ED EC 430 Early Childhood Mathematics 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, H 336 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 420 Early Childhood Science 3(3,0) Students develop knowledge, skills, and attitudes needed to foster science education among young children. Emphasis is on 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. Preq: General education requirements. Coreq: ED EC 400, 430, 450, 450, and READ 459.

ED EC 430 Early Childhood Mathematics 3(3,0) Theories and methods of teaching mathematics are examined 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. Preq: General education mathematics requirement; admission to the professional level. Coreq: ED EC 400, 420, READ 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 concepts, techniques, and methods in primary schools. Preq: Admission to the professional level. Coreq: ED EC 400, 420, 430, READ 459.

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; analyze the educational needs of the young child in the cognitive realm; and examine the implementation of activities, experiences, and play-based program models. Preq: Admission to the professional level. Coreq: ED EC 400, 420, READ 459.

ED EC 484 Directed Teaching in Early Childhood Education 12(1,33) 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. Preq: ED EC 400, 450, ED EL 321, 488, READ 459; admission to the professional level; consent of area committee chair.

EAST ASIAN STUDIES

E AS 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 211 Principles of Microeconomics 3(3,0) Introduction to the study of the behavior of consumers and business firms. Particular topics include competition, monopoly, international trade, and the impact of selected public policies. Intended as the first of a two-semester sequence in the foundations of economics.

ECON 212 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. Preq: ECON 211 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. Preq: ECON 314.

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

ECON 324 Economics and Sports 3(3,0)
Economic analysis of sports teams, leagues, and institutions. A discussion of 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. Preq: Sophomore standing. ECON 211.

ECON 325 Personnel Economics 3(3,0)
Studies the various compensation and personnel practices that 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. Preq: ECON 211 or consent of instructor.

ECON 340 Behavioral Economics 3(3,0)
Introduction to 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. Preq: ECON 211 or consent of instructor.

ECON 350, H 350 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? A study of 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. Preq: ECON 314 or consent of instructor.

ECON 360 Public Choice 3(3,0)
Cover 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. Preq: ECON 211 or consent of instructor.

ECON H 390 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 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. Preq: ECON 314.

ECON 402 Law and Economics 3(3,0)
Applications 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. Preq: 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. Preq: ECON 314 or consent of instructor.

ECON 405, 406 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 statistical software applications; multiple regression analysis; hypothesis testing under conditions of multicollinearity; heteroscedasticity, and serial correlation. Preq: ECON 211 and 212; MTHSC 108 or 207; EX ST 301 or MTHSC 301 or 309.

ECON 406, 406 A Advanced Econometrics 3(3,3)
Reviews statistical inference using multiple regression (OLS) analysis and model specification. Topics include multivariate analysis, heteroscedasticity, and serial correlation; two-stage 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. Preq: 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. Preq: ECON 314 or consent of instructor.

ECON 411, 611 Economics of Education 3(3,0)
A study 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 effect on economic growth and income distribution. Preq: ECON 314 or consent of instructor.

ECON 412 International Microeconomics 3(3,0)
A study of the essential aspects of international economic linkages. Gains and redistributive effects of trade and the barriers to trade are discussed within the context of a variety of economic models. The history of trade policy and the political economy of its determination are also discussed. Preq: ECON 314 or consent of instructor.

ECON 413 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. Preq: 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. Preq: 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. Preq: ECON 314 or consent of instructor.

ECON 422 International 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 the background of monetary history and institutions. Preq: ECON 314 and 315 or consent of instructor.

ECON 424 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. Preq: ECON 314 or consent of instructor.

ECON 425, 625 Antitrust Economics 3(3,0)
A study 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. Preq: ECON 309 or 314 or consent of instructor.

ECON 426, H 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. Preq: ECON 314, 405; or consent of instructor.

ECON 430 Topics in Mathematical Economics 3(3,0)
Skills acquired in freshman mathematics are applied to selected topics in economic theory. Course is a good complement to ECON 314 and provides excellent preparation for 400-level courses in economics, especially ECON 405. May be taken concurrently with ECON 314. Preq: ECON 314, and MTHSC 108 or 207.

ECON 440, 640 Game Theory 3(3,0)
Introduction to the formal analysis of strategic interaction among rational, self-interested rivals. Basic theoretical aspects of games are discussed and applied to such topics as bargaining, voting, auctions, and oligopoly. Preq: ECON 314 and MTHSC 106, or ECON 430, or consent of instructor.
Electrical and Computer Engineering


E C E 201, H 201 Logic and Computing Devices 3(2,2) Study of logic with an introduction to Boolean algebra; number systems and representation of information; use of integrated circuits to implement combinational and sequential logic functions and computing elements; organization and structure of computing systems. Preq: MTHSC 108, PHYS 122.


E C E 204 Circuit Analysis Problems I 1(0,3) A solution of the basic analysis problems in AC circuit analysis. Preq: E C E 202, MTHSC 206, PHYS 221. Coreq: E C E 204.

E C E 211 Electrical Engineering Laboratory I 1(0,2) Principles of measurement and instruments used to measure parameters and dynamic variables in electric 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, PHYS 221. Coreq: E C E 212.


E C E 223 Computer Systems Engineering 3(3,0) An analysis of implementation techniques for systems software. A survey of major programming concepts for new applications involving 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, H 262 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, Latch forms, and introduction to Fourier series and transforms. Preq: E C E 202, MTHSC 206, PHYS 221. Coreq: E C E 222, MTHSC 208.

E C E 263 Circuit Analysis Problems II 1(0,3) A solution of basic AC circuit analysis techniques to analyze the transient and steady-state behavior of both simple and complex circuits. Preq: E C E 262, MTHSC 208.

E C E 272 Computer Organization 4(3,2) Introductory course in computer organization and architecture. Topics include basic hardware and software structure, addressing methods, programs control, processing units, I-O organization, arithmetic, main-memory organization, peripherals, microprocessor families, RISC architectures, and multiprocessors. Preq: E C E 261 and CP SC 101 or 111 or 157 or 210.

E C E 300 Junior Honors Seminar 1(2,0) A selection of topics from various areas of research to acquaint 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.

E C E 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: E C E 309.

E C E 308 Electronics and Electromechanics 2(2) Continuation of E C E 307. Energy conversion systems are considered, as well as basic electronics. Preq: E C E 307.

E C E 309 Electrical Engineering Laboratory I 1(0,2) Laboratory to accompany E C E 307. Basic electrical circuits and instrumentation. Coreq: E C E 307.

E C E 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: E C E 262, MTHSC 208, PHYS 221. Coreq: E C E 311.


E C E 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: E C E 262, MTHSC 208, PHYS 221. Coreq: E C E 311.

E C E 321 Electronics II 3(3,0) A laboratory 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: E C E 320. Coreq: E C E 312.

E C E 327 Digital Computer Design 3(3,0) Design of high-speed A LUs; control and timing circuitry, memory systems and I/O circuits; microprogrammed computer design using bit-slice microprocessors; current hardware topics related to computer design; hands-on design experience; and use of logic analyzer for system debugging. Preq: E C E 371.

E C E 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: CP SC 102 or 210; CP SC 340 or 212; E C E 272.


E C E 352 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: CP SC 340 or 212 and MTHSC 419.

E C E 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: E C E 262, PHYS 221.

E C E 371 Microcomputer Interfacing 4(3,3-3) Interfacing of microcomputers to peripherals or other computers for purposes of data acquisition, device monitoring and control, and other communications. The interfacing problem is considered at all levels including computer architecture, logic, timing, loading, protocols, and software laboratory for building and simulating designs. Preq: E C E 262, 272. Coreq: E C E 320.

E C E 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 M axwell’s equations. Preq: E C E 262, MTHSC 206, PHYS 221.

E C E 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, coupled circuits. Preq: E C E 390, MTHSC 208.

E C E 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: E C E 320. Coreq: MTHSC 311 or 434.
E C E 405 Design Projects in Electrical and Computer Engineering 1-3(0)-6 Individually defined projects oriented toward providing experience in establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation; development of student creativity through the solution of open-ended problems; individual instruction in design methodology. May be repeated for a maximum of three credits. Prereq: E C E 330 or 409, consent of project supervisor.


E C E 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. Prereq: E C E 330. Coreq: E C E 495.

E C E 410, 610 Modern Control Theory 3(3,0) Introduction to modern control theory. Topics include fundamentals of matrix algebra, state space analysis and design, nonlinear systems and optimal control. Prereq: E C E 409.

E C E 412 Electrical Machines Laboratory 1(0,2) Selected experiments to familiarize students with characteristics of transformers, DC and A C motors and generators. Measurement techniques and component modeling are included. Coreq: M T H S C 434 or software of instructor. Prereq or Coreq: E C E 360 or 419.

E C E 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. Prereq: E C E 329, 352, M T H S C 419.

E C E 418, 618 Power System Analysis 3(3,0) Study of power system planning and operational problems. Subjects covered are load flow, economic dispatch, fault studies, transient stability, and control of problems. System modeling and computer solutions are emphasized through class projects. Prereq: E C E 360, 380.

E C E 419, 619 Electric Machines and Drives 3(3,0) Performance, characteristics, and modeling of A C and D C 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: M T H S C 434 or consent of instructor.

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. A application varies each semester. Extensive use is made of computer-aided design tools 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 (RT L) for description and design of digital systems. Prereq: E C E 272 or consent of instructor.

E C E 430, 630 Digital Communications 3(3,0) Study of digital communication systems. Topics include error-control coding, synchronization, multiple-access techniques, spread spectrum signaling, and fading channels. Prereq: E C E 427.

E C E 431, 631 Digital Electronics 2(2,2) Electronic devices and circuits of importance to digital computer operation and to other areas of electrical engineering are considered. A active and passive waveshaping, waveform generation, memory elements, switching, and logic circuits are some of the topics. Experimentation with various types of circuits is provided by laboratory projects. Prereq: E C E 321. Coreq: M T H S C 311 or 434.

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: M T H S C 311 or 434.

E C E 436, 636 Microwave Circuits 3(3,0) A nalysis 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: M T H S C 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) The underlying principles of design for optical fibers in practical systems are covered. Optical fiber as a waveguide is examined using wave optics and ray optics. Design criteria for using monomode and multimode fibers are discussed. Other topics include fabrication, measurement. Prereq: E C E 381. Coreq: M T H S C 434 or consent of instructor.

E C E 440, 640 Performance Analysis of Local Computer Networks 3(3,0) Introduction to the design and performance analysis of local computer networks. Emphasis is on performance analysis of representative multi-access procedures. Three common types of networks are considered in detail. Prereq: E C E 272, 317.

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 A I system architectures; system design in PROLOG and LISP. Project is required. Prereq: E C E 329, 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, M T H S C 311 or 434.

E C E 449 Computer Network Security 3(1,4) Hands-on practical in the administration and security of modern network service with emphasis on 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 329, 352.

E C E 455, 655 Fundamentals of Robotics 3(3,0) See M E 456.

E C E 459, 659 Integrated Circuit Design 3(2,2) Design concepts and factors influencing the choice of technology; fundamental M O S device design; silicon foundaries, custom and semicustom integrated circuits; computer-aided design software/hardware trends and future developments; hands-on use of C A D tools to design standard library cells; systems design considerations, testing, and packaging. Prereq: E C E 321. Coreq: M T H S C 311 or 434.

E C E 460 Computer-Aided Design and Analysis 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, M T H S C 311, 434, 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); codes, digital circuit power management, real time scheduling, and embedded operating systems. Lab work consists of projects on embedded hardware (e.g. PC-104+). Prereq: CP SC 212 and E C E 371 or consent of instructor.

E C E 491 U Undergraduate Honors Research 1-6 Individual research projects conducted under the direct supervision and guidance of a faculty member. May be repeated for a maximum of six credits.
Courses of Instruction

E C E 492, 692 Special Problems 1-3 Special assignment in electrical or computer engineering. Some typical assignments include computer programs, term papers, technical literature searches, hardware projects, and design project leadership. May be taken only once for credit.

E C E 493, 693 Selected Topics 1-3 (1-3,0) Classroom study of current and new technical developments in electrical and computer engineering. May be repeated for a maximum of six credits, but only if different topics are covered. Prereq: Consent of instructor.

E C E 495 Integrated System Design I 2(1,3) Engineering design of systems is considered in a continuous process of project definition, planning, execution, and evaluation. This process includes consideration of both technical and non-technical factors in design. Strong emphasis is placed on the development of effective technical communications skills, particularly oral communications competency. Prereq: E C E 321, 330, 360, 371, 381 (three of which must have been completed prior to enrollment, with the remaining taken as corequisite courses). Coreq: E C E 409 (in addition to any deficit courses in the prerequisites).

E C E 496 Integrated System Design II 2(0,6) Project-oriented course which brings together electrical engineering students of dissimilar training into teams or project groups. Group assignments are made which are designed to develop an appreciation for individual and creative thinking as well as team effort. Prereq: E C E 321, 330, 360, 371, 381, 409, 495.

ELEMENTARY EDUCATION

Professor: D. P. Reinking; Associate Professors: C. C. Linnell, D. A. Smith; Assistant Professor: C. O. Dean; Lecturers: W. L. Calvert, W. E. Holton, R. I. Jones, R. A. Kaminski, J. S. Wright

ED EL 304 Instructional Planning, Management, and Communications 3(3,0) Provides students with knowledge and techniques for short and long term planning of developmentally appropriate lessons. Students learn how to structure A DEPT lessons and activities to meet the needs of students. Students learn techniques for time and behavior management, organization, and effective communication with school audiences. Prereq: ED F 334, admission to the professional level.

ED EL 311 Teaching Diverse Populations 3(3,0) Pre-service teachers examine the role of teachers as they relate to culturally appropriate curricula, instruction, and evaluation. Prereq: Admission to the professional level.

ED EL 321 Physical Education Methods for Classroom Teachers 3(3,0) Provides education majors with a basic understanding of the methods and techniques utilized in teaching elementary physical education. Emphasis is placed on acquiring a basic understanding of the movement education approach and the ability to teach integrated lessons utilizing this approach. Prereq: Junior standing, admission to the professional level.

ED EL 401 Elementary Field Experience 3(0,9) Practical classroom experience prior to the student teaching semester for Elementary Education majors. For a twelve-week period, students spend two hours per week in schools observing, tutoring individuals, conducting small group activities, and teaching the class. To be taken Pass/Fail only. Prereq: ED F 334; concurrent enrollment in ED EL 488 and REA D 460; admission to the professional level.

ED EL 451 Elementary Methods in Science Teaching 3(3,0) 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. Prereq: Elementary Education science requirements concurrent enrollment in ED EL 401, 487, 488 and REA D 460, admission to the professional level.

ED EL 452 Elementary Methods in Mathematics Teaching 3(3,0) Special emphasis is given the development of understanding, skills, and attitudes in the elementary curriculum with focus on strategies, techniques, and materials for teaching elementary mathematics. Prereq: General Education mathematics requirement; admission to the professional level.

ED EL 458 Health Education Methods for the Classroom Teacher 3(3,0) Study of the content, methodology, and resource materials necessary for teaching comprehensive health education in public schools. Emphasis is on the National Health Education Standards and the health behaviors of youth that are allied with the Coordinated School Health Program. Prereq: Minimum grade point ratio of 2.0.

ED EL 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. Prereq: ED EL 321, 401, 451, 452, 487, 488, REA D 460; admission to the professional level, consent of area committee chair.

ED EL 487 Teaching Social Studies in the Elementary School 3(3,0) Introduction for pre-service teachers to the skills of social studies and methods, materials, and techniques needed to teach these skills to students in the elementary school. Prereq: HIST 172, 173; GEOG 101 or 103; concurrent enrollment in ED EL 401, 451, 488 (for Elementary majors) and REA D 460; admission to the professional level.

ED EL 488 Teaching the Language Arts in the Elementary School 3(3,0) Introduction for pre-service 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. Prereq: ENG L 103, 385; concurrent enrollment in ED EC 400, 450 (for Early Childhood majors); concurrent enrollment in ED EL 401, 451, 487 (for Elementary majors); REA D 459, 460; admission to the professional level.

ENGINEERING

Professor: B. L. Still, Director; Associate Professor: W. J. Park; Assistant Professor: M. W. Ohland; Lecturers: C. A. Balch; Visiting Instructor: E. A. Stephan

ENGR 101 Introduction to Engineering 1(0,2) Introduction to the engineering profession and engineering disciplines for the purpose of assisting students in their selection of an engineering major. Professional ethics, technical communications, word processing, and electronic communications are taught. Credit toward a degree will be given for only one of ENGR 101 or CES 101.

ENGR 110 Engineering Problems Workshop 1(0,2) Workshop devoted to the analysis and solution of engineering-oriented problems. Representative problems taken from the different fields of engineering are used to illustrate such analytical and problem-solving techniques as estimation and approximation, numerical aids to computation, and solutions by graphical methods.

ENGR 120, H 120 Engineering Problem Solving and Design 3(1,4) Methodology and practice of engineering problem solving and engineering design. Selected computer tools, teamwork, and communication modes are employed. Ethics, safety, economics, and environmental concerns are considered. Prereq: ENGR 101, MTH SC 106. Coreq: PHYS 122.

ENGR 130 Engineering Fundamentals 2(1,2) Topics include dimensional analysis, basic statistics, advanced spreadsheet applications (conditional statements, functions). Also included are laptop-based instrumentation used in solving problems and graphical representation of various physical phenomena. Sections are flavored to the various disciplines. Coreq: MTH SC 106 or higher.

ENGR 141 Programming and Problem Solving in Mechanical Engineering 3(2,2) Students formulate mechanics-based problems and solve using MATLAB programming; estimate answers for comparison to computed solutions; read, interpret, and write programs; write user instructions; design output, iterate, evaluate conditional statements, and debug; analyze data collected using laptop-based instrumentation.

ENGR 150 Introduction to Materials 1(1,0) Introduction to materials used in modern technology. Different materials (metals, ceramics, and polymers) and different forms (bulk, fibers, gels, thin films, etc.) are discussed in the context of their application to consumer products, structural composites, refractories, biomedical implants, and electronic and optical materials. Prereq: Enrollment in General Engineering or consent of instructor.

ENGR 180 Computers in Engineering 3(2,3) Introduction to the use of computers in engineering analysis, design, and communications. A high-level programming language and other software are used on microcomputers. Prereq: Engineering major; knowledge of a computer language. Coreq: MTH SC 106.
Courses of Instruction

ENGINEERING GRAPHICS
Lecturers: C. A. Balch, R. A. Emeret

E G 208 Engineering Graphics with Computer Applications 2(1,3) Introduction of basic concepts in engineering graphics as a means of communication. A reassessment include orthographic projections, descriptive modeling, and computer graphics. Credit toward a degree will be given for only one of E G 208 or 209. Coreq: ENG R 141.

E G 209 Introduction to Engineering Graphics 2(1,3) Introduction of basic graphical concepts needed for engineering education, including orthographic projections, descriptive modeling, and computer graphics. Credit toward a degree will be given for only one of E G 208 or 209. Preq: ENG R 120 or consent of instructor.

E G 412, 612 Interactive Computer Graphics 3(3,0) Graphics hardware and display technology; reduction and presentation of engineering data; techniques of geometrical transformations, perspective, and model manipulation; methodology of computer-aided design; application of higher-level software to engineering problems. Preq: E G 208 and MTH SC 208 or consent of instructor.

E G 490, 690 Special Topics in Engineering Graphics 1-3(1-3,0) Comprehensive study of any computer-aided topic in engineering graphics not covered in other courses. May be repeated for a maximum of six credits. Preq: Consent of instructor.

ENGINEERING MECHANICS

ENGL 101, H101 Composition I 3(3,0) Training in correct and effective expression in brief expository essays; review of the fundamentals of grammar and punctuation; instruction in common expository methods.

ENGL 102, H102 Composition II 3(3,0) Continued emphasis on correct and effective expression; training in the organization and writing of the research report. Preq: ENGL 101.

ENGL 103, H103 Accelerated Composition 3(3,1) Training in composing correct and effective expository and argumentative essays, including writing documented essays. Students placed in ENGL 103 receive credit for ENGL 101 after completing ENGL 103 with a C or better. Students who have received credit for ENGL 102 will not be allowed to enroll in or receive credit for ENGL 103. Preq: Satisfactory score on departmental placement exam.

ENGL 111 English as a Second Language 3(3,2) Special course for students learning English as a second language. Intensive study and drill in American English pronunciation and listening comprehension. Required of all foreign students who do not make a satisfactory grade on screening examination in oral English. To be taken Pass/Fail only. Carries no credit for graduation.

ENGL 190 Introduction to the English Major 2(2,0) Orientation to the English major as a discipline and as a preparation for a range of careers. Introduction to the digital portfolio as a place to collect, synthesize, and reflect on learning. Required of English majors, recommended for minors.

ENGL 202, H202 The Major Forms of Literature 3(3,0) Study of the basic structures and elements of fiction, poetry, and drama, including literary and critical theory, with readings in American, British, and world literature. Preq: Consisitency in composition must be demonstrated. Preq: ENGL 102.

ENGL 203, H203 Survey of English Literature I 3(3,0) Chief British authors and works from Beowulf to the Romantic period. Preq: ENGL 102.
ENGL 217 Vocabulary Building 3(3,0) Development of a useful discriminating vocabulary for writing, speaking, and reading. Student notebooks and proficiency quizzes. Preq: ENGL 103.

ENGL 231 Introduction to Journalism 3(3,0) Instruction and practice in writing for mass media; editorial responsibilities. Preq: ENGL 103.

ENGL 265 Introduction to Editing 3(3,0) Introduction to the practice of editing texts. Includes instruction in the principles and symbols of copy-editing and proof-reading as well as work with electronic editing tools. Also addresses editor's role in different types of editing, including copy-editing, comprehensive editing, and developmental editing for paper and electronic publication.

ENGL (G W) 301, H 301 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: memos, letters, reports, and proposals. Includes individual and team projects. Preq: 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. Preq: 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. Preq: Sophomore literature or consent of instructor.

ENGL 314, H 314 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. Preq: Junior standing.

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. Preq: Sophomore literature.

ENGL 332 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. Preq: Sophomore literature; ENGL 211 or consent of instructor.

ENGL 333 Reporting for the News Media 3(3,0) Practical experience in gathering and writing news and feature copy for the media, concentrating on print journalism; examination of the role of the modern journalist; laws governing the profession; journalistic ethics. Preq: ENGL 231 or consent of instructor.

ENGL 334 Feature Writing 3(3,0) Practical experience in writing feature articles for newspapers, magazines, and free-lance markets. Preq: ENGL 231 or consent of instructor.

ENGL 335 Editing for Newspapers 3(3,0) Examination of the editing process of newspapers and magazines. Practical experience in article selection, copy-editing, headline writing, and page design. Preq: ENGL 231 or consent of instructor.

ENGL 345 The Structure of Fiction 3(3,0) Introduction to the creative writing and critical study of prose fiction. Preq: ENGL 310 or consent of instructor.

ENGL 346 The Structure of Poetry 3(3,0) Introduction to the creative writing and critical study of poetry. Preq: 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. Preq: ENGL 310 or consent of instructor.

ENGL 349 Technology and the Popular Imagination 3(3,0) Examines relationships between technology and fiction and creative non-fictional texts, including print, film, and electronic media. Preq: Sophomore literature or consent of instructor.

ENGL 350 Mythology 3(3,0) Study of the great myths of the world with an emphasis on their applications to literature. Preq: ENGL 310 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, Chicano/Mexican Americans, Asian Americans, Italian Americans, and American Jews. Preq: ENGL 310 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. Preq: ENGL 310 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. Preq: ENGL 310 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. Preq: ENGL 310 or consent of instructor.

ENGL 359 Special Topics in Language, Literature, or Culture 3(3,0) Studies in varied topics not central to other English courses, such as Language and Art/Business/Sports Language and Style: Black Literature. Specific titles and course descriptions to be announced from semester to semester. May be repeated once with department chair's consent. Preq: ENGL 310 or consent of instructor.

ENGL H 367 Special Topics for Honors Students 3(3,0) Varied topics of general interest in literature, language, rhetoric, or culture for all honors students. Specific topics announced each semester. May be repeated for a maximum of nine credits. Preq: ENGL 310 or consent of instructor.

ENGL 380 British and American Women Writers 3(3,0) Poetry, drama, fiction, and prose by established and little-known women writers in Britain and America. Particular attention to works treating themes and issues concerning women's lives. Readings on such topics as women and work, education, religion, creativity. Preq: ENGL 310 or consent of instructor.

ENGL 385 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. Preq: ENGL 310 or consent of instructor.

ENGL 386 A dolescent Literature 3(3,0) Reading and analysis of literature written for readers age 12-18. Examination of historical context, chief themes and motifs, and censorship issues, as well as connections with classic literature. Preq: ENGL 310 or consent of instructor.

ENGL 387 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 390 Electronic Portfolio Studio 1(1,0) Studio course for English majors to complete their portfolios. Preq: ENGL 190, 310 (or concurrent enrollment).

ENGL 396 British Literature Survey I 3(3,0) Examination of key texts in British literature to 1789. Preq: Sophomore literature or consent of instructor.

ENGL 397 British Literature Survey II 3(3,0) Examination of key texts of British literature from 1789 to the present. Preq: Sophomore literature or consent of instructor.

ENGL 398 American Literature Survey I 3(3,0) Examination of key texts of American literature from beginnings of European settlement to the Civil War in historical context. Preq: Sophomore literature or consent of instructor.

ENGL 399 American Literature Survey II 3(3,0) Examination in historical context of key texts of American literature from the Civil War to the present. Preq: Sophomore literature or consent of instructor.

ENGL 400, 600 The English Language 3(3,0) Studies in English usage and historical development of the language. Preq: ENGL 310 or consent of instructor.

ENGL 401, 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. Preq: ENGL 310 or consent of instructor.

ENGL 403 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. Preq: 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. Preq: ENGL 310 or consent of instructor.
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<td>Principles and progress of drama from the Resto-</td>
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<td>Survey of the most significant forms and themes</td>
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<td>of the American novel from its beginnings to 1900.</td>
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<td>Southern Literature 3(3,0)</td>
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<td>South from 1607 to the present, with emphasis on</td>
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<td>the writers of the 19th century. Preq: ENGL 310</td>
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<td>Western Civilization from antiquity through</td>
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<td>poetry, and drama from the Post-WWII to the</td>
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<td>Renaissance. Preq: ENGL 310 or consent of</td>
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Courses of Instruction
ENGL 465, 656 Literature and Arts of the Holocaust 3(3,0) A 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 A Advanced Special Topics in Language, Literature, or Culture 3(3,0) A 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 Is 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 American Literature 3(3,0) Selected readings in American literature from a variety of time periods for focused study of authors, movements, themes, critical approaches, and genres specific to the American experience. 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 British Literature I 3(3,0) Selected readings in British literature to the Romantics focused on study of authors, movements, themes, critical approaches, and genres specific to the British experience. 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 British Literature II 3(3,0) Selected readings in British literature from the Romantics to the present for focused study of authors, movements, themes, critical approaches, and genres specific to the British experience. 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) Hands-on workshop in new forms of writing and hypertextual design for interactive electronic media. May be repeated once for credit. Preq: ENGL 310 or consent of instructor.

ENGL 478, 678 Digital Literacy 3(3,0) Examines how electronic texts differ from and resemble print 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 Fiction and Nonfiction 3(3,0) Critical examination of the various forms and genres of African American prose including the novel, short fiction, autobiography, nonfiction, and oratory with some attention to emerging theories about African American culture and its impact on African American cultural life in general. Preq: ENGL 310 or consent of instructor.

ENGL 483, 683 African American Poetry, Drama, and Film 3(3,0) Studies in the various forms, themes, and genres of African American poetry, drama, and film with some attention to emerging theories about African American culture and its impact on African American cultural life in general. Preq: ENGL 310 or consent of instructor.

ENGL 485, 685 Composition for Teachers 3(3,0) Practical training in teaching composition: finding workable topics, organizing and developing observations and ideas, evaluating themes, and creative writing. Preq: ENGL 310 or consent of instructor.

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 working proposals, manuals, reports, and publishable articles. Students produce work individually and in groups. Preq: ENGL 310 or consent of instructor.

ENGL (COMM) 491, 691 Classical Rhetoric 3(3,0) Study of the major texts in classical rhetoric. Examines the nature and functions of rhetoric in Greek and Roman societies. Traces the development of rhetoric from Protagoras through Isocrates, Plato, Aristotle, Cicero, and Quintilian 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 rhetoric" of the 20th century, which are grounded in classical rhetoric but which include findings from biology, psychology, linguistics, and anthropology, among other disciplines. Considers the theories and applications of communication. Preq: ENGL 310 or consent of instructor.

ENGL 494, 694 Writing A bout Science 3(3,0) A dvanced 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 310 or consent of instructor.

ENGL 496 Senior Seminar 3(3,0) Capstone course; requires participation and a substantial essay; allows graduating English majors the opportunity to work closely with faculty and other English majors on a special topic in the advanced study of literature. Fulfills English major distribution requirements. 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, G. L. Carner, J. D. Culkin, Chair; W. M. Good, J. C. Morse, P. A. Zungoli; Assistant 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 EN T 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(3,3) 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 A Piculture 3(2,3) Detailed study of the honey bee and its economic importance in pollination and honey production. A tention is given to bee behavior, colony management, equipment, honey-plant identification, and honey production and processing. Preq: BIOL 104 and consent of instructor.

ENT (BIOSC) 400, H 400, 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 401, H 401, 601 Insect Pests of Ornamental Plants and Shade Trees 3(2,3) Recognition, biology, damage, and control of insect pests of woody and other ornamental plants and shade trees. Preq: ENT 301.
ENT 404, H 404, 604 Urban Entomology 3(2,3) Study of pests common to the urban environment with emphasis on biology, damage, control, and identification of household, structural, stored products, and food pests. Students learn both theoretical and practical aspects of urban pest management and the pest-control industry. Prep: ENT 301.

ENT (PL PA) 406, H 406, 606 Diseases and Insects of Turfgrasses 2(2) See PL PA 406.

ENT 407, 607 A 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. Prep: ENT 301 or equivalent.

ENT (BIOCSC) 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. Prep: ENT 400 or consent of instructor.

ENT (BIOCSC), ENT (TOX) 430, 630 Toxicology 3(3,0) See ENT (TOX) 430.

ENT (BIOCSC) 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. Prep: ENT 301 or consent of instructor.

ENT (BIOCSC) 455, H 455, 655 Medical and Veterinary Entomology 3(2,3) Insects and their arthropod relatives which are of economic importance in their effect on man and animals. Prep: ENT 301 or consent of instructor.

ENT 461 Directed Research in Entomology 1-3(0,9) Development of a senior thesis based on a research project 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. Prep: Senior standing, consent of instructor.

ENT 462, 662 Seminar Presentation 1(1,0) A dvanced discussion and practice in delivering oral seminar presentations of scientific information. Emphasis is on preparing visual aids, organization, content, and practice in speaking to a specialized scientific audience.

ENT (BIOCSC, W F B) 469, H 469, 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. Prep: 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 preregistered at least two months in advance. Students must file written reports mid-way during enrollment period and at its conclusion and must appear for oral evaluation at the end of the period. Prep: Junior standing and consent of instructor.

ENVIRONMENTAL AND NATURAL RESOURCES

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. Prep: ENT 301, GEN 302.

ENVIRONMENTAL ENGINEERING AND SCIENCE

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. Prep: Junior standing in engineering or consent of instructor. Coreq: C E 341, C H E 311, 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. Introduction to the integration of unit operations and processes into water and waste treatment systems. Prep: C E 341, C H E 311, M E 308 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. Prep: 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 spectrometry; health physics survey instrumentation; and thermoluminescent dosimetry. Prep: 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 their effects, sources, dispersion models, engineering controls, and air-quality legislation. Prep: Senior standing in engineering or physical sciences.

EE&S (B E, FOR) 451, H 451, 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2) See B E 451.

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. Prep: EE&S 401 or consent of instructor.
EN SP 471, 671 M an and His Environment 2(2,0)
The interaction of man with his environment is surveyed. Factors such as urbanization, population growth, pathogens, disease vectors, ionizing radiation, sewage disposal, and noise control are considered. Effects of environmental contacts with air, water, food, and solid and liquid wastes are emphasized. Prereq: Consent of instructor.

EN SP 472, 672 Environmental Planning and Cont rol 2(2,0) Application of planning and control to effective environmental quality improvement. Water supply and treatment, wastewater treatment and disposal, solid waste disposal, air pollution abatement, and land use and zoning are considered from the standpoint of control. Not intended for graduate students in engineering. Prereq: Consent of instructor.

EN TOX 400, H400, 600 Wildlife Toxicology 3(3,0) A 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. Prereq: BIOCH 305 or organic chemistry, one year of general biology, WFB 350 or consent of instructor.

ENTOX 421, H421, 621 Chemical Sources and Fate in Environmental Systems 3(3,0) Chemical cycles in the environment are discussed on global and microcosm scales. The dependence of fate processes on physical and chemical properties and environmental conditions is examined. Breakdown, movement, and transport of selected toxicants are addressed to illustrate the mechanisms that govern chemical fate. Prereq: Organic and analytical chemistry or consent of instructor.

ENTOX (BIOSC, EN T) 430, 630 Toxicology 3(3,0) Basic principles of toxicology including quantitation of toxicity, toxicokinetics, biochemical action of poisons, and environmental toxicology are studied. A cute 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. Prereq: 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. Prereq: EN TOX 430 or consent of instructor.

EXE C UTIVE LEADERSHIP AND ENTREPRENEURSHIP

E L E 301 Executive Leadership and Entrepreneurship I 3(3,0) Cross-disciplinary course which seeks to create an appreciation of the opportunities and uncertainties in an entrepreneur's life through extensive readings and interactions with entrepreneurs. Prereq: Sophomore standing.

E L E (MK T) 314 New Venture Creation I 3(3,0) See MKT 314.

E L E (MG T) 315 New Venture Creation II 3(3,0) See MGT 315.

E L E (EC O N) 321 Economics of Innovation 3(3,0) See ECON 321.

E L E (PO SC, PSYCH, SOC) 356 Social Science of Entrepreneurship 3(3,0) See SOC 356.

E L E 400, 600 Technology Entrepreneurship 3(3,0) Introduction to technology entrepreneurship, with emphasis on ideation, opportunity assessment, market and technology forecasting, intellectual property protection, financial modeling and business valuation, project management, and cross-functional team building. Prereq: Junior standing in science or engineering major.

E L E 401 Executive Leadership and Entrepreneurship II 3(3,0) Continuation of E L E 301 with extensive use of a computer simulated business start-up. Prereq: E L E 301.

E L E 499 Executive Leadership and Entrepreneurship III 3(6-1,3-6-12) Continuation of E L E 401 and 400. Directed practical study of entrepreneurship and leadership. Students work closely with external infant firms to develop new products and bring existing products to market successfully. Prereq: E L E 401.

EXPERIMENTAL STATISTICS

Professors: W. C. Bridges, Jr., L. W. Grimes, H. S. Hill, Jr., J. R. Rieck, J. E. Toler; Lecturer: R. Martinez-Dawson

EX ST 222 Statistics in Everyday Life 3(3,0) Focuses on the role of statistics in a variety of areas including politics, medicine, environmental issues, advertising, and sports. Students explore common statistical misconceptions and develop an understanding of how principles of probability and statistics affect many aspects of everyday life. Not open to students who have received credit for EX ST 301, MTH SC 301, 302, or 309. Prereq: Satisfactory score on the Clemson Mathematics Placement Test or consent of department.

EX ST 301, H 301 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. The role of statistics in interpreting research and the general application of the methods are stressed. Credit toward a degree will be given for only one of EX ST 301, MTH SC 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 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 computer analyses and interpretations including computer generated graphics. Preq: MTHSC 206 or consent of instructor.

EX ST 462, 662 Statistics Applied to Economics 3(3,0) Continuation of EX ST 301 with emphasis on 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.