emphasizing mediation, fact-finding, and arbitration as they are used to resolve labor-management disputes in the public and private sectors. Prereq: Consent of instructor.

ECON 309 Government and Business 3(3,0) Relationships between government and business, including, among other topics, government efforts to enforce competition; to regulate public utilities; and to protect the special interest of laborers, farmers, and consumers. May not be used to satisfy requirements for a degree in Economics. Prereq: ECON 211 or consent of instructor.

ECON 310 International Economy 3(3,0) Studies of the process of international commerce. Covers basic theory of trade and exchange rates, institutional and legal environment, current policy issues. Not open to students who have taken ECON 412. May not be used to satisfy requirements for a degree in Economics. Prereq: ECON 211 and 212 or consent of instructor.

ECON 314, H314 Intermediate Microeconomics 3(3,0) Analytical study of basic concepts of value and distribution under alternative market conditions. Prereq: ECON 211 or consent of instructor.

ECON 315, H315 Intermediate Macroeconomics 3(3,0) Macroeconomic problems of inflation and unemployment are focal points. Includes statistics (measures of real output and the price level) and theory (covering the sources of short-run fluctuations and long-run growth). Analyzes appropriate public policies addressing these issues. Prereq: ECON 212 or consent of instructor.

ECON 319 Environmental Economics 3(3,0) Study of the application of economic logic to issues surrounding environmental management and policy. Examines individual, firm, and collective decision making as well as the evolution of regulatory approaches for controlling environmental use. Prereq: ECON 314.

ECON (E LE) 321 Economics of Innovation 3(3,0) Examines the nature of entrepreneurship and the contribution of innovation to economic growth. Investigates the organizational and institutional sources of innovation in different firms and different countries as well as the role of economic theorists concerning the role entrepreneurs play in bringing new products to market. Prereq: ECON 306 or 314.

ECON 325 Personnel Economics 3(3,0) Study of various compensation and personnel practices firms employ. Explains when each of those practices should be followed to elicit the desired employee effort and labor force quality. Topics include piece-rate and time-rate systems, seniority-based incentive schemes, promotion contests, evaluation systems, mandatory retirement, and up-or-out rules. Prereq: ECON 211 or consent of instructor.
ECON 340 Behavioral Economics 3(3,0) Introduces the economic, sociological, and psychological aspects of decision making under uncertainty. Presents the psychology of prediction, intuitive prediction; biases and corrective procedures. Topics also include framing, choice with costly information, and social influences on individual behavior. Prereq: ECON 211 or consent of instructor.

ECON 344 Economics of Institutions and Property Rights 3(3,0) Study of fundamental property rights structures and institutions in the capitalist economy and the arrangements that create incentives to produce and exchange. Prereq: ECON 211 and 212.

ECON 350, H350 Moral and Ethical Aspects of a Market Economy 3(3,0) Can a market system produce results that are fundamentally just? Is justice possible without voluntary exchange? Applies both economic and philosophical analyses to these questions. Emphasizes the causes, consequences, and morality of the distribution of wealth and income in a free-market system. Prereq: ECON 314 or consent of instructor.

ECON 360 Public Choice 3(3,0) Covers the economic approach to political activities and institutions. Topics include voting, voting rules, constitutions, political competition, political business cycles, vote trading, interest groups, bureaucracy, committees, legislators, executives, and judges. Designed for Economics and non-Economics majors and requires only basic skills in microeconomics. Prereq: ECON 211 or consent of instructor.

ECON H390 Junior Honors Research 1(1,0) Readings and research in conjunction with an approved economics course at the 300 or 400 level. Honors status required. May be repeated for a maximum of three credits.

ECON 397 Creative Inquiry—Economics 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.

ECON 401 Labor Market Analysis 3(3,0) Develops the methods of economic analysis of labor markets. Requires students to apply these methods to problems of the labor market. Topics include labor demand and supply, human capital, occupational choice, compensating wage differentials, organizational wage structures and incentive systems, unemployment, and discrimination. Prereq: ECON 314.

ECON 402 Law and Economics 3(3,0) Application of economics to the law of property, torts, and contracts; regulation of markets, business organizations, and financial transactions; distribution of income and wealth; and criminal law. Prereq: ECON 211 or consent of instructor.

ECON 404 Comparative Economic Systems 3(3,0) Comparative analytical and historical study of the principal economic systems which have been important in the modern world including, among others, capitalism and socialism. Prereq: ECON 314 or consent of instructor.

ECON 405, 605 Introduction to Econometrics 4(3,3) Introduction to methods of quantitative analysis of economic data. Reviews basic statistical methods and probability distribution. Topics include data management using professional software applications; multiple regression analysis; hypothesis testing under conditions of multicollinearity, heteroscedasticity, and serial correlation. Prereq: ECON 211 and 212; MTHS 108 or 207; EX ST 301 or MTHS 301 or 309.

ECON 406, 606 Advanced Econometrics 3(3,0) Reviews statistical inference using multiple regression (OLS) analysis and model specification. Topics include multicollinearity, heteroscedasticity, and serial correlation; two-staged least squares and instrumental variables models; simultaneous equations models; limited dependent variable models using maximum likelihood estimation and time-series analysis; and presentation of results in technical writing. Prereq: ECON 405 or consent of instructor.

ECON 410, 610 Economic Development 3(3,0) Consideration and analysis of economic and related problems of underdeveloped countries. Attention is given to national and international programs designed to accelerate solution of these problems. Prereq: ECON 314 or consent of instructor.

ECON 411, 611 Economics of Education 3(3,0) Analysis of economic issues related to education. The decision to invest in education, elementary and secondary school markets and reform, the market for college education, teacher labor markets, and education’s effects on economic growth and income distribution. Prereq: ECON 314 or consent of instructor.

ECON 412, 612 International Microeconomics 3(3,0) Analysis of the essential aspects of international economic linkages. Discusses gains and redistributive effects of trade and the barriers to trade within the context of a variety of economic models. Also discusses the history of trade policy and the political economy of its determination. Prereq: ECON 314 or consent of instructor.

ECON 413, 613 International Macroeconomics 3(3,0) Examination of macroeconomic linkages between an individual country and the rest of the world and how these linkages are affected by the choice of exchange rate regimes. Topics include the relation between domestic and foreign interest rates and exchange rates and the ability to pursue independent monetary policies. Prereq: ECON 315.

ECON 419 Economics of Defense 3(3,0) Examines the American defense establishment in terms of resources utilized, alternative uses, and the contribution to the national economy and scientific progress generated by resources in a defense use. Discusses economic problems inherent in shifting resources between defense and nondefense uses and among alternative defense uses. Prereq: ECON 314.

ECON 420 Public Sector Economics 3(3,0) Study of the role of government and its proper functions and limitations in a market. Provision of goods and services by all levels of government and instruments of taxation are evaluated according to efficiency and equity criteria. Contemporary public sector issues are emphasized throughout. Prereq: ECON 314 or consent of instructor.

ECON 422, 622 Monetary Economics 3(3,0) Intensive study of the role of monetary factors in economic change. Modern monetary theories and their empirical relevance for policy are developed against a background of monetary history and institutions. Prereq: ECON 314 and 315 or consent of instructor.

ECON 423, 623 Economics of Health 3(3,0) Applies microeconomic theory to examine the demand for health services and medical care, the market for medical insurance, the behavior of physicians and hospitals, and the role of government in healthcare provision and regulation. Prereq: ECON 314.

ECON 424, 624 Organization of Industries 3(3,0) Empirical, historical, and theoretical analyses of market structure and concentration in American industry: the effects of oligopoly, monopoly, and cartelization upon price, output, and other policies of the firm; antitrust and other public policies and problems are studied. Prereq: ECON 314 or consent of instructor.

ECON 425, 625 Antitrust Economics 3(3,0) Analysis of the economic and legal issues created by the exercise of market power. The motivation and execution of government policy towards mergers, predatory conduct, and various restraints of trade are intensively examined. Prereq: ECON 309 or 314 or consent of instructor.

ECON 426, 426, 626 Seminar in Sports Economics 3(3,0) Economic analysis of sports teams, leagues, and institutions. Topics include antitrust issues, public funding of sports venues, labor relations, wagering markets, athlete compensation, and application of economic principles to sports settings. Empirical research project is cornerstone of course. Prereq: ECON 314, 405; or consent of instructor.

ECON 427, 627 Development of the American Economy 3(3,0) Explores several topics relevant to understanding the American experience. Considers the institutions and developments critical to America’s ascendency from a small country to a dominant global economic power. Investigates immigration, innovation, education, finance, and the changing role of race and gender in the economy. Prereq: ECON 314, 315.

ECON 428, 628 Cost-Benefit Analysis 3(3,0) Develops techniques for the appraisal of public expenditure programs with particular emphasis on investment in infrastructure. Topics include choice of an appropriate discount rate and the calculation of social costs and benefits in the presence of market distortions. Prereq: ECON 314 or consent of instructor.

ECON 430, 630 Topics in Mathematical Economics 3(3,0) This course develops the mathematical tools underlying economic analysis and prepares students for doing advanced theoretical work in economics. The topics covered in this course provide excellent preparation for advanced economics courses, and lay the foundation for doing quantitative analysis associated with both career work and graduate study in economics. Prereq: ECON 314, and MTHS 108 or 207.
ED 111 Introduction to Supplemental Instruction 1(1,0) Students develop and reinforce interpersonal relationship skills in listening, decision making, communicating, group dynamics, leadership, assertiveness, time management, problem solving, and conflict resolution. To be taken Pass/Fail only.

ED 190 Leadership, Citizenship, and Community Service 3(3,0) Provides active learning opportunities for students to understand better the system of government, learn the mechanics of how leadership can influence education and other initiatives, and develop interpersonal skills that will assist them throughout their professional lives. Culminates with a service learning project for the students’ local community.

ED 197 Creative Inquiry—Education 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

ED 297 Creative Inquiry—Education 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

ED 322 Responding to Emergencies 3(2,1) Provides the citizen responder with the knowledge and skills necessary in a variety of emergencies to help sustain life and to minimize pain and the consequences of injury until professional help arrives. Includes first aid, CPR, and automated external defibrillation (AED).

ED 397 Creative Inquiry—Education 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

ED 405 Multiculturalism 3(3,0) Introduces prospective teachers to the influence of culture on learning from an anthropological and historical perspective. Prq: HIST 172, 173, or consent of instructor.

ED 439 Independent Study in Education 1-3(1-3,0) A faculty member must designate the student for the independent study. ED 439 credits do not count toward the major. Prq or Coreq: ED 314 and HIST 173, or consent of instructor.

ED 440, 640 Game Theory 3(3,0) Introduces the concepts of conceptual frameworks, state evaluation system, and rationality in terms of strategic interaction among rational, self-interested agents. Basic theoretical aspects of game theory are discussed and applied to such topics as bargaining, voting, auctions, and oligopoly. Prq: ECON 314 and MTHSC 106, or ECON 430, or consent of instructor.

EDC 199 Creative Inquiry—Counselor Education 1-4(1-4,0) In consultation with and under the direction of a faculty member students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

EDC 234 Introduction to Addictions: Basic Education and Prevention 3(3,0) Basic review of addictions and chemical dependence. Gives future educators skills in the identification of chemical abuse, techniques for intervention, and methods of prevention education. SOR 396 and 397 are recommended as follow-up courses for those interested in pursuing the topic.

EDC 299 Creative Inquiry—Counselor Education 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

EDC 300 Student Development Theory, Leadership, and Counseling Skills for Student Leaders 3(3,0) Introduction to theoretical and practical applications of student development and leadership on the university campus. Develops skills assisting with leadership development, problem solving, conflict resolution, confrontation, and referral. Explores legal and ethical issues for practitioners and effective utilization of resources available on the campus. May be repeated for a maximum of nine credits.

EDC 399 Creative Inquiry—Counselor Education 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

EDC 400 Introduction to Addictions: Basic Education and Prevention 3(3,0) Basic review of addictions and chemical dependence. Gives future educators skills in the identification of chemical abuse, techniques for intervention, and methods of prevention education. SOR 396 and 397 are recommended as follow-up courses for those interested in pursuing the topic.

EDC 497 Creative Inquiry—Education 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.
EDUCATIONAL FOUNDATIONS

Professors: D.E. Barrett, R.P. Green Jr., D.M. Switzer
Associate Professor: S. N. Rosenblith, Chair; Lecturers: A.O. Baldwin, R.D. Visser

ED F 301, H301 Principles of American Education 3(3,0) Study of the legal basis, historical development, characteristics, and functions of educational institutions in the United States. Preq: ED 105 (or concurrent enrollment); 2.0 minimum grade-point ratio, or consent of instructor.

ED F 302, H302 Educational Psychology 3(3,0) Introduction to classroom use of objectives, motivation theories, learning theories, tests and measurements, classroom management, and knowledge of exceptional learners. Preq: ED 105 (or concurrent enrollment), 2.0 minimum grade-point ratio, or consent of instructor.

ED F 308 Classroom Assessment 3(3,0) Introduction to classroom assessment and standardized testing. Preq: ED F 302.

ED F 315 Technology Skills for Learning 1(0,2) Students develop technology skills, such as creating Web pages and multimedia presentations in the context of general education class requirements. Products developed are linked within the School of Education e-portfolio. Preq: Admission to Teacher Education program, ED 105; or consent of instructor.

ED F (HIST) 320 History of United States Public Education 3(3,0) Historical survey of the development of United States public schools. Preq: ED 105 (or concurrent enrollment), 2.0 minimum grade-point ratio, or consent of instructor.

ED F 334, H334 Child Growth and Development 3(3,0) Introduction to lifespan development. Heavy emphasis is placed on the physical, social, emotional, and cognitive characteristics. Includes a minimum of five one-hour observation-participation visits to an elementary school. Preq: ED 105 (or concurrent enrollment), 2.0 minimum grade-point ratio, or consent of instructor.

ED F 335, H335 Adolescent Growth and Development 3(3,0) Introduction to lifespan development. Emphasizes the physical, social, emotional, and cognitive characteristics of the 10- to 18-year-old and the educational implications of those developmental characteristics. Preq: ED 105 (or concurrent enrollment), 2.0 minimum grade-point ratio, or consent of instructor.

ED F 406 Philosophy, Schooling, and Educational Policy 3(3,0) Analysis of the development of contemporary educational theory and its impact on current schooling practices and educational policy development.

ED F 425 Instructional Technology Strategies 1(0,2) Helps future teachers learn to use technology effectively in support of content area instruction. To be taken concurrently with either methods classes or during student teaching as directed by major. Preq: ED F 315 or 480.

ED F (AG ED) 480, 680 Digital Technology in the 21st Century Classroom 3(2,2) Fundamentals of computer applications for teachers. Develops competencies in general computer applications such as word processing and database management and addresses educational uses of the Internet and computer-assisted instruction, with emphasis on legal and ethical issues and the impact of computer technology upon society. Preq: Admission to a Teacher Education Program.

ED F (AG ED) 482, 682 Advanced Educational Applications of Microcomputers 3(2,2) Provides students with the knowledge and skills needed to apply microcomputer technology to the utilization and generation of educational software in accordance with sound educational principles. Preq: ED F (AG ED) 480.

ED F 490, H490, 690 Classroom Management 3(3,0) Aids students in developing strategies and plans to manage a classroom effectively. Topics include both time and behavioral management. Students will learn how to prevent problems as well as address problems once they have occurred. Preq: ED F 302 or PSYCH 201; ED F 334, 335, or suitable alternative; 2.0 minimum grade-point ratio; or consent of instructor.

ED F 497, 697 Instructional Media in the Classroom 3(3,0) Integrated approach to the use of audiovisual media stressing systematic planning, selection, utilization, and evaluation as well as production of materials and equipment operation. Preq: 2.0 minimum grade-point ratio.

ELECTRICAL AND COMPUTER ENGINEERING


E C E 199 Creative Inquiry–Electrical and Computer Engineering 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

E C E 201, H201 Logic and Computing Devices 2(2,0) Introduction to Boolean algebra and digital logic. Topics include number systems and representation of information; Boolean operators and algebra; expression minimization; combinational circuits, including adders, comparators, decoders and multiplexers; sequential logic, including flip-flops, shift registers, counters and memory. Preq: MTHSC 108, PHYS 122.


E C E 204 Circuit Analysis Problems I 1(0,3) Analysis and solution of electrical network problems using mesh and nodal analysis, Thévenin’s and Norton’s theorems and equivalent circuits and other circuit analysis from E C E 202. Coreq: E C E 202.

E C E 209, H209 Logic and Computing Devices Laboratory I 1(0,2) Introduction to designing, building, simulating and testing digital logic circuits. Topics include MSI and LSIs; general combinational circuits; adders, decoders and multiplexors; general sequential circuits; shift registers, counters and memory. Preq: E C E 201 (or concurrent enrollment).

E C E 211 Electrical Engineering Laboratory I 1(0,2) Principles of measurement and instruments used to measure parameters and dynamic variables in electrical circuits, steady state and transient measurements in DC and AC circuits, and data analysis methods are included. Coreq: E C E 202.

E C E 212 Electrical Engineering Laboratory II 1(0,2) Emphasizes measurement techniques in AC steady-state circuits and comparison to theoretical predictions. Two-port network methodology and transfer functions are studied experimentally and related to analysis using transform techniques. Preq: E C E 202, 211. Coreq: E C E 262.


E C E 223 Computer Systems Engineering 3(3,0) Analysis of implementation techniques for systems software. Applying engineering principles including code reading to the design of data structures and algorithms for low level computer systems, embedded systems, and hardware/software systems. Includes coverage of address translation, memory management, file systems, and process management. Preq: E C E 222.

E C E 262, H262 Electric Circuits II 3(3,0) Continuation of the study of electric circuits, including three-phase circuits, complex frequency and network functions, frequency response, two-port parameters, magnetically-coupled circuits, Laplace transforms, and introduction to Fourier series and transforms. Preq: E C E 202, MTHSC 206, PHYS 221. Coreq: E C E 212, MTHSC 208.

E C E 263 Circuit Analysis Problems II 1(0,3) Analysis of basic AC circuit analysis techniques to analyze the transient and steady-state behavior of both simple and complex circuits. Coreq: E C E 262, MTHSC 208.
ECE 272, H272 Computer Organization 3(3,0)
Introductory course in computer organization and architecture. Topics include CPUs, memory, I/O, processor families, buses, peripherals, microarchitectures, and instruction sets. Preq: ECE 201 and CP SC 111.

ECE 273, H273 Computer Organization Laboratory 1(0,2) Laboratory enhances students’ understanding of computer organization via assignments involving assembly language programming. Topics include basic syntax, branching and loops, addressing modes, arrays and pointers, subroutines and stacks. Preq: ECE 272 (or concurrent enrollment).

ECE 299, H299 Creative Inquiry—Electrical and Computer Engineering 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits.

ECE 300 Junior Honors Seminar 1(2,0) Acquaints students enrolled in the Departmental Honors Program with current research activities in the Department. Faculty provide seminars where research interests are summarized. Seminars are planned to prepare students in choosing research topics for their senior theses.

ECE 307 Basic Electrical Engineering 2(2,0) A first course in electrical engineering to provide non-Electrical Engineering majors with a knowledge of DC and AC circuit theory, AC power distribution, and numerous electrical devices, apparatus, and digital systems. Preq: MTHSC 206, PHYS 221. Coreq: ECE 309.

ECE 308 Fundamentals of Electrical Engineering 3(3,0) A first course in electrical engineering to provide non-Electrical Engineering majors with a knowledge of DC and AC circuit theory, AC power distribution, numerous electrical devices, digital systems, instrumentation and measurement systems, electronics, electromechanics, and electric motors. Credit may not be received for both ECE 307 and 308. Preq: MTHSC 206 and PHYS 221 or consent of instructor.

ECE 309 Electrical Engineering Laboratory I 1(0,2) Laboratory to accompany ECE 307. Basic electrical circuits and instrumentation. Coreq: ECE 307.

ECE 311 Electrical Engineering Laboratory III 1(0,2) Measurements and characteristics of electronic devices and circuits; use of manual and automated instruments to acquire data; oral and written engineering reports. Preq: ECE 262, MTHSC 208, PHYS 221. Coreq: ECE 320.

ECE 312 Electrical Engineering Laboratory IV 1(0,2) Design and characterization of functional circuits using solid-state devices; use of manual and automated instruments for measurements; statistical analysis of data; preparation of engineering reports. Preq: ECE 311, 320. Coreq: ECE 321.


ECE 320 Electronics I 3(3,0) Introduction to electronic materials and devices; principles of design; design of DC and AC circuits using diodes, bipolar junction transistors, field-effect transistors and use of transistors in digital circuits. Preq: ECE 262, MTHSC 208, PHYS 221. Coreq: ECE 331.

ECE 321 Electronics II 3(3,0) Analysis and design of discrete amplifier circuits at low and high frequencies; operational amplifiers, distortion in amplifiers, oscillator design, and circuit analysis of active digital devices. Preq: ECE 320. Coreq: ECE 312.

ECE 327 Digital Computer Design 3(3,0) Design of high-speed ALUs, control and timing circuitry, memory systems and I/O circuitry; microprogrammed computer design using bit-serial microprocessors; current hardware topics related to computer design; hands-on design experience; and use of logic analyzer for system debugging. Preq: ECE 371.

ECE 329 Computer Systems Structures 3(3,0) Fundamental structures and issues that arise in the analysis and implementation of computer systems. Topics include operating systems structures and data structures and their relationship to computer organization. Engineering science background for computer systems design. Preq: ECE 223, 272.


ECE 332 Programming Systems 3(3,0) Second course in programming languages and systems. Topics include assemblers, compilers, and syntactical methods; string manipulation and list processing; concepts of executive programs and operating systems; introduction to time-sharing systems. Preq: ECE 223; or CP SC 212 and 215. Coreq: MTHSC 119 or 419.

ECE 360 Electric Power Engineering 3(3,0) Presents the basic principles of electromagnetic induction and electromagnetic forces developed. Topics include synchronous machines, power transformers, electric power transmission, and distribution systems, DC motors, and induction motors. Preq: ECE 262, PHYS 221.

ECE 371 Microcontroller Interfacing 3(3,0) Discusses the programming and interfacing of microcontrollers in order to control their integrated devices and external peripherals. Topics include memory and I/O; interrupts, counters and timers; ADCs and DACs; PWMs; and parallel and serial communication. Preq: ECE 262, 272. Coreq: ECE 320.

ECE 372, Microcontroller Interfacing Laboratory 1(0,3) Discusses the programming and interfacing of microcontrollers in order to control their integrated devices and external peripherals. Topics include memory and I/O; interrupts, counters and timers; ADCs and DACs; PWMs; and parallel and serial communication. Preq: ECE 371 (or concurrent enrollment).

ECE 380 Electromagnetics 3(3,0) Introduction to electric fields and potentials, dielectrics, capacitance, resistance, magnetic field, forces, work and energy, inductance, time-varying fields, and Maxwell’s equations. Preq: ECE 262, MTHSC 206, PHYS 221.

ECE 381 Fields, Waves, and Circuits 3(3,0) Covers foundation of circuit theory, transmission lines and circuits, plane-wave propagation, fiber optics, radiation and antennas, and coupled circuits. Preq: ECE 380, MTHSC 288.

ECE 399, H399 Creative Inquiry—Electrical and Computer Engineering 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of three credits.

ECE 404, 604 Semiconductor Devices 3(3,0) Consideration of the principles of operation, external characteristics, and applications of some of the more important semiconductor devices presently available. Preq: ECE 320. Coreq: MTHSC 311 or 434.

ECE 405 Design Projects in Electrical and Computer Engineering I 3(0,2-6) Individually defined projects oriented toward providing experience in establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation. Develops student creativity through the solution of open-ended problems. Includes individual instruction in design methodology. May be repeated for a maximum of three credits. Preq: ECE 330 or 459, consent of project supervisor.

ECE 406, 606 Introduction to Microelectronics 3(3,0) Microelectronic processing, MOS and bipolar monolithic circuit fabrication, thin and thick film hybrid fabrication, applications to linear and digital circuits, fundamentals of device design. Preq: ECE 320. Coreq: MTHSC 311 or 434.

ECE 409 Continuous and Discrete Systems Design 3(3,0) Introduction to classical linear control systems. Topics include continuous and discrete descriptions of systems, time and frequency response, stability, system specification, system design of continuous and discrete systems. Preq: ECE 330. Coreq: ECE 495.

ECE 412 Electrical Machines Laboratory 1(0,2) Selected experiments to familiarize students with characteristics of transformers, DC and AC motors and generators. Measurement techniques and component modeling are included. Coreq: MTHSC 434 or consent of instructor. Preq or Coreq: ECE 360 or 419.

ECE 417, 617 Elements of Software Engineering 3(3,0) Foundations of software design, reasoning about software, the calculus of programs, survey of formal specification techniques and design languages. Preq: ECE 322, 352, MTHSC 419.

ECE 418, 618 Power System Analysis 3(3,0) Study of power system planning and operational problems. Topics include load flow, economic dispatch, transient studies, transient stability, and control of problems. System modeling and computer solutions are emphasized through class projects. Preq: ECE 360, 380.
Courses of Instruction

E C E 419, 619 Electric Machines and Drives 3(3,0)
Performance, characteristics, and modeling of AC and DC machines during steady-state and transient conditions. Introduction to power electronics devices and their use in adjustable speed motor drives. Prereq: E C E 321, 360, 380. Coreq: MTHSC 434 or consent of instructor.

E C E 420 Renewable Energy Penetration on the Power Grid 3(3,0)
Introduces the basic definition of electrical power, interfacing primary sources, generator/load characteristics, and renewable energy resources. Topics include solar energy grid interfacing, wind energy grid interfacing, battery charging/management, harmonic distortion, voltage sags, and national standards. Prereq: E C E 307 or 320.

E C E 422, 622 Electronic System Design I 3(2,2)
Emphasizes the application of theory and skills to the design, building, and testing of an electronic system with both analog and digital components. Application varies each semester. Computer software tools are used extensively in the design process. Prereq: E C E 321, 330, 360, 371, 381.

E C E 427 Communications Systems 3(3,0)
Study of communication systems design and analysis. Topics include signals and spectra, baseband signaling and detection in noise, digital and analog modulation and demodulation techniques, communications link budget analysis. Prereq: E C E 317, 330.

E C E 429, 629 Organization of Computers 3(3,0)
Computer organization and architecture. Topics include a review of logic circuits, bus structures, memory organization, interrupt structures, arithmetic units, input-output structures, state generation, central processor organization, control function implementation, and data communication. Registered Transfer Language (RTL) for description and design of digital systems. Prereq: E C E 272 or consent of instructor.

E C E 430, H430, 630 Digital Communications 3(3,0)
Introduction to modern digital communication systems, emphasizing modulation and detection, taking into account the effects of noise. Prereq: E C E 317, 330; and consent of instructor for 430 (consent not required for H430 or 630).

E C E 432, 632 Instrumentation 3(3,0)
Theory and analysis of transducers and related circuits and instrumentation. Generalized configurations and performance characteristics of instruments are considered. Transducer devices for measuring physical parameters such as motion, force, torque, pressure, flow, and temperature are discussed. Prereq: E C E 321. Coreq: MTHSC 311 or 434.

E C E 435, 635 Grounding and Shielding 3(3,0)
Introduction to electromagnetic compatibility concepts and techniques for students who will be designing or working with electronic systems when they graduate. Topics include electromagnetic interference and noise control, crosstalk and signal integrity, grounding, filtering, shielding, circuit board layout, lightning and electrostatic discharge protection. Prereq: E C E 381.

E C E 436, 636 Microwave Circuits 3(3,0)
Analysis of microwave networks comprising transmission lines, waveguides, passive elements, interconnects, and active solid state microwave circuits. Use of modern CAD tools to design RF/Microwave passive/active networks. Fabrication of typical circuits. Prereq: E C E 381 or equivalent. Coreq: MTHSC 311 or 434.

E C E 438, 638 Computer Communications 3(3,0)
Digital data transmission techniques, modern and communications channels, communications software and protocols, multiprocessors and distributed processing; concurrency and cooperation of dispersed processors. Prereq: Senior standing in Electrical or Computer Engineering or Computer Science or consent of instructor.

E C E 439, 639 Fiber Optics 3(3,0)
Covers the underlying principles of design for optical fibers in practical systems. Examines optical fiber as a waveguide using wave optics and ray optics. Discusses design criteria for using monomode and multimode fibers. Other topics include fabrication, measurement. Prereq: E C E 381. Coreq: MTHSC 434 or consent of instructor.

E C E 440, 640 Performance Analysis of Local Computer Networks 3(3,0)

E C E 442, 642 Knowledge Engineering 3(3,0)
Introduction to the theoretical and practical aspects of knowledge engineering or applied artificial intelligence. Topics include symbolic representation structures and manipulation, unification, production systems and structures, rule-based and expert systems, planning and AI system architectures; system design in PROLOG and LISP. Project is required. Prereq: E C E 322, 352.

E C E 446, 646 Antennas and Propagation 3(3,0)
Study of the theoretical and practical aspects of antenna design and utilization, input impedances, structural considerations, and wave propagation. Prereq: E C E 330, 381 or 436, MTHSC 311 or 434.

E C E 449, 649 Computer Network Security 3(1,4)
Hands-on practicum in the administration and security of modern network service emphasizing intrusion prevention techniques, detection, and recovery. Prereq: Senior standing in Computer Engineering.

E C E 453 Software Practicum 3(1,6)
Students design and implement a software system that satisfies both a requirements and specifications document. The resulting system is tested for compliance. Prereq: E C E 322, 352.

E C E 455, 655 Robot Manipulators 3(3,0)
Analysis of robot manipulator systems with special focus on interaction of these technologies with society. Emphasis is on rigid-link robot manipulator systems. Topics include history of robot technology, kinematics, dynamics, control, and operator interfaces. Case studies reinforce impact of robot technology on society and vice versa. Prereq: MTHSC 206, 311, or consent of instructor.

E C E (M) 456, 656 Fundamentals of Robotics 3(3,0) See M E 456.

E C E (M) 457 Fundamentals of Wind Power 3(3,0)
Introduces wind turbine systems, including wind energy potential and application to power generation. Topics include wind energy principles, wind site assessment, wind turbine components, power generation machinery control systems, connection to the electric grid, and maintenance. Prereq: E C E 307 or 320 or consent of instructor.

E C E 459, 659 Integrated Circuit Design 3(2,2)
Design concepts and factors influencing the choice of technology; fundamental MOS device design; silicon foundry, custom and semicustom integrated circuits; computer-aided design software/hardware trends and future developments; hands-on use of CAD tools to design standard library cells; systems design considerations, testing, and packaging. Prereq: E C E 321. Coreq: MTHSC 311 or 434.

E C E 460 Computer-Aided Analysis and Design 3(3,0)
Principles and methods suited to the solution of engineering problems on the digital computer. Topics include widely used methods for the solution of the systems of algebraic and/or differential equations which arise in modeling of engineering systems, data approximation and curve fitting, continuous system simulation languages, and design-oriented programming systems. Prereq: E C E 262, MTHSC 311, 434, or consent of instructor.

E C E 461 Fundamentals of Solar Energy 3(3,0)
Introduces solar energy conversion systems. Topics include environmental benefits of solar energy, solar thermal systems, concentration solar power, photovoltaic (PV) cell design and manufacturing, sizing of PV system, hybrid photovoltaic/thermal systems, energy storage, and urban/rural applications. Prereq: E C E 320 or consent of instructor.

E C E 467, 667 Introduction to Digital Signal Processing 3(3,0)
Introduction to characteristics, design, and applications of discrete time systems; design of digital filters; introduction to the Fast Fourier Transform (FFT); LSI hardware for signal processing applications. Prereq: E C E 330.

E C E 468, 668 Embedded Computing 3(2,2)
Principles of using computing in the larger context of a system. Topics include bus and processor design types (e.g. microprocessor, microcontroller, DSP), codecs, digital circuit power management, real time scheduling, and embedded operating systems. Lab work consists of projects on embedded hardware (e.g. PC-104+). Prereq: E C E 223, 371 or consent of instructor.

E C E 470 Vehicle Electronics 3(3,0)
Introduction to vehicle electronic systems and networks. Topics include a review of electronic systems in automotive and aerospace applications; vehicle components, sensors and actuators; communication busses; electric power generation and distribution in vehicle systems; vehicle diagnostics; reliability; and trends in vehicle system design. Prereq: E C E 320 or consent of instructor.

E C E 471 Electric Vehicles and Energy Storage 3(3,0)
Introduction to hybrid electric propulsion systems and energy storage systems. Topics include a review of fundamentals of electric vehicles and hybrid electric vehicles architectures covering reasons for hybridization, energy analysis of architecture and components; overview of energy storage systems (batteries and supercapacitors); modeling of components; vehicle simulation; and supervisory control. Prereq: E C E 320 or consent of instructor.

E C E 473, 673 Introduction to Parallel Systems 3(3,0)
Introduces parallel system design concepts and factors influencing the choice of parallelism; parallelism in software; parallelism in hardware. Topics include architecture of parallel systems; parallel system implementation; parallel system programming. Prereq: E C E 329 or equivalent.

E C E 475, 675 Robotics 3(3,0)
Introduction to robotics, focusing on the design and fabrication of robotic systems. Topics include kinematics, dynamics, control, and operator interfaces. Case studies reinforce impact of robotics on society and vice versa. Prereq: MTHSC 206, 311, or consent of instructor.

E C E 489, 689 Introduction to Quantum Computing 3(3,0)
Introduction to the principles of quantum computing and its potential applications to solving problems in science, engineering, and finance. Prereq: E C E 322 or consent of instructor.

E C E 496, 696 Photovoltaic Conversion Systems 3(3,0)
Introduction to photovoltaic (PV) cell design and manufacturing, including photovoltaic cell design and manufacturing, sizing of PV system, hybrid photovoltaic/thermal systems, energy storage, and urban/rural applications. Prereq: E C E 320 or consent of instructor.

E C E 497 Electric Vehicles and Energy Storage 3(3,0)
Introduction to hybrid electric propulsion systems and energy storage systems. Topics include a review of fundamentals of electric vehicles and hybrid electric vehicles architectures covering reasons for hybridization, energy analysis of architecture and components; overview of energy storage systems (batteries and supercapacitors); modeling of components; vehicle simulation; and supervisory control. Prereq: E C E 320 or consent of instructor.

E C E 499 Independent Study 3(3,0)
Students design and implement a software system that satisfies both a requirements and specifications document. The resulting system is tested for compliance. Prereq: E C E 322, 352 or equivalent.
ED 311 Teaching Diverse Populations 3(3,0)
Preservice teachers examine the role of teachers as they relate to culturally appropriate curricula, instruction, and evaluation. Prereg: Admission to the professional level.

ED 321 Physical Education Methods and Content for Classroom Teachers 3(3,0)
Provides education majors with a basic understanding of the methods and techniques utilized in teaching elementary physical education. Emphasizes acquiring a basic understanding of the movement education approach and the ability to teach integrated lessons utilizing this approach. Prereg: Junior standing, admission to the professional level.

ED 401 Elementary Field Experience 3(1,6)
Practical classroom experience prior to the student teaching semester for Elementary Education majors.

ED 405 Social Justice and 21st Century Learners 3(3,0)
Using an integrated focus approach to social justice education, preservice teachers investigate educational and/or issues through a combination of race, gender, or socioeconomic factors. Preservice teachers write personal classroom stories related to practice/praxis; and use technology to document stories of themselves, their mentor and/or their teacher education preparation. Prereg: Admission to the professional level.

ED 451, H451 Elementary Methods in Science Teaching 3(2,3)
Development of process skills, technical skills, and attitudes needed to foster increased confidence and commitment to the teaching of elementary science, with emphasis on teaching strategies and techniques and their implications for what we know of how children learn science. Prereg: Elementary Education science requirements; concurrent enrollment in ED 401, 487, 488 and EDLT 460, admission to the professional level.

ED 452 Elementary Methods in Mathematics Teaching 3(2,3)
Special emphasis is given to the development of understanding, skills, and attitudes in the elementary curriculum with focus on strategies, techniques, and materials for teaching elementary mathematics. Prereg: General Education mathematics requirement; admission to the professional level.

ED 458 Health Education Methods and Content for the Classroom Teacher 3(3,0)
Study of the content, methodology, and resource materials necessary for teaching comprehensive health education in public schools. Emphasizes the National Health Education Standards and the health behaviors of youth that are allied with the Coordinated School Health Program. Prereg: Minimum grade-point ratio of 2.0.

ED 467 Principles and Strategies for Teaching English to Speakers of Other Languages (ESOL) in Elementary School Settings 3(3,0)
Introduces preservice teachers to the theories and principles related to second language acquisition as applied in culturally and linguistically responsive classrooms. Presents instructional models and strategies for teaching the language acquisition process within a context of academics supportive of English language learners (ELLs) and their needs. Prereg: Admission to the professional level.

ED 481 Directed Teaching in the Elementary School 12(1,33)
Supervised observation and teaching experiences in cooperation with selected elementary schools. Restricted to seniors or graduates who have completed prerequisite courses. Prereg: ED 321, 401, 451, 452, 487, 488, EDLT 461; admission to the professional level, consent of area committee chair.

ED 482 Capstone Seminar in Elementary Teaching 3(3,0)
Students strengthen connections between theory and pedagogy; analyze and solve contemporary problems in elementary education; and reflect upon their personal growth as educators within a social justice framework. Prereg: Enrollment in student teaching.

ED 483 Directed Teaching in the Elementary School 90(0,27)
Supervised observation and teaching experience in cooperation with selected elementary schools. Restricted to seniors or graduates who have completed prerequisite courses. Prereg: ED 321, 401, 451, 452, 487, 488, EDLT 461; admission to the professional level; consent of area committee chair.

ED 487 Elementary Methods in Social Studies Teaching 3(2,3)
Introduction to methods, materials, and techniques needed to teach social studies in the elementary schools. Prereg: HIST 101, 102, 172, or 173; GEOG 101 or 103; concurrent enrollment in ED 401, 451, 452, 488 (for Elementary majors) and EDLT 461; admission to the professional level; consent of instructor.

ED 488 Elementary Methods in Language Arts Teaching 3(2,3)
Introduction for preservice teachers to the skills of the language arts other than reading and the methods, materials, and techniques needed to teach these skills to students in the elementary school. Prereg: ENGL 385; concurrent enrollment in ED 401, 451, 452, 487, EDLT 461 (for Elementary majors); admission to the professional level or consent of instructor.
ENGR 190, H190 Special Projects in Engineering I 1-3(1-3,0) Individual or group projects in engineering. Projects may be interdisciplinary in nature and may involve analysis, design, and/or implementation. Instruction in use of necessary tools and test equipment is included when appropriate. May be repeated for a maximum of six credits. Prq: Senior standing and consent of instructor.

ENGR 290, H290 Special Projects in Engineering II 1-3(1-3,0) Individual or group projects in engineering. Projects may be interdisciplinary in nature and may involve analysis, design, and/or implementation. Instruction in use of necessary tools and test equipment is included when appropriate. May be repeated for a maximum of six credits. Prq: Sophomore standing and consent of instructor.

ENGR 390, H390 Special Projects in Engineering III 1-3(1-3,0) Individual or group projects in engineering. Projects may be interdisciplinary in nature and may involve analysis, design, and/or implementation. Instruction in use of necessary tools and test equipment is included when appropriate. May be repeated for a maximum of six credits. Prq: Junior standing and consent of instructor.

ENGR 490, H490 Special Projects in Engineering IV 1-3(1-3,0) Individual or group projects in engineering. Projects may be interdisciplinary in nature and may involve analysis, design, and/or implementation. Instruction in use of necessary tools and test equipment is included when appropriate. May be repeated for a maximum of six credits. Prq: Senior standing and consent of instructor.
ENGL 214, H214 American Literature 3(3,0) Introduction to selected authors and major periods of the American literary tradition from 1620 to 1945. Prq: ENGL 102 or 103.

ENGL 215, H215 Literature in 20th- and 21st-Century Contexts 3(3,0) Introduction to major contemporary cultural movements via selected authors in 20th- and 21st-century literature, primarily American and British, with attention to poetry, fiction, and drama since World War II. Prq: ENGL 102 or 103.

ENGL 217 Vocabulary Building 3(3,0) Development of a useful discriminating vocabulary for writing, speaking, and reading. Student notebooks and proficiency quizzes. Prq: ENGL 103.

ENGL 231 Introduction to Journalism 3(3,0) Instruction and practice in writing for mass media; editorial responsibilities. Prq: ENGL 103.

ENGL 300 Professional Development 2(2,0) Orientation to the English major as a discipline and as a preparation for a range of careers. Introduction to and assistance with the compilation of the digital portfolio as a place to collect, synthesize and reflect on learning.

ENGL (G W) 301, H301 Great Books of the Western World 3(3,0) See G W 301.

ENGL 304 Business Writing 3(3,0) Introduction to audience, context, purpose, and writing strategies for texts common in professional business settings: memoranda, letters, reports, and proposals. Includes individual and team projects. Prq: Junior standing.

ENGL 310 Critical Writing About Literature 3(3,0) Terms and techniques for literary analysis, including close reading, vocabulary for analysis, research and writing skills, casebook study of critical approaches. Discussion of poetry and genres preferred. Prq: Sophomore literature (or concurrent enrollment) or consent of instructor.

ENGL 312 Advanced Composition 3(3,0) Workshop in practical writing focusing on principles and style. Prq: Sophomore literature or consent of instructor.

ENGL 314, H314 Technical Writing 3(3,0) Intensive, project-based application of principles of audience, context, purpose, and writing strategies of technical writing: proposals, reports, communication deliverables. Individual and team projects. Prq: Junior standing.

ENGL 315 Scientific Writing and Communication 3(3,0) Study and practice of rhetorical conventions in professional scientific communication through the analysis and writing of major genres. Focuses on principles, strategies, and styles of scientific argumentation and audience adaptation in written, oral, and visual media. Intended for students majoring in the sciences. Prq: ENGL 103; BIOL 103 and 104, or 110 and 111; Junior standing, or consent of instructor.

ENGL 316 Writing and International Trade 3(3,0) Students complete projects demanding a variety of communications skills that professionals in international trade need; sensitivity to foreign audiences and cultures in oral and written communication, electronic and graphic communication, collaborative writing and management. Prq: Sophomore literature.

ENGL 318 Visual Communication 3(3,0) Hands-on survey of visual communication theories and practices used by technical communicators in business and industry environments. Class meets regularly in computer classrooms. Prq: Sophomore literature; ENGL 211 or consent of instructor.

ENGL 333 Writing for the News Media 3(3,0) Practical experience in gathering and writing news and feature copy for the media, preparing for an array of writing styles as demanded by the broad spectrum of print and media outlets. Examination of the modern media specialist, laws governing the profession, and journalistic ethics. Prq: ENGL 231 or consent of instructor.

ENGL 335 The Structure of Fiction 3(3,0) Introduction to the creative writing and critical study of prose fiction. Prq: ENGL 310 or consent of instructor.

ENGL 336 The Structure of Poetry 3(3,0) Introduction to the creative writing and critical study of poetry. Prq: ENGL 310 or consent of instructor.

ENGL (THEA) 347 The Structure of Drama 3(3,0) See THEA 347.

ENGL 348 The Structure of the Screenplay 3(3,0) Introduction to the creative writing and critical study of the screenplay. Screenplays vary from semester to semester. May be repeated once for credit with consent of instructor. Prq: ENGL 310 or consent of instructor.

ENGL 349 Technology and the Popular Imagination 3(3,0) Examines relationship between technology and fiction and creative nonfictional texts, including print, film, and electronic media. Prq: Sophomore literature or consent of instructor.

ENGL 350 Mythology 3(3,0) Study of the great myths of the world emphasizing their applications to literature. Prq: Sophomore literature or consent of instructor.

ENGL 353 Ethnic American Literature 3(3,0) Critical examination of essays, poetry, fiction, and drama written by members of a variety of American racial and ethnic groups, such as Native Americans, African Americans, Chicanos/Mexican Americans, Asian Americans, Italian Americans, and American Jews. Prq: Sophomore literature or consent of instructor.

ENGL 355 Popular Culture 3(3,0) Examination of the nature, functions, history, and impact upon American society of best sellers, popular magazines, television, movies, and other like phenomena. Prq: Sophomore literature or consent of instructor.

ENGL 356 Science Fiction 3(3,0) Readings in science fiction from the 17th century to the present, with special emphasis on writers since Verne and Wells. Prq: Sophomore literature or consent of instructor.

ENGL 357 Film 3(2,3) Examination of the film medium as an art form: its history, how films are made, why certain types of films (western, horror movies, etc.) have become popular, and how critical theories provide standards for judging film. Prq: Sophomore literature or consent of instructor.

ENGL 358 Children’s Literature 3(3,0) Reading and analysis in a wide range of authors, illustrators, and genres appropriate for children from preschool through eighth grade, classic as well as modern. Critical approaches include historical, thematic, and social. Prq: Sophomore literature or consent of instructor.

ENGL 364 Adolescent Literature 3(3,0) Reading and analysis of literature written for readers age 12–18. Emphasis is on historical context, chief themes and motifs, and censorship issues, as well as connections with classic literature. Prq: Sophomore literature or consent of instructor.

ENGL 366 American Literature Survey I 3(3,0) Examines key texts in British literature to 1789. Prq: Sophomore literature or consent of instructor.

ENGL 367 British Literature Survey II 3(3,0) Examines key texts of British literature from 1789 to the present. Prq: Sophomore literature or consent of instructor.

ENGL 368 American Literature Survey II 3(3,0) Examines key texts of American literature from beginnings of European settlement to the Civil War in historical context. Prq: Sophomore literature or consent of instructor.

ENGL 369 American Literature Survey III 3(3,0) Examines key texts of American literature from the Civil War to the present in historical context. Prq: Sophomore literature or consent of instructor.

ENGL 372, 600 The English Language 3(3,0) Studies in English usage and historical development of the language. Prq: ENGL 310 or consent of instructor.

ENGL 374, 601 Grammar Survey 3(3,0) Survey of modern grammars with a focus on exploring the impact structural grammar has had on traditional grammar. Recommended for English teachers. Prq: ENGL 310 or consent of instructor.

ENGL 375 The Classics in Translation 3(3,0) Examination of Homer’s Iliad and Odyssey, Virgil’s Aeneid, and Ovid’s Metamorphoses. A few shorter works by other Greek and Roman writers may also be read. Prq: ENGL 310 or consent of instructor.

ENGL 407, 607 The Medieval Period 3(3,0) Selected works of Old and Middle English literature, exclusive of Chaucer. Prq: ENGL 310 or consent of instructor.

ENGL 408, 608 Chaucer 3(3,0) Selected readings in Middle English from The Canterbury Tales and other works by Chaucer. Prq: ENGL 310 or consent of instructor.
ENGL 410, 610 Drama of English Renaissance 3(3,0) Selected readings in non-Shakespearean dramatic literature of the 16th and 17th centuries. Preq: ENGL 310 or consent of instructor.

ENGL 411, 611 Shakespeare 3(3,0) Study of selected tragedies, comedies, and history plays of Shakespeare. Required of all English majors. Preq: ENGL 310 or consent of instructor.

ENGL 414, 614 Milton 3(3,0) Development of Milton’s art and thought from the minor poems and selected prose through Paradise Lost, Paradise Regained, and Samson Agonistes, set against the background of the late Renaissance. Preq: ENGL 310 or consent of instructor.

ENGL 415, 615 The Restoration and Eighteenth Century 3(3,0) Readings in Dryden, Swift, Pope, and Dr. Johnson. Preq: ENGL 310 or consent of instructor.

ENGL 416, 616 The Romantic Period 3(3,0) Readings from the poetry and critical prose of Blake, Wordsworth, Coleridge, Byron, Shelley, Keats, and other representative figures. Preq: ENGL 310 or consent of instructor.

ENGL 417, 617 The Victorian Period 3(3,0) Reading from the poetry and nonfiction prose of selected Victorian authors, including works of Carlyle, Tennison, Browning, Arnold, and other representative figures. Preq: ENGL 310 or consent of instructor.

ENGL 418, 618 The English Novel 3(3,0) Study of the English novel from its 18th century beginnings through the Victorian Period. Preq: ENGL 310 or consent of instructor.

ENGL 419, 619 Postcolonial and World Literatures 3(3,0) Selected readings in post-colonial literature and theory, focusing on issues of nationalism, migration, resistance, race, language, and master narratives. Preq: ENGL 310 or consent of instructor.

ENGL 420 American Literature to 1799 3(3,0) Focused study of authors, movements, themes, critical approaches, and genres in literature of colonial and early national America from early European explorations of the continent to 1799. Preq: ENGL 310 or consent of instructor.

ENGL 421 American Literature from 1800 to 1899 3(3,0) Focused study of authors, movements, themes, critical approaches, and genres in the poetry and prose of major American authors and literary movements from the nineteenth century. Preq: ENGL 310 or consent of instructor.

ENGL 425, 625 The American Novel 3(3,0) Survey of the most significant forms and themes of the American novel from its beginnings to 1900. Preq: ENGL 310 or consent of instructor.

ENGL 426, 626 Southern Literature 3(3,0) Intellectual and literary achievement of the South from 1607 to the present, with emphasis on the writers of the 19th century. Preq: ENGL 310 or consent of instructor.

ENGL 428, 628 Contemporary Literature 3(3,0) Focuses on American, British, and other fiction, poetry, and drama from Post-World War II to the present. Preq: ENGL 310 or consent of instructor.

ENGL 429, 629 Dramatic Literature I 3(3,0) Selected reading in the dramatic literature from the classical era of Greece and Rome to the Renaissance. Preq: ENGL 310 or consent of instructor.

ENGL (THEA) 430, 630 Dramatic Literature II 3(3,0) Principles and progress of drama from the Restoration to the present; analysis of representative plays; critical reports; discussion of trends in dramatic literature. Preq: ENGL 310 or consent of instructor.

ENGL 431, 631 Modern Poetry 3(3,0) The modern tradition in English and American poetry from Yeats to the present; relevant critical essays. Preq: ENGL 310 or consent of instructor.

ENGL 432, 632 Modern Fiction 3(3,0) American and British novels and short stories of the 20th century. Preq: ENGL 310 or consent of instructor.

ENGL 433, 633 The Anglo-Irish Literary Tradition 3(3,0) Exploration of the unique literary heritage and achievement of English-language Irish writers in the 19th and 20th centuries. Major figures of the Irish tradition: W. B. Yeats, James Joyce, Samuel Beckett, and other writers; consideration of the specifically Irish aspects of their works. Preq: ENGL 310 or consent of instructor.

ENGL 434, 634 Environmental Literature 3(3,0) Survey of literature that examines the relationship between human beings and the natural world, including analysis of environmental themes in myths and legends and in selected poetry and prose of 19th- and 20th-century England and America. Preq: ENGL 310 or consent of instructor.

ENGL 435, 635 Literary Criticism 3(3,0) Major critical approaches to literature. Preq: ENGL 310 or consent of instructor.

ENGL (W S) 436, 636 Feminist Literary Criticism 3(3,0) Introduces the germinal works of feminist literary theory and criticism. Outlines the development of modern literary criticism by studying feminist versions of the major critical methodologies. Preq: ENGL 310 or consent of instructor.

ENGL 437, 637 Directed Studies 1-3(1-3,0) Class and tutorial work for students with special interests or projects in American, British, or European literature outside the scope of existing courses. Applications must be approved during the registration period of the semester preceding the one in which directed studies will occur. May be repeated by arrangement with the department. Preq: ENGL 310 or consent of instructor.

ENGL H438 Departmental Honors Research 3(3,0) Research for the preparation of an honors project. Preq: ENGL 310 or consent of instructor.

ENGL H439 Departmental Honors Project 3(3,0) Preparation of an honors project. Preq: ENGL 310 or consent of instructor.

ENGL 440, 640 Literary Theory 3(3,0) Examination of how approaches such as Marxism, psychoanalysis, Feminism, Deconstruction, New Historicism, Post-Colonialism, Cultural Studies, and Queer Theory answer the question, “What is literature?” Preq: ENGL 310 or consent of instructor.

ENGL 441, 641 Literary Editing 3(3,0) Examination of how the theories and practices of editing construct texts, stressing the problems and objectives of editing and providing practical experience with literary editing. Preq: Sophomore literature.

ENGL 442, 642 Cultural Studies 3(3,0) Investigation of the similarities and connections between a wide variety of cultural products, events, and practices—from fast food to opera to online shopping—using theories ranging from Marxism to hybridity. Preq: ENGL 310 or consent of instructor.

ENGL 444, 644 Renaissance Literature 3(3,0) Selected readings in non-Shakespearean British literature from 1500-1660. Includes drama, poetry, and prose. Preq: ENGL 310 or consent of instructor.

ENGL 445, 645 Fiction Workshop 3(3,0) Workshop in the creative writing of prose fiction. May be repeated once for credit. Preq: ENGL 345 or consent of instructor.

ENGL 446, 646 Poetry Workshop 3(3,0) Workshop in the creative writing of poetry. May be repeated once for credit. Preq: ENGL 346 or consent of instructor.

ENGL (THEA) 447, 647 Playwriting Workshop 3(3,0) See THEA 447.

ENGL 448, 648 Screenwriting Workshop 3(3,0) Workshop in the creative writing of screenplays. May be repeated once for credit. Preq: ENGL 348 or consent of instructor.

ENGL 449, 649 Creative Non-Fiction 3(3,0) Advanced workshop in writing non-fiction prose for magazine and free-lance markets. Preq: ENGL 312 or 334 or consent of instructor.

ENGL 450, 650 Film Genres 3(2,3) Advanced study of films that have similar subjects, themes, and techniques, including such genres as the Western, horror, gangster, science fiction, musical, and/or screwball comedy. Also considers nontraditional genres, screen irony, genre theory, and historical evolution of genres. Topics vary. Preq: ENGL 357 or consent of instructor.

ENGL (COMM) 451, 651 Film Theory and Criticism 3(2,3) Advanced study into the theory of film/video making emphasizing understanding a variety of critical methods to approach a film. Examines the history of film theory and defines the many schools of film criticism, including realism, formalism, feminism, semiotics, Marxism, and expressionism. Preq: ENGL 357 or consent of instructor.

ENGL 452, 652 Great Directors 3(2,3) Intensive study of one to three film directors emphasizing understanding the entire canon of each director. Students study similarities in techniques, shifts in thematic emphasis, and critical methodologies for approaching the works of each director. Topics vary. Preq: ENGL 357 or consent of instructor.

ENGL 453, 653 Sexuality and the Cinema 3(2,3) Examination of male/female sexual roles and their evolution in American genre films, avant-garde cinema, and international films. Includes the study of movies in relation to cultural values and social stereotypes, introduction to feminist film theory, and consideration of film pornography. Preq: ENGL 357 or consent of instructor.

ENGL (LANG) 454 Selected Topics in International Film 3(2,3) See LANG 454.

ENGL 455, 655 American Humor 3(3,0) Native American humor of the 19th and 20th centuries. Preq: ENGL 310 or consent of instructor.
ENGL (HUM) 456, 656 Literature and Arts of the Holocaust 3(3,0) Addresses the Holocaust through literature, art, architecture, music, and film. Beginning with historical, political, and economic forces that contributed to the Holocaust, course then focuses on highly diverse creative responses to this event—responses that often reflect the difficulties and politics of these commemorative gestures. Preq: ENGL 310 or consent of instructor.

ENGL 459, 659 Special Topics in Language, Criticism, and Theory 3(3,0) Advanced studies in topics not central to other English courses, such as certain authors, works, genres, themes, or areas of knowledge and culture. Specific topics are announced when offered. May be repeated once for credit with department chair’s consent. Preq: ENGL 310 or consent of instructor.

ENGL 460, 660 Issues in Writing Technologies 3(3,0) Examination of writing technologies from different historical periods. Investigates how writing is understood, circulated, legislated, and protected in terms of its production technology. Preq: Sophomore literature; ENGL 211 or consent of instructor.

ENGL 463, 663 Topics in Literature to 1699 3(3,0) Selected readings in literature from antiquity through the 17th century for focused study of authors, movements, themes, critical approaches, and genres. Topics vary and are constructed by individual faculty. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: ENGL 310 or consent of instructor.

ENGL 464, 664 Topics in Literature from 1700 to 1899 3(3,0) Selected readings in 18th- and 19th-century literature for focused study of authors, movements, themes, critical approaches, and genres. Topics vary and are constructed by individual faculty. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: ENGL 310 or consent of instructor.

ENGL 465, 665 Topics in Literature from 1900 to 1999 3(3,0) Selected readings in 20th- and 21st-century literature for focused study of authors, movements, themes, critical approaches, and genres. Topics vary and are constructed by individual faculty. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: ENGL 310 or consent of instructor.

ENGL 475, 675 Writing for Electronic Media 3(3,0) Workshop in new forms of writing and hypertextual design for interactive electronic media, including social networks, online and video communities. May be repeated once for credit at the undergraduate level. Preq: ENGL 310 or consent of instructor.

ENGL 478, 678 Digital Literacy 3(3,0) Examines how technology has expanded ideas of literacies and texts. Includes reading, studying and analyzing print and digital texts to determine how digital techniques change patterns of reading and how readers make sense of electronic texts. Preq: ENGL 310 or consent of instructor.

ENGL 482, 682 African American Literature to 1920 3(3,0) Critical examination of the development of the African American literary tradition from the Colonial Period to the Harlem Renaissance. Considers the historical and cultural contexts of a variety of texts, themes and theories. Preq: ENGL 310 or consent of instructor.

ENGL 483, 683 African American Literature from 1920 to the Present 3(3,0) Critical examination of the development of the African American literary tradition from the Harlem Renaissance to the present. Considers historical and cultural contexts of a variety of texts, themes, theories and literary movements. Preq: ENGL 310 or consent of instructor.

ENGL (EDSEC) 485, 685 Composition and Language Studies for Teachers 3(3,0) Examines the principles and practices of composing and teaching composition. Includes a historical study of English language with attention to phonology, morphology, syntax, semantics, and practical aspects of language grammars. Serves as a practicum in composing and assessing processes, collaborative learning, writers purposes, audience expectations, and language conventions. Preq: ENGL 310 or consent of instructor.

ENGL 487 Topics in Book History 3(3,0) Examines the material and theoretical constructions of the book. Covers both historical and contemporary dimensions of dissemination, reception, artistry, and influence of books. Preq: ENGL 103.

ENGL 488, 688 Genre and Activity Theory 3(3,0) Examination of the forms that texts take, of the print and digital media in which they are composed, and of the ways they circulate among experts, in the public, and around the world. Preq: Junior standing.

ENGL 489, 689 Special Topics in Writing and Publication Studies 3(3,0) Selected readings from topics in writing and publication studies, emphasizing areas such as major theories, practices, research, and critical approaches. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: ENGL 310 or consent of instructor.

ENGL 490, 690 Advanced Technical and Business Writing 3(3,0) Advanced work in writing proposals, manuals, reports and publishable articles. Client-based and collaborative writing. Preq: ENGL 304 or 314 or consent of instructor.

ENGL (COMM) 491, 691 Classical Rhetoric 3(3,0) Traces the development of rhetoric from Protagoras through Isocrates, Plato, Aristotle, Cicero and Quintillian and considers questions essential to understanding persuasive theory and practices. Preq: ENGL 310 or consent of instructor.

ENGL (COMM) 492, 692 Modern Rhetoric 3(3,0) Examines the “new rhetorics” of the 20th century, which are grounded in classical rhetoric but include findings from biology, psychology, linguistics and anthropology, among other disciplines. Preq: ENGL 310 or consent of instructor.

ENGL 494, 694 Writing About Science 3(3,0) Advanced work in scientific writing and editing for peer and lay audiences. Preq: ENGL 310 or consent of instructor.

ENGL 495, 695 Technical Editing 3(3,0) Practical experience in editing and preparing technical manuscripts for publication. General introduction to the functions of the technical editor. Preq: ENGL 314 or consent of instructor.

ENGL 496 Senior Seminar 3(3,0) Capstone course requiring participation and a substantial essay, allowing graduating English majors the chance to work closely with faculty and other English majors on a special topic in the advanced study of literature, rhetoric, writing, and/or publication studies. Preq: ENGL 310, Senior standing in English, or consent of instructor.

ENGL 498, 698 Studio Composition and Communication 3(3,0) Preparation for students to work in the Class of 1941 Studio for Student Communication. Preq: Sophomore standing or consent of instructor.

ENGL 499 Practicum in Writing 3(3,0) Students apply their knowledge of concepts and principles to a substantive project involving their internship experiences and/or writing and publishing interests. To be taken Pass/Fail only. Preq: Sophomore literature, Junior standing in English.

ENTOMOLOGY

Professors: P.H. Adler, R.G. Bellinger, E.P. Benson, J.D. Culin, W.M. Hood, P.A. Zungoli; Associate Professor: M.W. Turnbull

ENT 200 Six-Legged Science 3(3,0) Introduction to insects, their various relationships with humans, other animals, and plants. The general nature of this course makes it beneficial to all students regardless of specialty. Not open to students who have received credit for ENT 301 or equivalent.

ENT 201 Selected Topics 1(1,0) Discussion course covering topics dealing with insects and related arthropods. Subjects are chosen to reflect issues of current interest as well as those having significance in human history. May be repeated for a maximum of three credits.

ENT 300 Environmental Entomology 3(3,0) Exploration of diversity and roles of insects in natural and affected environments, impact of insects and pesticides on environmental quality, and discussion of environmental ethics in entomological science. Preq: Any biological or physical science.

ENT (BIOSC) 301 Insect Biology and Diversity 4(3,1) Introduction to the study of insects, with emphasis on their structure, function, ecology, and behavior. Identification of commonly encountered species is highlighted. Relationships between insect and human populations are discussed. Control technologies are introduced, with emphasis on environmentally responsible tactics. Offered fall semester only.

ENT 308 Apiculture 3(2,3) Detailed study of the honey bee and its economic importance in pollination and honey production. Attention is given to bee behavior, colony management, equipment, honey-plant identification, and honey production and processing. Preq: BIOL 104/106 and consent of instructor.

ENT (BIOSC) 400, H400, 600 Insect Morphology 4(3,3) Study of insect structure in relation to function and of the variation of form in insects. Preq: ENT 301.
ENT 404, H404, 604 Urban Entomology 3(3,0)
Study of pests common to the urban environment with emphasis on arthropod pest biology, pest importance, and management strategies. Students learn both theoretical and practical aspects of urban pest management. Prereq: BIOL 103 and 104, or 110 and 111, or ENT 301, or consent of instructor.

ENT (PL PA) 406, 606 Diseases and Insects of Turfgrasses 2(2,0) See PL PA 406.

ENT 407, 607 Applied Agricultural Entomology 4(3,3) Topics include recognition, biology, damage, and control of economically important insects and mites found on major Southeastern field, fruit, nut, and vegetable crops. Principles and practices of crop protection, including pesticide application, economic basis for decision making, and development of scouting programs are introduced. Prereq: ENT 301 or equivalent.

ENT (PL PA) 408 Diseases and Insects of Turfgrasses Laboratory 1(0,3) See PL PA 408.

ENT 409, H409, 609 Urban Entomology Laboratory 1(0,3) Identification of household and structural pests common to the urban environment. Students also gain hands-on experience in termite and general pest control. Prereq: BIOL 103 and 104, or 110 and 111, or ENT 301, or consent of instructor; concurrent enrollment in ENT 404.

ENT (BIOSC) 415, 615 Insect Taxonomy 3(1,6) Identification of the principal families of the major orders of adult insects. Laboratory work consists of intensive practice of such identification. Lecture material deals with theoretical discussion of taxonomic features observed in the laboratory. Prereq: ENT (BIOSC) 400 or consent of instructor.

ENT (BIOSC) 436, 636 Insect Behavior 3(2,3) Fundamentals of insect behavior in an evolutionary and ecological perspective. Laboratory emphasizes generation and testing of hypotheses and observation, description, and quantification of insect behavior. Prereq: ENT 301 or consent of instructor.

ENT 461 Directed Research in Entomology 1-3(0,3-9) Development of a senior thesis based on a research problem in a selected entomological area. Emphasis is on integrating the knowledge gained in the student's program with the results of the research project. May be repeated for a maximum of three credits. Prereq: Senior standing, consent of instructor.

ENT (BIOSC, W F B) 469, H469, 669 Aquatic Insects 3(1,6) Identification, life history, habitats, and interrelationships of aquatic insects; techniques of qualitative field collecting; important literature and research workers. Prereq: ENT 301 or consent of instructor.

ENT 490 Practicum 1-4 Supervised entomological learning opportunity providing highly individualized experiences to complement other programs and courses. Must be prearranged at least two months in advance. Students must file written reports midway during enrollment period and at its conclusion and must appear for oral evaluation at the end of the period. Prereq: Junior standing and consent of instructor.

ENT (GEN) 495, 695 Insect Biotechnology 3(3,0) Considers many unique genetic features exhibited by insects and describes the applications of biotechnology to enhance useful products from insects and to affect the control of destructive insects. Prereq: ENT 301, GEN 302.

ENT (SSCS) 496 Selected Topics in Creative Inquiry 1-2(1,2) See SSCS 496.

ENT (SSCS) 497 Selected Topics in Creative Inquiry Laboratory 1-2(0,3) See SSCS 497.

ENVIRONMENTAL AND NATURAL RESOURCES

Professors: M. Espey, J.D. Lanham, P.A. Layton; Associate Professors: A. Johnson, C.J. Post, S.R. Templeton; Assistant Professor: R.F. Baldwin

E N R 101 Introduction to Environmental and Natural Resources I 1(1,0) Informative overview of environmental and natural resources and their impact on society. Education and career opportunities are emphasized.

E N R 302 Natural Resources Measurements 3(2,3) Introduction to measurements of natural resources including land, vegetation, animal habitat, water quality and quantity, climate, and recreation. Remote sensing techniques are also introduced. May not be taken for credit by Forest Resource Management majors. Coreq: EX ST 301.

E N R 312 Environmental Risks and Society 3(3,0) Examines the perception, analysis and management of natural and technological risks in modern society, such as how society responds to natural or human-caused disasters and global environmental challenges; and the roles of experts, the government and the general public. Case studies foster debate and critical analysis of controversial issues. Prereq: Junior standing and completion of the General Education mathematics requirement, or consent of instructor.

E N R (BIOSC) 413, 613 Restoration Ecology 3(3,0) Applies ecological principles to the restoration of disturbed terrestrial, wetland, and aquatic ecosystems. Includes the restoration of soils and waterways, of flora and fauna, and of natural ecological processes such as plant succession and nutrient cycling. Prereq: Introductory course in ecology or conservation biology, consent of instructor.

E N R (FOR) 416, 616 Forest Policy and Administration 3(3,0) See FOR 416.

E N R 429, 629 Environmental Law and Policy 3(3,0) Develops an understanding of the three branches of government that affect and dictate use and protection of natural resources. Attention is given to major federal environmental statutes. Includes examination of how policy is developed, implemented, and evaluated in the public and private sectors. Prereq: Junior standing or consent of instructor.

E N R (FOR) 434, 634 Geographic Information Systems for Landscape Planning 3(2,3) See FOR 434.

E N R 450, 650 Conservation Issues 3(3,0) Interactive study and discussion of issues related to the conservation of natural resources, emphasizing current issues in the conservation of biodiversity, identification of conflicting issues between consumptive and nonconsumptive resource management, and development of viable solutions for conservation of natural resources. Prereq: W F B (BIOSC) 313 or consent of instructor.

ENVIRONMENTAL ENGINEERING AND SCIENCE


EE&S 201 Environmental Engineering Fundamentals I 3(3,0) Overview of topics and engineering application areas that comprise the environmental engineering profession. Significant emphasis is given to development of oral and written communication skills needed by the engineering profession and application of engineering fundamentals to environmental systems. Prereq: MTHSC 108; CH 101.

EE&S 202 Environmental Engineering Fundamentals II 4(3,3) Overview of fundamentals related to environmental engineering processes, including water treatment, wastewater treatment, solid and hazardous waste management, air pollution control, risk assessment, and pollution prevention strategies. Laboratories cover measurement techniques and applications to process engineering. Prereq: EE&S 201; CH 102.

EE&S 401, 601 Environmental Engineering 3(3,0) Introduction to the field of environmental engineering. Topics include environmental phenomena, impact of pollutants in the aquatic environment, solid-waste management, air pollution control, radiological health, and simple water and wastewater treatment systems. Prereq: Junior standing in engineering or consent of instructor. Coreq: C E 341, CH E 230, M E 308, or consent of instructor.

EE&S 402, 602 Water and Waste Treatment Systems 3(3,0) Study of fundamental principles, rational design considerations, and operational procedures of the unit operations and processes employed in water and waste treatment. Both physiochemical and biological treatment techniques are discussed. Introduces the integration of unit operations and processes into water and waste treatment systems. Prereq: EE&S 202 or 401; or consent of instructor.

EE&S 403 Water and Waste Treatment Laboratory 1(0,3) Laboratory exercises to accompany EE&S 402 in selected water and wastewater treatment operations and processes. Emphasis is on understanding of fundamental principles and operational procedures, experimental design, data analysis, use of experimental data in engineering design applications, and writing of engineering reports. Prereq: EE&S 202; Coreq: EE&S 402; or consent of instructor.

EE&S 410, 610 Environmental Radiation Protection I 3(3,0) Fundamental principles of radiological health and radiation safety. Topics include radiation fundamentals, basic concepts of environmental radiation protection, internal and external dosimetry, environmental dose calculations and radiation protection standards. Prereq: Consent of instructor.
EE&S 411, 611 Ionizing Radiation Detection and Measurement 3(2,3) Laboratory exercises in ionizing radiation detection and measurements. Topics include nuclear electronics; counting statistics; radiation interactions; basic gas, scintillation, and semiconductor detectors; gamma-ray spectroscopy; health physics survey instrumention; and thermoluminescent dosimetry. Prq: EE&S 410 or consent of instructor.

EE&S 430, 630 Air Pollution Engineering 3(3,0) Introductory course in air pollution and its control. Topics include air pollutants and effects, sources, dispersion models, engineering controls, and air-quality legislation. Prq: EE&S 202 or Senior standing in engineering or physical sciences or consent of instructor.

EE&S 450 Professional Seminar 1(1,0) Covers various topics related to skills and techniques for evaluating career opportunities, seeking and obtaining environmental engineering employment, career development, professional registration, professional ethics, and other factors necessary for achieving success in a professional career. Course enables students to make decisions that will help them succeed in their careers. Prq: Senior standing.

EE&S (B E, FOR) 451, H451, 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2) See B E 451.

EE&S 475 Capstone Design Project 3(1,6) Students apply creativity and their engineering knowledge to solve open-ended environmental engineering problems. Problems are formulated and solutions are evaluated by faculty and practicing engineers. Oral and written communication skills are developed through presentations, correspondence and project reports. Prq: Senior standing.

EE&S 480, 680 Environmental Risk Assessment 3(3,0) Quantitative estimation of human health risk posed by the release of a contaminant to the environment. Topics include methods for analyzing emission rate, environmental transport, exposure, and health effects; methods of uncertainty analysis; and the role of risk assessment in environmental regulation and environmental decision making. Prq: EE&S 202 or 401 or consent of instructor.

EE&S (B E) 484, 684 Municipal Solid Waste Management 3(3,0) Introduction to the problems, regulations, collection, handling, recycling, and disposal of municipal solid wastes in the urban and rural sectors. Emphasizes an integrated waste-management system with resource recovery, composting, incineration, landfill disposals, and their costs. Prq: EE&S 202 or Senior standing in engineering or science or consent of instructor.

EE&S 485, 685 Hazardous Waste Management 3(3,0) Introduction to the problems, regulations, treatment, and ultimate disposal of hazardous and toxic materials. Spill cleanup, groundwater transport, land disposal, incineration, and treatment technologies are discussed. Prq: EE&S 202 or 401 or consent of instructor; one semester of general chemistry.

EE&S 486, 686 Pollution Prevention and Industrial Ecology 3(3,0) Topics include pollution prevention technology, the role of pollution prevention within a corporation, source reduction and recycling assessments, treatment to reduce disposal, life-cycle assessment, design for environment, and industrial ecology. Emphasizes case studies. Prq: Junior standing in College of Engineering and Science or consent of instructor.

EE&S 490, H490, 690 Special Projects 1-3(1-3,0) Studies or laboratory investigations on special topics in the environmental engineering and science field. Arranged on a project basis with a minimum of individual student effort and a maximum of staff guidance. May be repeated for a maximum of three credits. Prq: Consent of instructor.

EE&S 491 Selected Topics in Environmental Engineering 1-3(1-3,0) Study of the dynamic role of environmental engineering in maintaining environmental quality. A comprehensive study of any phase of environmental engineering. May be repeated for credit, but only if different topics are covered. Prq: Consent of department chair.

ENVIRONMENTAL SCIENCE AND POLICY

Professor: A.W. Elzerman; Associate Professor: E.R. Carraway; Assistant Professors: S. Brame, J.T. Coates, M.L. Thompson

EN SP 200 Introduction to Environmental Science 3(3,0) Basic principles of environmental science, including ecology, energy, resources, waste management, and air, water, and soil pollution. Consideration of issues, specific cases, investigative approaches, and remedial actions. Prq: Sophomore standing and two semesters of freshman chemistry or biology, or consent of instructor.

EN SP 315, 6315 Environment and Agriculture 3(3,0) See AGRIC 315.

EN SP 400 Studies in Environmental Science 3(3,0) Study of historical perspectives, attitudes, and government policy within the framework of environmental case studies to illustrate the interaction between human and natural factors as they mutually affect the environment and man’s ability to deal with that environment. Prq: EN SP 200 or consent of instructor.

EN SP 472, 672 Environmental Planning and Control 2(2,0) Application of planning and control to effective environmental quality improvement. Considers water supply and treatment, wastewater treatment and disposal, solid waste disposal, air pollution abatement, and land use and zoning from the standpoint of control. Not intended for graduate students in engineering. Prq: Consent of instructor.

ENVIRONMENTAL TOXICOLOGY


ENTOX 400, 600 Wildlife Toxicology 3(3,0) Assessment of impacts of toxic substances on reproduction, health, and well-being of wildlife species; acute and chronic effects of agricultural chemicals, pesticides, hazardous waste, industrial waste, and oil releases are discussed. Prq: BIOCH 305 or organic chemistry, one year of general biology, W F B 350 or consent of instructor.

ENTOX 421, H421, 621 Chemical Sources and Fate in Environmental Systems 3(3,0) Discusses chemical cycles in the environment on global and microcosm scales. Examines the dependence of fate processes on physical and chemical properties and environmental conditions. Addresses breakdown, movement, and transport of selected toxincants to illustrate the mechanisms that govern chemical fate. Prq: Organic and analytical chemistry or consent of instructor.

ENTOX 430, 630 Toxicology 3(3,0) Basic principles of toxicology, including quantitation of toxicity, toxikokinetics, biochemical action of poisons, and environmental toxicology, are studied. Acute and chronic effects of various classes of poisons (e.g., pesticides, drugs, metals, and industrial pollutants) are discussed in relation to typical routes of exposure and regulatory testing methods. Prq: Organic Chemistry, one year of general biology, or consent of instructor.

ENTOX 437, 637 Ecotoxicology 3(3,0) Study of the effects of stressors on the ecosystem. Explores the integrative relationships that comprise the field of ecotoxicology in a hierarchical format that focuses on the various levels of ecological organization. Prq: ENTOX 430 or consent of instructor.

ENTOX 446 Soil and Water Quality Fundamentals 3(3,0) Studies those aspects of water quality that are influenced by soil systems. Many water quality concerns arise from land-applied chemicals, natural or manufactured. Basic soil and water chemistry principles including sorption, solution chemistry, and soil chemical transport are studied. Prq: CSENV 475 and CH 224, or consent of instructor.

ENTOX 447 Soil and Water Quality Applications 3(3,0) Potential for water quality concerns arising from land application of natural or manufactured chemicals is varied. Case studies of potential water quality concerns related to fertilizers, pesticides, biosolids, manures, and other sources are presented. Practices that can improve water quality are also studied and evaluated. Prq: CH 224 and CSENV 475, or consent of instructor.

ENTOX (CSENV, GEOL) 485, 685 Environmental Soil Chemistry 3(3,0) See CSENV 485.

EXECUTIVE LEADERSHIP AND ENTREPRENEURSHIP

Professor: W.B. Gartner; Associate Professor: W.H. Stewart; Assistant Professors: P.T. Gianiold, A.E. Ingram, J.W. Ridge; Lecturers: J.E. Hopkins, D.M. Wyman

E L E 301 Introduction to Entrepreneurship 3(3,0) An overview of entrepreneurship topics: opportunity creation and discovery, business concepts and business models, feasibility and business plans. Financial, managerial, legal, social and ethical issues are also addressed. Prq: MGT 201.

E L E (MKT) 314 New Venture Creation I 3(3,0) See MKT 314.
EX ST 301, H301 Introductory Statistics 3(2,2)
Basic concepts and methods of statistical inference; organization and presentation of data, elementary probability, measures of central tendency and variation, tests of significance, sampling, simple linear regression and correlation. Stresses the role of statistics in interpreting research and the general application of the methods. Credit toward a degree will be given for only one of EX ST 311, MTHS C 301, 302, 309.

EX ST 311 Introductory Statistics II 3(2,2)
Introduction to simple linear and multiple regression, principles of experimental design, and analysis of data using parametric and nonparametric techniques. Analysis of data is conducted using SAS. Examples come primarily from agriculture, food, life and health sciences, forestry, and natural resources. Credit toward a degree will be given for only one of EX ST 311 or MGT 310. Preq: EX ST 301 or equivalent with a C or better.

EX ST 402, 602 Introduction to Statistical Computing 3(3,0)
Introduction to statistical computing packages. Topics include data importation, basic descriptive statistic computation, basic graphic preparation, and statistical analysis methods and procedures. Preq: EX ST 301.

EX ST 411, 611 Statistical Methods for Process Development and Control 3(3,0)
Experimental design techniques for use in process development, application of screening experiments and response surface experiments, techniques for process control with implications for product quality control. Includes discussions of the use of statistical computation and analysis interpretations including computer-generated graphics. Preq: MTHS C 206 or consent of instructor.

EX ST 462 Statistics Applied to Economics 3(3,0)
Continuation of EX ST 301 emphasizing statistical methods used in the collection, analysis, presentation, and interpretation of economic data. Special attention is given to time-series analysis, the construction of index numbers, and the designing of samples for surveys in the social science fields. Preq: EX ST 301.

FINANCE
Professors: J.C. Alexander Jr., M.F. Spivey, T.M. Springer, N.G. Waller; Associate Professors: J.M. Harris Jr., A.G. Morgan, J.G. Wolf; Assistant Professor: T. Tang; Lecturer: K.D. McMillan

FIN 301 Personal Finance 3(3,0)
Analysis of the preparations of personal financial plans. Topics include savings and budgeting, personal taxes, housing and automobile decisions, loans, insurance needs, investments, and retirement needs. May not be counted toward a major or minor in Financial Management.

FIN 304 Risk and Insurance 3(3,0)
Studies the nature of risk and the role of insurance in risk management from individual and business viewpoints. Topics include probability, theory of the firm under uncertainty, insurance carriers and contracts, underwriting, and regulation. Preq: FIN 306 or 311.

FIN 305 Investment Analysis 3(3,0)
Study of techniques useful in analyzing alternative investment opportunities with emphasis on corporate securities. Investment planning and portfolio management are considered. Preq: FIN 306 or 311 with a C or better.

FIN 306 Corporation Finance 3(3,0)
Introduction to financial management of nonfinancial firms. Includes such topics as analysis of financial statements, financial forecasting, capital budgeting, working capital management, and long-term financing decisions. Credit may not be received for both FIN 306 and 311. Preq: ACCT 201; and MTHS C 309 or EX ST 301.

FIN 307 Principles of Real Estate 3(3,0)
Acquaints students with the theories, practices, and principles that govern real estate markets. Major emphasis is on specifics of real estate brokerage, property rights, and ownership; making real estate investment decisions; and financing real estate investments. Preq: FIN 306 or 311 with a C or better.

FIN 308 Financial Institutions and Markets 3(3,0)
Study of the various types of financial institutions and of topics critical to the financial institutions practitioner. Topics include financial regulations, financial security types and their yields, interest rate risk management, foreign currency risks management, and stock index futures. Preq: FIN 306 or 311 with a C or better.

FIN 311, H311 Financial Management I 3(3,0)
First in a two-course sequence to provide in-depth exposure to the theory and practice of corporate financial management and to demonstrate how financial management techniques are applied in decision making. Credit may not be received for both FIN 306 and 311. Preq: ACCT 201 and 204 each with a C or better; and MTHS C 309 or EX ST 301.

FIN 312, H312 Financial Management II 3(3,0)
Continuation of the two-course sequence that begins with FIN 311. Preq: FIN 306 or 311 with a C or better.

FIN 398 Creative Inquiry—Finance 1-4(1-4,0)
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of six credits.

FIN 399 Finance Internship 1-3(1-3,0)
Pre-planned, preapproved, faculty-supervised internships to give students on-the-job learning in support of classroom education. Internships must be no fewer than six full-time, consecutive weeks with the same internship provider. Restricted to students with a major or minor in Financial Management. To be taken Pass/Fail only. Preq: Consent of instructor.

FIN 402, H402, 602 Advanced Corporate Finance 3(3,0)
Study of the decision process and analytical techniques used in evaluating corporate investment and financing decisions. Topics include capital budgeting, corporate governance, executive compensation, mergers and acquisitions, and restructuring. Preq: FIN 312 with a C or better.
FIN 404, H404 Financial Modeling 3(3,0) Helps students develop the practical skills that combine theory, business planning, and forecasting needed to make financial decisions. Emphasizes the use of spreadsheet software used to set up and solve these models. Topics include financial statement analysis, valuation, and cost of capital. Preq: FIN 312 with a C or better; CP SC 220 or MGT 218.

FIN 405, H405 Portfolio Management and Theory 3(3,0) Introduction to portfolio management. Includes the underlying theory, managing the equity and the fixed-income portfolios, portfolio evaluation, option-pricing theory, futures markets and instruments. Preq: FIN 305 with a C or better.

FIN 406, H406, 606 Analysis and Use of Derivatives 3(3,0) Consideration of the option pricing theory and strategy techniques most commonly used in the market for options. Also considers an overview of the futures markets. Special emphasis is given to interest-rate futures, stock-index futures, and foreign-exchange futures. Preq: FIN 305 with a C or better.

FIN 408 Management of Financial Institutions 3(3,0) Detailed study of the operational, marketing, and regulatory aspects of the management of depository financial institutions. Emphasizes decision making through the extensive use of cases. Preq: FIN 308 with a C or better.

FIN 409 Professional Financial Planning 3(3,0) Concepts and practical implementation of professional financial planning focusing on essentials of budgeting and saving, risk management, tax planning, investment planning, and retirement and estate planning. Emphasizes integrating these elements into a comprehensive personal financial plan. Preq: ACCT 404, 408, FIN 304, 305.

FIN 410, H410 Research in Finance 1-3 Directed research for students interested in careers in finance. Research topic is selected by student and approved by instructor. A formal research paper is required. Preq: FIN 306 or 312, consent of instructor.

FIN 411 International Financial Management 3(3,0) Extension of the principles of finance to the international context. Focuses on implications of the existence of multiple currencies and the operations across borders of sovereign nation-states for the multinational corporation. Preq: FIN 306 or 312 with a C or better.

FIN 415, 615 Real Estate Investment 3(3,0) Focuses on the structure and analysis of real estate investment emphasizing financial theory and analysis technique. Case study and project-oriented homework assignments facilitate the understanding of real estate investments. Preq: FIN 307 with a C or better.

FIN 416, 616 Real Estate Valuation 3(3,0) Advanced course in commercial real estate valuation. Topics include income capitalization, cash equivalency, highest and best use analysis, the cost approach, the direct sales comparison approach, and DCF analysis. Preq: FIN 307 with a C or better.

FIN 417, 617 Real Estate Finance 3(3,0) Advanced course applying financial analysis and theory to real estate. Emphasizes mortgage credit analysis and current financing techniques for residential and commercial properties. Topics include financial institutions, syndications, and construction financing. Preq: FIN 307 with a C or better.
FD SC 407, 607 Quantity Food Production 2(1,3)
Principles of the production of food in quantity for use in food service systems. Emphasizes functions of components of foods and of ingredients in food, and focuses on the quality of the final product, on safe production of food, and on proper use of equipment. Coreq: FD SC 306, 404.

FD SC 408, 608 Food Process Engineering 4(3,3)
Study of basic engineering principles and their application in food processing operations. Emphasizes the relation between engineering principles and fundamentals of food processing. Prq: CH 102, FD SC 214, MTHSC 106, PHYS 207 or 200 or 122 or consent of instructor.

FD SC (PKGSC) 409 Total Quality Management for the Food and Packaging Industries 3(3,0)
Introduction to the principles of modern quality management emphasizing quality standards and issues and the practices necessary for food processing and packaging companies to survive in a customer-driven marketplace.

FD SC 410, 610 Food Product Development 4(3,3)
A strategic and systems approach to integrated product development practices for developing new food products within a team setting. Focuses on the Stage-Gate process for moving from product idea to launch and application of sensory analysis techniques.

FD SC 417 Seminar 1(1,0)
Literature research and oral presentation of a current food science topic.

FD SC 418 Seminar 1(1,0)
Literature research and oral presentation of a current food science topic.

FD SC 420, H420 Special Topics in Food Science 3-3(1-3,0)
Special topics in food science not covered in other courses. May be repeated for a maximum of 12 credits, but only if different topics are covered. Prq: Consent of instructor.

FD SC 421, H421 Special Problems in Food Science 1-40(3-12)
Independent research investigation in food science areas not conducted in other courses. May be repeated for a maximum of 12 credits. Prq: Consent of instructor.

FD SC 430, 630 Dairy Processing and Sanitation 3(2,3)
Processing, manufacture and distribution of fluid, frozen, cultured and other dairy products. Emphasizes sanitation in a commercial food processing plant environment, chemical and microbiological aspects, processing procedures, equipment operation, ingredient applications, formulation and functional properties. Prq: BIOL 104/106, CH 102.

FD SC 450 Creative Inquiry—Food Science 1-6(1-6,0)
Individual or small team research experience in close collaboration with a faculty member. Expands undergraduate learning by application of the scientific method. Research is selected by the student with approval of faculty. May be repeated for a maximum of ten credits.

FD SC 491 Practicum 1-4
Supervised experiential opportunities in the food industry. May be repeated for a maximum of 12 credits. Prq: Junior standing and consent of department chair.

FD SC 493 Practicum 1-4
Supervised experiential opportunities in the food industry. May be repeated for a maximum of 12 credits. Prq: Junior standing and consent of department chair.

FD SC 495, 695 Food Science Capstone 2(2,0)
A capstone experience that integrates the knowledge and skills acquired in the food science curriculum. Prq: FD SC 410 or consent of instructor.
FOR 410, 610 Harvesting Processes 4(3,3) Study of forest harvesting processes with detailed analysis of production, cost, environmental impacts, safety, transportation, and business considerations. 

Preq: Senior standing or consent of instructor.

FOR 413, 613 Integrated Forest Pest Management 4(3,3) Nature and control of pests of forest trees and products. Focuses on the relation of pests to silviculture, management, and natural forest ecosystems. 

Preq: Junior standing in Forest Resource Management.

FOR 415, 615 Forest Wildlife Management 3(2,3) Principles, practices, and problems of wildlife management emphasizing upland forest game species. Habitat manipulation through use of appropriate silvicultural practices in association with other techniques is evaluated. 

Preq: FOR 460 or consent of instructor.

FOR (E N R) 416, 616 Forest Policy and Administration 3(3,0) Introduction to the development, principles, and legal provisions of forest policy in the United States and an examination of administrative and executive management in forestry.

FOR 417, 617 Forest Resource Management and Regulation 3(3,0) Fundamental principles and analytical techniques in planning, management, and optimization of forest operations. 


FOR 418, 618 Forest Resource Valuation 3(3,0) Analysis of capital investment tools and their application to decision making among forestry investment alternatives; valuation of land, timber, and other resources associated with forestry, including the impact of inflation and taxes. 

Preq: FOR 304 or consent of instructor.

FOR 419 Senior Problems 1-3(1-3,0) Problems chosen with faculty approval in selected areas of forestry. With department chair’s approval, may be repeated once for credit. Preq: Senior standing.

FOR 423, 623 Current Issues in Natural Resources 2(2,0) Lectures in various fields of forestry delivered by selected representatives from forest industries, consultants, agencies, associations, and other forestry operations. Will not be taught when enrollment is less than 15. To be taken Pass/Fail only. Preq: Junior standing or consent of instructor.

FOR 425 Forest Resource Management Plans 2(1,3) Development of multiple resource forest management plans. Economic and environmental impacts of implementing management plans. 

Preq: FOR 417 or consent of instructor.

FOR 426, H426 Forest Resource Management Plans Seminar 1(1,0) In-depth exploration of topics and problems presented in FOR 425. To earn honors credit, students must be enrolled in corequisite FOR 425 and earn a B or better in both courses. 

Preq: Senior standing, approval of Department of Forest Resources. Coreq: FOR 425.

FOR (HORT) 427, 627 Urban Tree Care 3(3,0) Principles, practices, and problems of protecting and maintaining trees in urban and recreational areas. Examines environmental and biological factors affecting trees in high-use areas, their management and cultural requirements, and the practices necessary for their protection and care as valuable assets in the landscape. 

Preq: FOR 205 or HORT 303.

FOR 431, 631 Recreation Resource Planning in Forest Management 2(1,3) Analysis of forest recreation as a component of multiple-use forest management; techniques of planning; physical and biological effects on forest environments; and forest site, user, and facility management.

FOR 433, 633 GPS Applications 3(2,3) Develops competence in global positioning system (GPS) technology, including theory, methods, and application to natural resources mapping. Topics include basic concepts of GPS; projection systems; types of data; mission planning; and data capture, correction, and export to geographical information systems (GIS). Preq: Senior standing or consent of instructor.

FOR (E N R) 434, 634 Geographic Information Systems for Landscape Planning 3(2,3) Develops competence in geographical information systems (GIS) technology and its application to various spatial analysis problems in landscape planning. Topics include data development and management, spatial analysis techniques, critical review of GIS applications, needs analysis and institutional context. GIS hardware and software, hands-on application. Credit may be received for only one of C R P 434, FOR (E N R) 434.

FOR 441, 641 Properties of Wood Products 3(3,0) Basic properties of wood, including the hygroscopic, thermal, electrical, mechanical, and chemical properties; standard testing procedures for wood. Preq: Junior standing or consent of instructor.

FOR 442, 642 Manufacture of Wood Products 3(3,0) Study of the manufacture of lumber, plywood, poles, piles; drying, preservation, grading, and uses of wood products. Considers the manufacture of particleboard, flakeboard, oriented-strand board, fiberboard, and paper products. Includes physical, mechanical, and chemical properties and their applications. Preq: Consent of instructor.

FOR 444, 644 Forest Products Marketing and International Trade 3(3,0) Study of marketing and international trade practices currently employed by the forest products industry and the application of basic marketing principles and global trade concepts in the industry’s current and future environment. Preq: FOR 442 or consent of instructor.

FOR 447 Special Problems in Forest Products 1-3(0,3-9) Laboratory, library, or field study of problems in selected areas of forest products. Emphasizes the planning and execution of research and the reporting of results. Research must be conducted under the guidance of a Forest Products faculty member. May be repeated for a maximum of three credits, but only if different topics are covered. Preq: Senior standing and consent of instructor supervising the study.

FOR 450, 650 Woody Plant Stress Physiology 3(3,0) Structure, function, and physiology of tree shoot and crown growth, wood formation, diameter growth, root growth, and reproduction, especially as related to stress factors. Preq: BIOSC 401 or FOR 460 or consent of instructor.

FOR (B E, EE&S) 451, H451, 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2) See B E 451.

FOR 461 Silviculture Seminar I 1(1,0) In-depth exploration of topics and problems presented in FOR 465. To earn honors credit, students must be enrolled in FOR 465 and earn a B or better in both courses. Preq: Junior standing and approval of Department of Forest Resources. Coreq: FOR 465.

FOR 463 Silviculture Seminar II 1(1,0) In-depth exploration of topics and problems presented in FOR 465. To earn honors credit, students must be enrolled in FOR 465 and earn a B or better in both courses. Preq: Junior standing and approval of Department of Forest Resources. Coreq: FOR 465.

FOR 465, 665 Silviculture 4(3,3) Discussion of the theory and practice of manipulating forests to meet the needs and values of landowners and society in accordance with biological, ecological, and economic principles. Preq: FOR 206 and Forestry Summer Camp or consent of instructor.

FOR 480 Selected Topics in Urban Forestry 1-3(1-3,0) Study of selected and varied topics, problems, and issues in urban forestry and arboriculture through readings, class discussion, and individual and group projects. Preq: FOR (HORT) 427.

FOR 493 Selected Topics in Forest Resources 1-15(1-15,2-30) Specialized topics not covered in other courses that explore current areas of research and management in forest resources in a format of lecture, lab, or both. May be repeated for a maximum of 15 credits, but only if different topics are covered. Preq: Junior standing or consent of instructor.

FOR 498 Senior Portfolio 1(1,0) Collection of Web-based materials representing the creative and scientific papers, presentations, and résumés written by students to satisfy curriculum requirements. Students are informed in FOR 102 and regularly thereafter regarding the format and content of their portfolios. Preq: Senior standing in Forest Resource Management. Coreq: FOR 425.

FOREST AND NATURAL RESOURCES

Professors: R. J. Johnson, J.D. Lanham, P.A. Layton, Director; G.K. Yarrow; Associate Professors: W.R. English, C.J. Post; Assistant Professors: R.F. Baldwin, E. Mikhailova; Extension Associate: R.D. Willey

F N R 102 Forestry and Natural Resources Freshman Portfolio 1(1,0) Informative sketch of forestry, wildlife biology, and natural resources; education and career opportunities for natural resource professionals. Students initiate their Web-based student portfolios, which showcase their skills and experiences (e.g., résumés, accomplishments, and work samples) during their undergraduate degree. To be taken Pass/Fail only. Restricted to Environmental and Natural Resources, Forest Resource Management, Forestry and Natural Resources—Undeclared, and Wildlife and Fisheries Biology majors.

F N R 204 Soil Information Systems 4(3,3) Includes input, storage, analysis, and output of soil information through the use of global positioning systems, direct/remote sensing, geographic information systems, and web soil survey. Provides fundamental knowledge of the role of soils in forest and wildlife management. Preq: General chemistry sequence.
Courses of Instruction

FR N R 466, 666 Stream Ecology 3(2,3) Covers the ecology of flowing water systems. Topics include geomorphology, physical and chemical factors of streams, biology of stream-dwelling organisms, trophic relationships, competition, colonization, drift, community structure, disturbance, and human impacts. Prq: Junior standing or consent of department chair.

FN R 470 Creative Inquiry I-3(1-3,0) Multisemester commitment to participate in forestry and natural resources research with a group of peers, mentored by a faculty member or advanced graduate student. Students learn to collect, analyze, evaluate, and present information. May be repeated for a maximum of six credits. Prq: Consent of instructor.

FN R 490 Field Training in Natural Resources 3(0,9) Four to eight week internship in which students work in natural resources. Students have supervised management responsibility. Total of 135 hours required. Must be arranged at least two months in advance. To be taken Pass/Fail only. Prq: Senior standing in Environmental and Natural Resources, Forestry, or Wildlife and Fisheries Biology, or consent of instructor.

FN R H491 Senior Honors Thesis I 3(3,0) Individual research for students in the Forestry and Natural Resources Honors Program. Focuses on developing a plan of research under the direction of a faculty advisory committee. Prq: Senior standing, membership in Calhoun Honors College, and approval of Department of Forestry and Natural Resources.

FN R H492 Senior Honors Thesis II 3(3,0) Individual natural resources research for students in the Forestry and Natural Resources Honors Program. Focuses on data collection, analysis, report writing, and oral presentation. Prq: FN R H491.

FN R 499 Natural Resources Seminar I 1(0,0) Exploration of current literature and research in natural resources. Students participate in the analysis of research findings, utilizing skills acquired in their undergraduate programs. May be repeated for maximum of two credits.

FRENCH

FR 101 Elementary French 4(3,1) Multimedia course for beginners that combines video, audio, and print to teach the fundamentals of the French language and culture. Emphasizes communicative proficiency (listening comprehension, speaking, reading, and writing).

FR 102 Elementary French 4(3,1) Continuation of FR 101; three hours a week of classroom instruction and one hour a week in the language laboratory.

FR 104 Basic French 4(3,1) Intensive one-semester program combining FR 101 and 102 for students who have previously studied French. Includes fundamentals of grammar and vocabulary as a foundation for building written and oral proficiency.

FR 151 French for Graduate Students 3(3,0) Intensive program only for graduate students preparing for the reading examination in French. A minimum grade of B on a final examination will satisfy graduate school foreign language requirement. May be repeated once for credit. To be taken Pass/Fail only. Prq: Graduate standing.


FR 297 Creative Inquiry—French I 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. Arrangements with faculty members must be established prior to registration.

FR 299 Foreign Language Drama Laboratory 1(0,3) Participation in foreign drama productions. No formal class meetings, but an average of three hours per week in a foreign language drama workshop for production. May be repeated for a maximum of three credits. Prq: Consent of instructor directing the play.

FR 300 Survey of French Literature 3(3,0) Study of selected masterpieces of French literature in their artistic, cultural, and historical context. May include theme and genre studies. Prq: FR 202 or consent of department chair.

FR 304 French Short Story 3(3,0) Introduction to the study of French narrative literature and the elements of critical analysis through the examination of short stories spanning the medieval era to the present from both France and Francophone countries. Prq: FR 305 or consent of instructor.

FR 305 Intermediate French Conversation and Composition I 3(3,0) Practice in the spoken language stressing vocabulary building, pronunciation, intonation, and comprehension. Requires written work to increase accuracy and assignments in the language laboratory. Prq: FR 202 or consent of department chair.

FR 307 French Civilization 3(3,0) Study of significant aspects of French culture from its origins to the present. Prq: FR 305 or consent of instructor.

FR 308 French Linguistics I: Phonetics, Phonology, and Morphology 3(3,0) Study of the fundamental sound patterns, melodic structure, and work formation processes of modern standard French. Prq: FR 304 or consent of instructor.

FR 309 French Linguistics II: Syntax and Semantics 3(3,0) Study of the fundamental structures of French syntax and semantics. Prq: FR 304 or consent of instructor.

FR 310 CLIP Summer Immersion Program 6(6,0) Conducted entirely in French for eight hours daily. This summer immersion program consists of activities that combine interrelating cultural topics with language skill practice. Frequent opportunities to converse with native speakers during meals and on excursions. Students receive six credits, three of which may be taken in lieu of FR 202. Prq: FR 201.

FR 312 Writing in French I 3(3,0) Study of the vocabulary, syntax, and stylistics in short compositions and creative papers in French, on both fiction and non-fiction topics. Prq: FR 202 or consent of department chair.

FR 316 French for International Trade 1 3(3,0) Spoken and written French common to the French-speaking world of business and industry, emphasizing business practices and writing and translating business letters and professional reports. Cross-cultural references provide opportunity for comparative and contrasting analyses of American and French cultural perspectives in a business setting. Prq: FR 202, 305 (or concurrent enrollment); or consent of department chair.

FR 317 Contemporary French Civilization 3(3,0) Study of significant aspects of France today; the country, its economy, government, and society. Taught in French. Prq: FR 305 or consent of instructor.

FR 320 Studies in French Theatre 3(3,0) Explores a variety of genres (medieval farce, classical comedy and tragedy, romantic melodrama, and the Nouveau Théâtre) with emphasis on staging. Class materials consist of scripts, videotaped performances, and theoretical readings on issues pertaining to spectacle in social, political, and artistic terms. May be repeated for a maximum of six credits. Prq: FR 202 or consent of department chair.

FR 357 Selected Topics in the Culture of Paris 3(3,0) On-site study of Paris and its relationship to France and Europe through readings, lectures, field trips, small student-group explorations, and reporting sessions. All activities are conducted in French. Prq: FR 202 or consent of instructor.

FR 363 French and Francophone Poetry 3(3,0) Study of traditions and major works of French and/or Francophone poetry in their historical, cultural, and aesthetic contexts. Topics may include genres, periods, traditions (romanticism, symbolism, cubism, surrealism), or themes. Prq: FR 305.

FR (PO SC) 383 French-Language News 1(1,0) See PO SC 383.

FR H391 Survey of French Literature 1(1,0) One-hour independent study to allow honors students to pursue supervised research on a topic relating to the literary, cultural, and artistic movement in France. Coreq: FR 300, membership in Calhoun Honors College.

FR 392 Creative Inquiry—French I 1-4(1-4,0) Students focus on a special research area under the guidance of a faculty member. After acquiring the requisite background, students formulate hypotheses for a group project, develop a critical framework, and initiate research on a specific topic.

FR 398 Directed Reading 1-3(1-3,0) Directed study of selected topics in French literature, language, and culture. May be repeated for a maximum of six credits. Prq: Consent of department chair.

FR 400 Modern French Literature 3(3,0) Study of selected works of 20th-century French literature in their artistic, cultural, and historical context. Prq: FR 202 or consent of department chair.

FR 409 Writing in French II 3(3,0) Intensive study of syntax and stylistics through composition and translations. Prq: Senior standing or consent of department chair.
FR 410 Francophone Literature 3(3,0) Study of selected works of francophone literature emphasizing Africa and the Caribbean in their artistic, cultural, historical, and political contexts. Prereq: FR 300 or consent of department chair.

FR 411 Advanced French Conversation and Composition 3(3,0) Continuation of FR 305 emphasizing greater fluency and sophistication in oral and written expression. Prereq: FR 305 or consent of instructor.

FR 412 French and Francophone Cinema 3(2,3) Examination of cinematic practice as a discourse and the role it plays in the representation of social relations, particularly race, ethnicity, class, power, sex, and gender in the French-speaking world. May include a study of major directors, genres, and movements. Taught in French. Films with English subtitles. Prereq: FR 305 or consent of instructor.

FR 415 Translation Seminar 3(3,0) Methods and theory of translation and a comparison of French and English structures. Practical exercises in translating from French to English and vice versa in a variety of texts. Prereq: FR 305 or consent of instructor.

FR 416 French for International Trade II 3(3,0) Study of language and cultural environment of the French-speaking markets of the world, including the linguistic and cultural idioms that support global marketing in general and the international marketing of textiles, agricultural products, and tourism in particular. Prereq: FR 316.

FR 420 French Enlightenment, Revolution and Romanticism 3(3,0) Cultural and literary studies of the century and a half (1715–1851) in which France occupied the center stage of world history and its modern institutions came into being. Emphasizes the free intellectual inquiry championed by philosophers and the romantic melancholy in the aftermath of the Revolution. Prereq: FR 305 or consent of instructor.

FR H438 French Honors Research 3(3,0) Individual honors research conducted under the direction of Language Department faculty. May not be used to satisfy requirements for the major in Modern Languages–French or Language and International Trade or the minor in Modern Languages. Prereq: Junior standing and membership in Calhoun Honors College.

FR H439 French Honors Thesis 3(3,0) Individual honors research conducted and thesis completed under the direction of Language Department faculty member. May not be used to satisfy requirements for the major in Modern Languages–French or Language and International Trade or the minor in Modern Languages. Prereq: Junior standing, FR H438, membership in Calhoun Honors College.

FR 475 Advanced French Seminar 3(3,0) Concentrated research and discussion on an advanced topic in French literature, film, drama, music, or philosophy. May be repeated for a maximum of six credits, but only if different topics are covered. Prereq: FR 304 or 305, Senior standing; or consent of instructor.

FR 476 Advanced Seminar on French Thought 3(3,0) Research and discussion of an advanced topic, text, or group of texts with a particular focus on French theory and philosophy but including works of French literature. Conducted in English. May be repeated for a maximum of six credits, but only if different topics are covered. Prereq: Senior standing or consent of instructor.

FR 477 Advanced Seminar on the French and Francophone Novel 3(3,0) Examination of the French novel and/or narrative prose focusing on a theme, genre, or period. May be repeated for a maximum of six credits, but only if different topics are covered. Prereq: FR 304 or 305, Senior standing; or consent of instructor.

FR H491 Modern French Literature 1(1,0) Independent study to allow honors students to pursue in depth an author, work, movement, or genre related to contemporary French culture, art, or literature. Coreq: FR 400, membership in Calhoun Honors College.

FR H492 The French Corporation 1(1,0) Independent study to allow honors students to pursue an indepth study of the organization, structure, functions, and economic role of a French business enterprise. Coreq: FR 417, membership in Calhoun Honors College.

FR 497 Creative Inquiry—French 1+4(4,0) Continuation of research initiated in FR 397. Students complete their projects and disseminate their research results. Prereq: FR 397 or consent of instructor.

FR 498 Independent Study 1-3(1-3,0) Directed study of a selected topic in French literature, language, or culture. May be repeated for a maximum of six credits. Prereq: Consent of department chair.

FR 499, 699 Selected Topics in French Literature 3(3,0) Selected topics that have characterized French literature, language, and culture. May be repeated for a maximum of six credits. Prereq: Consent of department chair.

GENETICS


GEN 103 Careers in Biochemistry and Genetics 1(1,0) Introduction to biochemistry and genetics career paths, professional organizations, ethical issues, and requirements for advanced study. Also gives students training in design of a professional portfolio. Students may not receive credit for both BIOCH 103 and GEN 103. Prereq: Freshman or sophomore standing in Biochemistry or Genetics or consent of instructor.

GEN 300 Fundamental Genetics 3(3,0) Introductory course covering fundamental principles of genetics in prokaryotes and eukaryotes. Emphasizes Mendelian genetics, physical and chemical basis of heredity, and population genetics. Prereq: BIOL 103 or 110 or consent of instructor.

GEN 301 Fundamental Genetics Laboratory 1(0,3) Experimental and observational approach addressing the concepts presented in GEN 300. Inheritance patterns in a wide variety of eukaryotic and prokaryotic organisms are covered. Prereq: GEN 300 (or concurrent enrollment).

GEN 302, H302 Molecular and General Genetics 3(3,0) Rapidly-paced course covering Mendelian and molecular genetics, with introductory coverage of quantitative and population genetics. Emphasizes the molecular basis of heredity and gene expression in prokaryotes and eukaryotes and modern genetic technology. Prereq: BIOL 110 with C or better.

GEN 303 Molecular and General Genetics Laboratory 1(0,4) Laboratory exercises introducing fundamental principles of inheritance in prokaryotes and eukaryotes. Prereq: BIOL 110 with C or better and GEN 302 or concurrent enrollment.

GEN (BIOSCI) 405, 605 Molecular Genetics of Eukaryotes 3(3,0) Molecular genetic analyses of eukaryotes in relation to mutations and repair, complex phenotypes, biochemical pathways, short- and long-term regulation of gene expression, and evolution. Prereq: GEN 302 or equivalent and one semester of biochemistry, or consent of instructor.

GEN 410, H410, 610 Population and Quantitative Genetics 3(3,0) Classical and computational genetics topics, including Mendelian vs. non-Mendelian inheritance, genetic variation, evolutionary, conservation, coalescent theory, molecular evolution, quantitative trait locus, and association mapping in the framework of population and quantitative genetics. Prereq: EX ST 301 and GEN 302 with C or better.

GEN 411, 611 Population and Quantitative Genetics Laboratory 2(0,4) Exercises are performed using eukaryotic organisms with appropriate markers, and molecular markers are amplified, sequenced, and analyzed. Collected data are used to test hypotheses regarding possible modes of inheritance and patterns of molecular evolution. Population and molecular evolutionary genetics concepts are also examined. Prereq: GEN 410 or concurrent enrollment, or consent of instructor.

GEN 420, H420, 620 Molecular Genetics and Gene Regulation 3(3,0) Molecular genetics, including replication, transcription and translation, gene expression, recombinant DNA technology, developmental, human, cancer, and behavioral genetics. Prereq: BIOCH 301 and GEN 302 with C or better, or consent of instructor.

GEN 421 Molecular Genetics and Gene Regulation Laboratory 2(0,4) Explores molecular genetics techniques (transformation, cloning, PCR, gel electrophoresis, Southern Blotting, reporter genes, gene mapping) using prokaryotic and eukaryotic organisms. Prereq: GEN 420 or concurrent enrollment, or consent of instructor.

GEN (BIOCH) 440, H440, 640 Bioinformatics 3(3,0) Theory and application of computational technology to analysis of the genome, transcriptome, and proteome. Prereq: GEN 302 and BIOCH 301 with C or better, or consent of instructor.
Courses of Instruction

GEN 450, H450, 650 Comparative Genetics 3(3,0)
Outlines the genome structure, function, and evolution based on available complete genome sequences. Topics include the evolution of multigene families, origin of eukaryotic organelles, molecular phylogeny, gene duplication, domain shuffling, transposition, and horizontal gene transfer. Prq: GEN 420 and 440 with C or better, or consent of instructor.

GEN 470, 670 Human Genetics 3(3,0) Basic principles of inheritance; population, molecular and biochemical genetics; cytogenetics; immunogenetics; complex traits; cancer genetics; treatment of genetic disorders; genetic screening and counseling; and the Human Genome Project. Prq: GEN 300 or 302 with C or better, or consent of instructor.

GEN 490 Selected Topics in Genetics 1-4(1-4,0)
Comprehensive study of selected topics not covered in other courses. May be repeated for a maximum of eight credits, but only if different topics are covered. Prq: consent of instructor.

GEN 491, H491 Directed Research in Genetics 1-8(1-8,0) Orientation in genetic research (i.e. experimental planning, execution, and reporting). May be repeated for a maximum of eight credits. Prq: consent of instructor.

GEN 493, H493 Senior Seminar 2(2,0) Analysis and presentation of the selected reading. May be repeated for a maximum of six credits. Prq: Junior standing or consent of instructor.

GEOG 103 World Regional Geography 3(3,0) Introduction to the contemporary survey of the world, including its physical and cultural features. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 104 Introduction to Physical Geography 4(3,3) Examines the condition of the physical environment, especially the earth’s surface and the processes that act on it. Topics range from earth-sun relations to the evolution of landscapes; human habitats and human alteration of the environment. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 301 Political Geography 3(3,0) Geographic basis of states: sovereignty, territory, power within states, relations between states. The geography of international affairs. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 302 Economic Geography 3(3,0) Spatial analysis of economic activity emphasizing regional economics and development. Topics include world population; technology and economic development; principles of spatial interaction; and geography of agriculture, energy manufacturing, and tertiary activities. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 303 Urban Geography 3(3,0) Historical and contemporary survey of the urban world. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 305 Cultural Geography 3(3,0) Broad examination of the basic cultural variables in the human occupation of the earth using ecological, spatial, regional, and historical approaches. Topics vary but may include cultural areas and distributions, cultural change, cultural landscape, and cultural ecology. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 306 Historical Geography 3(3,0) Exploration of geographical change and the varied patterns of past human activities and people’s relationships with the physical environment. Case studies from around the world are used to emphasize key themes in historical geography. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 330 Geography of the Middle East and North Africa 3(3,0) Thematic survey of a world region extending from Morocco to Afghanistan. Emphasizes climate, environment, social geography, historical development of the regional culture of Islam, and common problems facing the area today. Prq: GEOG 101 or 103, or consent of instructor.

GEOG 340 Geography of Latin America 3(3,0) Introduction to the physical, economic, political, and human/cultural geography of Latin America. Special focus is on regional unity and diversity and the historical interaction of man and environment.

GEOG 350 Geography of Africa 3(3,0) Study of how tropical, or sub-Saharan, Africa functions in the modern world. Africa’s physical environments, peoples and cultures, colonial and post-colonial history, and ideologies of economic development. Five basic themes are covered: population, natural resources, environmental quality, political organization, economic development. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 399 Creative Inquiry—Geography 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. Prq: at least nine credits. Prq: GEOG 101, 103, or consent of instructor.

GEOG 401, 601 Studies in Geography 3(3,0) Intensive study of the geography of a selected world region, such as North America, Europe, or the Middle East, or the geography of a topic, such as the geography of oil or the geography of underdevelopment. May be repeated once for credit with departmental consent. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 410, 610 Geography of the American South 3(3,0) Study of the geography of the American South in its changing complexities across almost 400 years of development. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 420, 620 Historical Geography of the United States 3(3,0) Survey that places the spatial concepts of geography into a time sequence with special emphasis upon the United States. Prq: GEOG 101 or 103 or consent of instructor.

GEOG (PRTM) 430, 630 World Geography of Parks and Equivalent Reserves 3(3,0) See PRTM 430.

GEOG 440, 640 Geography of Historic Preservation 3(3,0) Aspects of historic preservation emphasizing sites and structures in their geographical, historical, and socioeconomic contexts. Examples are drawn from American architectural styles and settlement forms. Prq: GEOG 101 or 103 or consent of instructor.

GEOG 499 Independent Study in Geography 3(3,0) Study of selected topics in geography under the direction of a faculty member chosen by the student. Student and faculty member develop a course of study designed for the individual student and approved by the department chair prior to registration.

GEOLOGY

Associate Professors: E.R. Carraway, M.A. Schlautman
Assistant Professors: T.A. Kendall, S.M. Mooney; Lecturers: W.G. Dean, L.B. Krause

GEOL 100 Current Topics in Geology 1(1,0) Lectures and demonstrations covering topics of current interest in the different fields of geology. Recent research developments and career opportunities in the geosciences are emphasized.

GEOL 101, H101 Physical Geology 3(3,0) Study of the minerals and rocks that compose earth’s crust, their origins and transformations. Emphasizes geological processes, both internal and external, by which changes are produced on or in the earth.

GEOL 102, H102 Earth History 4(3,3) Survey of the earth’s geologic history emphasizing how the continents and ocean basins have evolved through geologic time. Evolution of life from the beginning of the fossil record through the present; identification of fossil plants and animals and interpretation of earth’s past through study of geologic maps. Field trips illustrate principles. Prq: GEOL 101, 103.

GEOL 103, H103 Physical Geology Laboratory 10(2) Laboratory to accompany GEOL 101. Provides instruction in the identification of minerals and rocks and in the interpretation of geologic processes through study of topographic maps.Field trips provide direct observation of processes and results. Coreq: GEOL 101.

GEOL 112 Earth Resources 3(3,0) Survey of earth’s mineral, energy, water, and land resources and environmental and societal impacts associated with the use of these resources.
GEOL 114 Earth Resources Laboratory 1(0.2) Laboratory to accompany GEOL 112. Provides instruction in the identification of ore and gem minerals and of other earth materials of economic importance. Land and water resources are explored through the use of topographic maps, aerial photographs, remotely sensed images, and field trips. Coreq: GEOL 112.

GEOL 120 Natural Hazards 3(3,0) This class explains the scientific causes of various natural hazards (earthquakes, volcanoes, hurricanes, tsunamis, etc.) Additionally, topics explore how economic, social, and political factors influence our preparedness for and response to disasters. Discussions also examine moral dilemmas resulting from technological limits on our ability to predict and prevent such events.

GEOL (ENSP) 125 Sustainable Resource Use 3(3,0) This course explores the challenges our society faces in making the transition to renewable resource use in a way that is truly sustainable environmentally, economically and socially. The conflicting demands of each system will be examined and used to critically examine possible solutions using a systems based approach.

GEOL 205 Mineralogy and Introductory Petrology 3(3,0) Includes crystal symmetry and introduction to x-ray crystallography, composition and stability of minerals, survey of common rock-forming minerals, petrological classification of rocks and introduction to rock associations. Credit toward a degree will be given for only one of GEOL 207 or 208. Coreq: GEOL 205.

GEOL 207 Mineralogy and Introductory Petrology Laboratory 1(0,3) Identification of rock-forming minerals and important ore minerals based on their physical properties. Includes hand specimen petrology of igneous, sedimentary, and metamorphic rocks. Credit toward a degree will be given for only one of GEOL 207 or 208. Coreq: GEOL 205.

GEOL 208 Mineralogy and Petrography Laboratory 2(0,6) Identification of rock-forming minerals and important ore minerals based on their physical and optical properties. Hand specimen petrology and petrography of igneous, sedimentary, and metamorphic rocks. Study of minerals in thin section using polarizing microscope. Credit toward a degree will be given for only one of GEOL 207 or 208. Coreq: GEOL 205.

GEOL 210 Geology of the National Parks 3(3,0) Survey of selected national parks and monuments emphasizing the dynamic geological processes that have shaped the landscapes of these areas. Special attention is focused on parks exhibiting recent geological structures of the earth, their description, origin, and field recognition. Practical problems in interpreting geologic structures are utilized, in addition to theoretical considerations of the mechanics and causes of tectonism. Coreq: GEOL 101 or consent of instructor.

GEOL 211 Geoanalysis I 4(3,3) Students develop a working knowledge of statistical methods used to formulate and solve problems in the earth sciences. Emphasis is on sampling methods and experimental design for geologic settings and on formulating and evaluating hypotheses using statistical inference of data sets. Coreq: MTHSC 108.

GEOL 212 Geoanalysis II 4(3,3) Students develop a working knowledge of deterministic methods used to formulate and solve problems in the earth sciences. Emphasis is on developing conceptual models from geologic field observations, formulating idealized problems, and analyzing and interpreting solutions. Special focus is on using computer software to support analyses. Coreq: GEOL 211, MTHSC 108.

GEOL [ASTR] 220 Planetary Science 3(3,0) Survey of the formation and evolution of planetary bodies. Emphasizes the origin of planetary material and procedures for the primary processes operative on planetary surfaces. Describes major features of the planets and moons in our solar system, as revealed by recent space missions.

GEOL 270 Experiences in Sustainable Developments 2(0,6) Integrates cross-disciplinary perspectives on sustainability through active student participation in real-world development projects. Focuses on identifying and overcoming environmental, technical, social/organizational, and economic barriers to the sustainability of water resources. Emphasizes small-scale international water resources development.

GEOL 291 Introduction to Research I 1(1,0) Required group learning and research experience for Geology majors (open to others with consent of instructor). Introduction to problem solving through case studies and interdisciplinary team approaches. Focus is on, but not limited to, research approaches in geology. Social and ethical contexts, communication skills, and professional development are incorporated. Coreq: GEOL 291 or consent of instructor.

GEOL 292 Introduction to Research II 1(1,0) Required group learning and research experience for Geology majors (open to others with consent of instructor). Introduction to problem solving through case studies and interdisciplinary team approaches. Focus is on, but not limited to, research approaches in geology. Social and ethical contexts, communication skills, and professional development are incorporated. Coreq: GEOL 291 or consent of instructor.

GEOL 300, H300 Environmental Geology 3(3,0) Discussion-oriented introduction to relationships of man to his physical surroundings and problems resulting from upsetting the established equilibria of geologic systems; man’s role as a geologic agent, environmental conservation and management. Coreq: GEOL 101 or consent of instructor.

GEOL 302, H302 Structural Geology 4(3,3) Diverse geologic structures of the earth, their description, origin, and field recognition. Practical problems in interpreting geologic structures are utilized, in addition to theoretical considerations of the mechanics and causes of tectonism. Coreq: GEOL 102 or consent of instructor.

GEOL 313 Sedimentology and Stratigraphy 4(3,3) Topics include origin, composition, and texture of sediments and sedimentary rocks; sedimentation processes, depositional environments, facies relationships, and diagenesis; introduction to stratigraphic methods and geochronology. Laboratory involves description and classification of hand specimens and thin sections and analytical methods. Coreq: GEOL 206 or consent of instructor.

GEOL 314, H314 Sedimentary Petrology 3(2,3) Origin, composition, and texture of sediments and sedimentary rocks, including both siliciclastic and chemical varieties. Interpretation of tectonic settings, depositional systems, facies relationships, and diagenesis. Laboratory involves description and classification of hand specimens and thin sections and analytical methods. Coreq: GEOL 206 or consent of instructor.

GEOL 316, H316 Igneous and Metamorphic Petrology 3(2,3) Classification, occurrence, and origin of igneous and metamorphic rocks. Discussion of the chemical and physical processes involved in magmatic crystallization and metamorphism. Laboratory study of igneous and metamorphic rocks in hand specimen and thin section. Coreq: GEOL 206, 216 or consent of instructor.

GEOL 318 Introduction to Geochemistry 3(3,0) Introduction to distribution of elements in the core, mantle, and crust of the earth. Control of rock type on trace element content in soils and sediments. Weathering; soil and regolith formation; water-sediment interrelations; solubility, mobility and bioavailability in relation to redox, pH and complexation; biogeochemical cycles of selected elements. Coreq: GEOL 101 and CH 102 or consent of instructor.

GEOL 360 Geology and Castles of Scotland 3(1,4) Students spend two weeks in Scotland exploring its diverse geology and visiting medieval castles and ancient stone mountains. Highlights include studying the unconformity at Secair Point made famous by James Hutton, the father of modern geology; and travelling “The Rock Route” through the Scottish Highlands, where modern ideas about mountain building were birthed.

GEOL 370 Western United States Field Study 3(1,4) Field excursion to a geologic region in the western United States. Students visit sites where the stratigraphy and structure are well exposed, studying a variety of landforms and the geologic processes responsible for their formation. Pre-trip sessions are held on campus. Additional fees are required. May be repeated for a maximum of six credits. Coreq: GEOL 101 or consent of instructor.

GEOL 375, H375 Bahamian Field Study 3(1,4) Students develop an understanding of Bahamian geology, culture, and social structure (including the influences of historical context and natural environments). Students stay one week on Andros Island in the Bahamas, traveling by van and boat to various sites. Additional fees are required. Coreq: GEOL 101 or consent of instructor.

GEOL 391 Research Methods I 2(2,0) Required group learning and research experience for Geology majors (open to others with consent of instructor). Introduction to problem solving through case studies and interdisciplinary team approaches. Focus is on, but not limited to, research methods in geology. Social and ethical contexts, communication skills, and professional development are incorporated. Coreq: GEOL 292 or consent of instructor.
GEOL 392 Research Methods II 2(2,0) Required group learning and research experience for Geology majors (open to others with consent of instructor). Introduction to problem solving through case studies and interdisciplinary team approaches. Focus is on, but not limited to, research methods in geology. Social and ethical contexts, communication skills, and professional development are incorporated. Preq: GEOL 391 or consent of instructor.

GEOL 403, 603 Invertebrate Paleontology 3(2,3) Study of life of past geologic ages as shown by fossilized remains of ancient animals, with emphasis on the invertebrates. Preq: GEOL 101 or consent of instructor.

GEOL 405, 605 Surficial Geology 4(3,3) Study of surface features of the earth and the processes that produce them. Analysis of landforms including their form, nature, origin, development, and rates and patterns of change. Laboratory studies emphasize terrain analysis and the mechanics of surficial geological processes. Preq: GEOL 102, 300, or consent of instructor.

GEOL H408, 608 Geohydrology 3(3,0) Study of the hydrologic cycle, aquifer characteristics, theory of groundwater movement, mechanics of well flow, experimental methods, and subsurface mapping. Preq: GEOL 101, 102.

GEOL 409, H409, 609 Environmental and Exploration Geophysics 4(3,3) Students develop an understanding of the principles and methods used to acquire, analyze, and interpret geophysical data. Emphasis on seismic/radar, gravimetric, and electromagnetic methods. Applications to hydrogeology, environmental engineering and science, soil science, contaminant transport and remediation, near surface geology, geotechnical problems, oil and gas exploration, and carbon sequestration. Preq: GEOL 101 or consent of instructor.

GEOL 411, H411 Research Problems 1-3(0,3-9) Field, laboratory, or library study of an approved topic in geology. Topic would be one not normally covered in formal courses, but may be an extension of a course. Taught either semester. May be repeated for a maximum of six credits. Preq: Senior standing or consent of instructor.

GEOL 413, 613 Stratigraphy 3(2,2) Analysis of stratified rocks as the repository of earth history and the conceptual framework used to synthesize the world geologic record as a coherent whole. Emphasizes not only traditional lithostratigraphy but also modern seismic stratigraphy, biostratigraphy, magnetostratigraphy, and current stratigraphic issues. Preq: GEOL 314 or consent of instructor.

GEOL 415 Analysis of Geological Processes 3(3,0) Introduction to methods for analyzing geological processes. Mathematical methods are introduced to solve problems related to stream flow, reaction kinetics, radioactive decay, heat flow, diffusion, fluid flow through geologic media and related processes. Preq or Coreq: MTHSC 206 or consent of instructor.

GEOL 421, 621 GIS Applications in Geology 3(1,4) Introduction to geographic information systems with applications to current geological and hydrological problems. Topics include the use of global positioning systems, spatial analysis, and image analysis. Hands-on training with geographic information systems software and techniques is covered in lab. Preq: Senior standing, strong computer skills.

GEOL 451, 651 Selected Topics in Hydrogeology 1-4(1-3,0-3) Selected topics in hydrogeology emphasizing new developments in the field. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: GEOL 300 or 408, or consent of instructor.

GEOL 459, 659 Biogeochmistry 3(0) Examines how biology directs mass and energy transfer between the lithosphere, biosphere, hydrosphere, and atmosphere. Scale of examination ranges from molecular to global. Topics include element cycling, the mineral-microbe/plant interface, biom-ineralization, and biogeochemical applications to bioremediation, ecology, environmental toxicology, and biotechnology. Preq: CH 102 or GEOL 318 or consent of instructor.

GEOL 475 Summer Geology Field Camp 6(4,6) Introduction to field techniques emphasizing methods applied to hydrogeology. Includes description and mapping of hydrogeologic units and structures using outcrop data and lithologic and geophysical well logs. Also covers construction of potentiometric maps from water level data, performance of pumping tests on mapped aquifers, and analysis of data to determine aquifer characteristics. Preq: GEOL 205 and 302, or consent of instructor.

GEOL (CSENV, ENTOX) 485, 685 Environmental Soil Chemistry 3(3,0) See CSENV 485.

GEOL 491 Research Synthesis I 3(2,3) Required capstone group learning and research experience for Geology majors (open to others with consent of instructor). Involves synthesis of applied geology and other approaches for problem solving through collaborative teams. Course is the culmination of a sequence of case studies incorporating social and ethical contexts, communication skills, and professional development. Preq: GEOL 392 or consent of instructor.

GEOL 492 Research Synthesis II 3(2,3) Required capstone group learning and research experience for Geology majors (open to others with consent of instructor). Involves synthesis of applied geology and other approaches for problem solving through collaborative teams. Course is the culmination of a sequence of case studies incorporating social and ethical contexts, communication skills, and professional development. Preq: GEOL 491 or consent of instructor.

GERMAN

Professor: G.J. Lowe; Associate Professor: J. Schmidt; Assistant Professor: S. Fredrick; Lecturers: L.J. Ferrell, J.T. Littlejohn

GER 101 Elementary German 4(3,1) Course for beginners in which, through conversation, composition, and dictation, the fundamentals of the language are taught and a foundation is provided for further study and the eventual ability to read and speak the language. Three hours a week of classroom instruction and one hour a week in the language laboratory.

GER 102 Elementary German 4(3,1) Continuation of GER 101; three hours a week of classroom instruction and one hour a week in the language laboratory.

GER 104 Basic German 4(3,1) Intensive one-semester program combining GER 101 and 102 for students who have previously studied German. Includes fundamentals of grammar and vocabulary as a foundation for written and oral proficiency.

GER 151 German for Graduate Students 3(3,0) Intensive program only for graduate students preparing for the reading examination in German. A minimum grade of B on a final examination will satisfy graduate school foreign language requirement. May be repeated once for credit. To be taken Pass/Fail only. Preq: Graduate standing.

GER 201, H201 Intermediate German 3(3,1) Brief review of GER 101 and 102, with conversation, composition, and dictation, and the reading of more serious German prose in short stories and plays. Includes literary and cultural perspectives. Preq: GER 102.

GER 202, H202 Intermediate German 3(3,1) Emphasizes reading nontechnical German prose more rapidly. Writing, speaking, and listening skills continue to be developed. Includes literary and cultural perspectives. Preq: GER 201 or consent of instructor.

GER 260 Selected Topics in German Literature 3(3,0) Study of significant aspects of German literature. Conducted in English.

GER 297 Creative Inquiry—German 1-4(1-4,0) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. Arrangements with faculty members must be established prior to registration.

GER 299 Foreign Language Drama Laboratory 10(0,3) Participation in foreign language drama productions. No formal class meetings, but an average of three hours per week in a foreign language drama workshop for production. May be repeated for a maximum of three credits. Preq: Consent of instructor directing the play.

GER 305 German Conversation and Composition 3(3,0) Training in spoken and written German emphasizing vocabulary acquisition, oral and written communication strategies, appropriate linguistic formulations for specific cultural contexts, and stylistics. Preq: GER 202 or consent of instructor.

GER 306 The German Short Story 3(3,0) Examines the Austrian, German, and Swiss short story as a distinct literary genre that flourished particularly after 1945. Provides ample conversation and composition practice, as well as an introduction to principles of literary prose analysis. Preq: GER 202 or consent of instructor.

GER 310 Summer Immersion Program 6(6,0) Conducted entirely in German for eight hours daily. Program consists of activities that combine interrelating cultural topics with language skill practice. Frequent opportunities to converse with native speakers during meals and on excursions. Students receive six credits, three of which may be taken in lieu of GER 202. Preq: GER 201.
GER 316 German for International Trade I 3(3,0)
Spoken and written German common to the German-speaking world of business and industry emphasizing business practices and writing and translating business letters and professional reports. Corequisite references provide opportunity for comparative and contrastive analysis of American and German cultural patterns in a business setting. Prereq: GER 202 and 305 (or concurrent enrollment) or consent of department chair.

GER 340 German Culture 3(3,0) Examines the cultures of German-speaking nations from their origins to the present. Emphasizes the Federal Republic of Germany both before and after the German unification of 1990. Prereq: GER 305 or 306 or consent of instructor.

GER 360 German Literature to 1832 3(3,0,0) Extensive study of a major theme or aspect of German drama. May include recorded live performances, stage design, theatre architecture, and the music and art of the theatre. Prereq: GER 305 or 306 or consent of instructor.

GER 445 German Film 3(2,3) Overview of German cinema including the expressionist classics of the Weimar Republic, entertainment and documentary movies of the Nazi era, classics of the postwar New German Wave (West Germany), distinctive East German films, and vanguard contemporary films. Prereq: GER 305 or 306 or consent of instructor.

GER 460 Modernism in German Literature 3(3,0) Study of major works of German literature and culture in the modernist era (1888-1933). May include drama, music, philosophy, and the plastic arts. Prereq: GER 305 or 306 or consent of instructor.

GER 461 German Literature Since 1933 3(3,0) Study of selected authors, texts, or genres in contemporary German literature. Prereq: GER 305 or 306 or consent of instructor.

GER 475 Advanced German Seminar 3(3,0) Concentrated research and discussion on advanced topics, works, or texts in German literature, film, art, drama, music, or philosophy. Conducted in German. May be repeated for a maximum of six credits, but only if different topics are covered. Prereq: One 400-level German course or consent of instructor.

GER 476 Advanced Seminar in German Thought 3(3,0) Concentrated research and discussion on advanced topics, works or texts in German literature, film, art, drama, music or philosophy. Conducted in English. May be repeated for a maximum of six credits, but only if different topics are covered. Prereq: Senior standing or consent of instructor.

GER 497 Creative Inquiry—German 141(1-4,0) Continued of research initiated in GER 397. Students complete their project and disseminate their research results. Prereq: GER 397 or consent of instructor.

GER 498, 698 Independent Study 1-3(1-3,0) Supervised study of selected topics in German literature, language, or culture. May be repeated for a maximum of six credits. Prereq: Consent of department chair.

GRAPHIC COMMUNICATIONS
Professors: J.C. Birney, K. Neubecker; Associate Professors: E.M. Weisennich, N.L. Wolfkamp; Assistant Professor: L.H. O’Hara; Senior Lecturers: C.D. Jones, N.W. Leininger, P.G. Rose

G C 101 Orientation to Graphic Communications 1(1,0) Introduction to the curriculum and the industry, including its processes, products, and careers. Emphasizes the attributes most desirable for successful entry and advancement up a variety of career ladders.

G C 102 Computer Art and CAD Foundations 4(2,6) Graphic Communications industries make extensive use of software and best practices from concept through production. This course provides a solid foundation in drawing, imaging and layout software; packaging structure and 3D-CAD; design principles and problem solving relative to audience, need, typography, color, materials, printing and end use.

G C 103 Graphic Communications I for Packaging Science 4(2,6) Emphasizes the interrelationships of packaging and graphic arts. Topics include theory and practice in packaging requirements relative to basic graphic arts concepts, principles, and practices; layout; design: electronic copy preparation; the printing processes of offset lithography; screen printing; gravure; and flexography. Includes digital and specialty printing processes, environmental, health, and safety concerns.

G C 104, H104 Graphic Communications I 4(2,6) Emphasizes basic graphic arts industries concerning principles and practices, with laboratory applications in photography, layout and design, conventional and electronic copy preparation, reproduction photography, offset lithography, screen printing, and finishing operations. Covers flexography, gravure, letterpress, and specialty printing processes, along with environmental, health, and safety concerns.

G C 199 Creative Inquiry—Graphic Communications I 1-3(1-3,0) Under the direction of a faculty member, students pursue approved scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of six credits. Prereq: Freshman standing.

G C 207, H207 Graphic Communications II 4(2,6) Continuation of G C 104. Intermediate course for graphic communications and graphic arts specialists. Emphasizes the attributes most desirable for successful entry and advancement up a variety of career ladders.

G C 299 Creative Inquiry—Graphic Communications II 1-3(1-3,0) Under the direction of a faculty member, students pursue approved scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of six credits. Prereq: Sophomore standing.

G C 340 Digital Imaging and eMedia 4(2,6) Course centers around digital camera capture and control, and provides students with experience, techniques and processing options for creating interactive, integrated eMedia. Coursework includes commercial photography, color profiling, digital asset management, personalized cross-media campaigns, Web design and podcasts. Prereq: G C 102 and 104.

G C 350 Graphic Communications Internship I 1(0,3) Full-time supervised employment in an industrial in-plant setting for expansion of experience with materials and processes, production people, and organizations. Restricted to Graphic Communications majors. Prereq: G C 104 or equivalent, consent of instructor. Coreq: CO-OIP 101.

G C 399 Creative Inquiry—Graphic Communications III 1-3(1-3,0) Under the direction of a faculty member, students pursue approved scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of six credits. Prereq: Junior standing.
Courses of Instruction

G C 406, H406, 606 Package and Specialty Printing 4(2,6) In depth study of the problems and processes for printing and converting in package label and specialty printing industries. Flexographic prepara-
tion, printing, die making, diecutting, printing screen, container printing, pad printing and bar code produc-
tion are covered. New developments and trends are discussed. Laboratory in techniques includes printing and converting. Prereq: G C 310 or 340; or consent of instructor.

G C 407, 607 Advanced Flexographic Methods 4(2,6) In-depth study of the methods used in flexographic printing and converting of porous and nonporous substrates. Theory and laboratory applications include setting standards for process color, preparation of plate systems, ink mixing and color matching, testing of films and foils, analysis of recent developments, and prediction of future markets. Prereq: G C 406 or consent of instructor.

G C 440, H440, 640 Commercial Printing 4(2,6) Advances skills learned in previous graphic communications courses and applies the knowledge to large format presses. Students work from the design conception stage through all aspects of preparation, production, and finishing. Emphasizes understanding and incorporating emerging technologies into the production workflow. Prereq: G C 310, 340 or consent of instructor.

G C 444, H444, 644 Current Developments and Trends in Graphic Communications 4(2,6) Advanced course for Graphic Communications majors. Emphasizes the theory and technical developments that affect process and equipment selection. Topics include color theory and applica-

G C 445, H445 Advanced Screen Printing Methods 3(2,3) In depth study of the systems and materials used with the screen printing process. Emphasizes techniques of control and procedures for establishing screen printing methods and standards. Prereq: G C 207 or consent of instructor.

G C 446, 646 Ink and Substrates 3(2,3) Covers components, manufacturing, process use as well as end use of ink and substrates used in lithography, flexography, gravure, and screen printing. Examines the interrelationship between inks, substrates, and the printing process. Through controlled testing and examination, optimum conditions for improved printability are determined. Prereq: G C 405; 406 or 440; or consent of instructor.

G C 448, H448, 648 Planning and Controlling Printing Functions 3(2,3) Study of systems for setting printing production standards, estimating, scheduling, job planning, and the selection of new hardware and technologies. Prereq: G C 350, 405, 406, 440, 450 or consent of instructor.

G C 450 Graphic Communications Internship II 10(0,3) Continuation of G C 350. Prereq: G C 350, 405, 406 or 440; consent of instructor. Coreq: COOP 102.

G C 451, H451 Special Projects in Graphic Communications 1-60,3-18) Advanced projects covering theory and/or practices going beyond the scope of regular coursework. Written project approval is required before registering. May be repeated with advisor’s approval. Prereq: Junior standing, comple-
tion of three graphic communications courses, or consent of instructor.

G C 455 Advanced Graphic Communications Internship 10(0,3) Fulltime employment in an industry directly or indirectly related to printing. Work site and job must be approved in advance. Prereq: G C 350.

G C 480 Senior Seminar in Graphic Communications 2(2,0) Study of current trends and issues in the graphic communications industry. Class centers around group discussions dealing with relevant topics facing the graphic communications manager today. Students draw upon academic experiences, internship experiences, and library research to fa-
cilitate discussion. Must be taken during student’s last semester on campus. Prereq: G C 450.

G C 490, 690 Graphic Communications Selected Topics 1-3(1-3,0) Subjects not covered in other graphic communications courses; organized ac-
cording to industry trends and student needs. May be repeated for a maximum of 18 credits, but only if different topics are covered. Prereq: Consent of instructor.

G C 499 Creative Inquiry—Graphic Communications IV 1-3(1-3,0) Under the direction of a faculty member, students pursue approved scholarly activi-
ties individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registra-
tion. May be repeated for a maximum of six credits. Prereq: Senior standing.

GREAT WORKS

G W (ENGL) 301, H301 Great Books of the Western World 3(3,0) Introduces Great Works minor. Includes readings about the Great Books concept, as well as various great books from the humanities, arts, and natural and social sciences. Prereq: Sophomore literature.

G W 402, H402 Great Works of Science 3(3,0) Understanding of science in terms of its history and its approach to problem-solving through study of selected great works. Emphasis is on develop-
ing students’ abilities to reflect on the problems and methodologies encountered in the scientific method.

G W 403, H403 Special Topics in Continental Literature 3(3,0) Important primary texts written in modern European languages are taught in English. Content varies according to instructor. Prereq: Sophomore literature.

G W 405, H405 The Darwinian Revolution 3(3,0) Examination of Charles Darwin’s The Origin of Spec-
es and its cultural impact from his time to ours. Topics include the contemporaneous reception of Darwin’s work, the Scopes Monkey Trial, and more recent controversies over Creationism and Intel-
ligent Design. Prereq: Sophomore literature.

HEALTH


HLTH 202 Introduction to Public Health 3(3,0) Examination of the forces that have influenced current health delivery systems, health practices, and trends. General systems theory is introduced. Health majors and minors will be given enroll-
ment priority.

HLTH 203 Overview of Health Care Systems 3(3,0) Introduction to the health care delivery system in-
cluding public health and health care components. Examines and discusses individual and public ex-
pectations of need and demand for health care and delivery of public health and health care services.

HLTH 240 Determinants of Health Behavior 3(3,0) Analysis of health behaviors based on psychological, social, cultural, and environmen-
tal factors. Introduces health behavior theories. Prereq: Health Science major, HLTH 202 or 298.

HLTH 250 Health and Fitness 3(3,0) Study of interrelationship between health and fitness. Emphasizes the cardiovascular system and benefits of exercise.

HLTH 298 Human Health and Disease 3(3,0) Study of good health practices emphasizing lifestyles and measures of health. Health majors and minors will be given enrollment priority.

HLTH 303 Public Health Communication 3(3,0) Introduction to the use of health and communica-
tion theory and social marketing strategies to create effective, evidence-based, culturally appropriate health communication messages and campaigns. Prereq: HLTH 240, 298.

HLTH 305 Body Response to Health Behaviors 3(3,0) Positive benefits and the negative impact of certain behaviors at cellular, organ, and body-
system levels are examined. The pathways of selected injury and disease are explored. Expected physiological changes are applied in identifying strategies for promoting health in the presence (or absence) of disease. Health majors and minors will be given enrollment priority. Coreq: BIOSC 223 or consent of instructor.

HLTH 310 Women’s Health Issues 3(3,0) Exploration of specific health needs of women, with em-
phasis on understanding and preventing problems of women’s health. Health majors and minors will be given enrollment priority. Prereq: Two-semester sequence in science or consent of instructor.

HLTH 315 Social Epidemiology 3(3,0) Exploration of the current problems and issues associated with the health of population groups. The interrela-
tionships of biological, sociocultural, behavioral, environmental, political, and economic risk fac-
tors and the health and illness patterns of those in population groups are examined. Prereq: HLTH 298, 380 or consent of instructor.