951F. Planning Change in Educational Organizations  
(ED 956., EAC 951F.) Winter, Summer. 3(3-0) Approval of instructor.  
Analysis of research, theory and practice of the change process in educational organizations.  
Planned change concepts and methods are examined and tested by laboratory and field experiences.

951G. Using Standardized Tests for Decision Making  
(ED 959., EAC 951G.) Fall, Spring. 3(0-0) Approval of department.  
School administrative decision making based on information yielded by standardized tests. Participants will also engage in private consultations with the instructor concerning system or building data.

951H. Field Research Methods in Education  
(ED 961., T E 930., EAC 951H.) Spring. 3(0-0)  
Methods of interview, participant observation or observation for carrying on educational research.

951I. Professional Lectures in Educational Administration  
(ED 978., EAC 951I.) Fall, Spring. 3(3-0)  
Graduate students in Educational Administration or approval of department.  
Lectures by faculty in Educational Administration in individual faculty research and service interests, expansion of recent research and other scholarly publications.

951J. Conflict Management in Educational Administration  
Fall, Spring. 3(3-0) Approval of department.  
Theories, rationales, and strategies of conflict management. Managing conflict situations in educational environments.

952A. Externship in Educational Administration  
(ED 971., EAC 952A.) Fall, Winter, Spring. 3 credits. May reenroll for a maximum of 67 credits. Present or past position as an educational administrator.  
Discussion of participants' current administrative problems and solution strategies, faculty visits to participants' schools and speakers on issues in educational administration.

952B. Multidisciplinary Seminar in Educational Administration  
(ED 972., EAC 952B.) Fall, Winter, Spring. 3 credits. May reenroll for a maximum of 18 credits. 9 credits of EAD 952A.  
Discussion of generic problems and issues in administration identified and interpreted through selected readings and speakers from the several behavioral sciences.

960. Seminar: Continuing Education in Higher Education Institutions  
(ED 987B., EAC 960.) Winter. 3(3-0)  
May reenroll for a maximum of 6 credits. Majors or approval of department.  
Patterns, problems, and potential for continuing education in two and four year colleges. Problems of governance, reward system, leadership roles, etc.

970A. The Law of Higher Education  
(ED 980., EAC 970A.) Fall, Spring. 3(3-0)  
Graduate students in College and University Administration; others, approval of instructor.  
Principles and cases of law applied to problems of governance, management, and instruction in post-secondary educational institutions. Emphasis upon personnel and student administration and equity issues.

970B. Higher Education Finance  
(ED 970B.) Fall, Spring. 3(0-0) Admission to M.A. or Ph.D. programs in the College of Education.  
Structures, processes and problems related to the financing of higher education in the United States. Emphasis on alternatives for the future.

971A. The Department in Higher Education  
(ED 957., EAC 971A.) Winter. 3(3-0) Approval of instructor.  
The Department as an administrative structural element of the University. The duties and responsibilities of the chairperson as they relate to the management of the Department.

971B. Management Systems in Higher Education Administration  
(ED 958., EAC 971B.) Fall, Spring. 3(3-0) Graduate students in College and University Administration; others, approval of instructor.  
The application of National Center for Higher Education Management Systems tools to decision making in higher education administration. Resource Requirement Prediction Model 1.0, student flow and faculty activity analysis are major tools investigated.

971C. Evaluation of Higher Education  
(ED 965C., EAC 971C.) Spring. 3(3-0)  
Graduate students in College and University Administration, EAD 972A or approval of instructor.  
Ways in which evaluation takes place in higher education; course examinations, grading, comprehensive examinations, teacher evaluation, institutional evaluation, state surveys, and regional and national studies of higher education problems.

971D. Community College Administration  
(ED 979., EAC 971D.) Winter. 3(3-0)  
Graduate students in College and University Administration. Others, approval of instructor.  
Functional areas of community college administration with emphasis upon instruction, finance and student services including the importance of local, state and federal influences.

973A. College Student Affairs Administration I  
(ED 973., EAC 973A.) Fall. 3(3-0)  
Doctoral students in Student Affairs Emphasis. Others, approval of instructor.  
Emphasis on planning, organization, financing, research, evaluation and administration for programs and services which exist primarily to serve individuals with special needs: counseling, orientation, health, placement, financial aids, etc.

973B. College Student Affairs Administration II  
(ED 974., EAC 973B.) Winter. 3(3-0)  
Doctoral students in Student Affairs Emphasis. Others, approval of instructor.  
Student organizations and activities: student union; on- and off-campus living environment. Emphasis on planning, organization, financing, research, evaluation and administration of these programs and services.

973C. College Student Affairs Administration III  
(ED 975., EAC 973C.) Spring. 3(3-0)  
Doctoral students in Student Affairs Emphasis. Others, approval of instructor.  
Analysis of student rights and responsibilities; academic freedom; regulation of student conduct; systems of governance and judicial processes; legal basis for student personnel programs and administration.

976A. Doctoral Internship in College and University Administration  
(ED 991., EAC 976A.) Fall, Winter, Spring, Summer. 3(0-9) May reenroll for a maximum of 12 credits. Doctoral students in College and University Administration, approval of instructor.  
Students intern in on- and off-campus offices and agencies as observers of and participants in the administration of programs particular to their major field of study.

978A. Independent Research in Higher Education Administration  
(ED 940., EAC 978A.) Fall, Winter, Spring. 1 to 6 credits. May reenroll for a maximum of 6 credits. Doctoral students in College and University Administration. Supervised and guided in-depth readings in literature and research specific to higher education administration which lead to the development of materials such as position papers, articles for publication, and grant and dissertation proposals.

982. Seminars in Administration and Curriculum  
(ED 982., EAC 982.) Fall, Winter, Spring. 1 to 9 credits. May reenroll for a maximum of 15 credits. Approval of department.

983. Readings and Independent Study in Administration and Curriculum  
(ED 983., EAC 983.) Fall, Winter, Spring. 1 to 6 credits. May reenroll for a maximum of 15 credits. Approval of department.

999. Doctoral Dissertation Research  
(ED 999., EAC 999.) Fall, Winter, Spring. Variable credit. Approval of department.

ELECTRICAL ENGINEERING AND SYSTEMS SCIENCE

College of Engineering

Electrical Engineering
231. Computer Organization and Usage
Fall, Winter, Spring. 4(4-0) E E 230.
Computer structure and machine language; macros; addressing techniques; computer bus; program segmentation and linkage; microcomputer case study; survey of applications in science and engineering.

300. Electric Circuits I
Fall, Winter. 4(4-0) MTH 113.

301. Electric Circuits II
Winter, Spring. 4(4-0) E E 300, MTH 214

302. Basic Electronic Circuits
Spring, Summer. 4(4-0) E E 301, MTH 215
Volt-ampere characteristics of diodes and transistors. Voltage, current and power amplification. Stability, transient and high-frequency effects. Feedback, oscillators and operational amplifiers.

303. Electronics Laboratory I
Winter, Spring. 1(0-3) E E 300; E E 301 concurrently.
Electronic test equipment and measurement fundamentals. Experimental verification of topics covered in E E 300 and E E 301. Computer-aided circuit analysis and design.

304. Electronics Laboratory II
Fall, 1(0-3) E E 302.

305. Electromagnetic Fields and Waves I
Fall, Winter. 3(3-0) MTH 310, PHY 289
Vector analysis. Electrostatic fields; EM sources, scalar potential. Poisson’s and Laplace’s equations, dielectric media, capacitance, and energy storage. Boundary value problems for electrostatic fields.

306. Electromagnetic Fields and Waves II
Winter, Spring. 4(4-0) E E 305.
Magnetostatic fields: EM sources, vector potential, magnetic media, inductance, and energy storage, time-varying fields and Maxwell’s equations; potential theory and boundary-value problems. Energy conservation and conversion.

307. Electromagnetic Fields and Waves III
Spring, Summer. 3(3-0) E E 306.
Application of Maxwell’s equations; radiation, propagation, reflection, and power flow of plane EM waves; EM boundary value problems. Transmission line theory; transient and steady state waves, standing and traveling waves, reflections and standing-wave-ratio.

308. Fields and Waves Laboratory
Fall, Spring. 1(0-3) E E 307 or concurrently.
Experimental investigation of charged particle motion in EM fields, dielectric and magnetic properties and materials, probing of currents and charges, and propagation of transient and steady-state waves. Digital computer solutions for EM field and wave problems.

345. Introduction to Electronic Instrumentation Systems
Fall, Winter, Spring. 4(3-3) PHY 288.
Basic electronic concepts; passive and active components; operational amplifiers; switching devices, equivalent circuits; transducers; signal conditioning; recording; data management; basic elements of control.

355. Deterministic Communication Systems
(455.) Fall, Winter, Spring. 3(3-0) E E 301, MTH 214. Interdepartmental with Systems Science.
Communication systems. Representation of signals in time and frequency domain. Processing of signals by linear, simple nonlinear and time-variant systems. Linear and nonlinear, analog and digital modulation and demodulation; for example, AM, FM, FCM.

412. State Models, Analysis, and Simulation
Spring. 3(3-0) E E 311, MTH 310, MTH 339. Interdepartmental with Electronics Science.

413. Analysis of Control Systems
(313.) Fall. 4(4-0) E E 301, E E 355. Interdepartmental with Systems Science.
Linear system characteristics, performance criteria, transient and steady-state responses, error analysis, stability, root locus and frequency response techniques. Control system design using root locus and frequency response methods.

414. Control Systems Laboratory
Experimental investigations of feedback systems. Study of solid state controllers. Properties and applications of phase lock loops. Introduction to digital control.

415. Digital Control Systems
Winter. 3(3-0) E E 321, SYS 311, SYS 413. Interdepartmental with Systems Science.
Organization of digital control systems, classical and modern techniques for the design of digital control systems. Hardware and software considerations with emphasis on microprocessor implementation.

418. Introduction to Computer-Aided Circuit Design
Fall. 3(3-0) CPS 120, E E 362.
Introduces the techniques used for automatic formulation, analysis and optimization of linear and nonlinear electronic circuits. Students will write a modest but useful analysis program package.

419. Physical Phenomena and Electronic Instrumentation I
Winter. 4(3-3) PHY 289, PHY 298 or approval of department, MTH 215. Interdepartmental with and administered by Physics.
Concepts of electronics relative to uses in investigations of physical phenomena and their subsequent applications to provide reliable instrumentation. Nuclear radiation detectors, photometers and magnetometers are examples of specific topics covered.

420. Electromechanical Energy Conversion
Winter. 3(3-0) E E 301, E E 306.
Review of electronic phenomena; design, specification, and use of d.c. machines in industrial and servo-control application, synchronous generators and transformers for power systems; three phase power, per unit notation.

421. Power System Analysis
Spring. 3(3-0) E E 307, E E 420.
Model of power system components; analysis and planning techniques including load flow, short circuit, transient stability; voltage and frequency control, economic operation of power systems.

430. Digital Electronics
Fall, Winter, Spring. 3(3-2) E E 330, E E 362.
Diodes and transistors as switching elements, logic families, data conversion circuits; memory circuits; digital subsystem design.

431. Computer Interfacing
Fall, Winter, Spring. 4(3-3) E E 331; E E 430.
Case study of a small computer system; I/O control design; bus interface requirements, interrupt structure, data transfer. Digital system design.

435. Microwave Circuits and Systems
Fall. 3(3-0) E E 307.

436. Radiation and Reception of Electromagnetic Waves
Winter. 3(3-0) E E 307.
Radiation, propagation, scattering and reception of electromagnetic waves; circuit and radiation characteristics of wire and microwave antennas; radiation fields, self and mutual impedances of antennas and arrays; microwave aperture antennas.

438. Transmission and Radiation Laboratory
Winter. 1(0-3) E E 435; E E 436 concurrently.
Microwave transmission and radiation laboratory. Measurement of frequency, wavelength, standing waves, impedance, and power. Experiments on transmission lines, waveguides, cavity resonators, microwave circuits, and circuit and radiation properties of antennas.

456. Applied Probability in Communication Theory
Fall, Winter. 3(3-0) E E 355.
457. Statistical Communication Systems
Fall, Winter, Spring. 3(3-0) E E 456; E E 467 currently.
Representation, processing and filtering of random signals. Performance of digital systems with noise. Optimal digital communications systems. Signal detection, information concepts, coding, communication systems such as radar, television, PCM, and telephony.

467. Communications Laboratory
Spring. 1(0-3) E E 456; E E 457 currently.
Experimental investigations on communication theory and information transmission topics from E E 455, E E 456, and E E 457.

474. Physical Principles of Electronic Devices
Fall. 4(4-0) E E 302; E E 305.
Energy levels in atoms and crystals; density of states: Fermi-Dirac and Maxwell-Boltzmann statistics; transport properties of bulk materials; metal-semiconductor contacts; the p-n junction and BJTs.

475. Electronic Devices and Circuits
Winter. 3(3-0) E E 474.
Fabrication technology: models and characteristics of BJTs, JFETs, and MOS devices; application to linear and digital circuits.

476. Applications of Electronic Devices
Spring. 3(3-0) E E 474.
Power devices and applications; transistors, diacs, triacs, and SCR's; high frequency devices and applications; transistors; impact; Gunn and vacuum devices; photo-devices; solar cells and LED's.

477. Electro-optic Devices
Spring of odd-numbered years. 3(3-0) E E 306.
Atomic origin and the operational characteristics of light sources and detectors. Basic design considerations for gas and solid state lasers. Methods of optical detection, applications.

478. Integrated Circuit Fabrication Laboratory
Winter, Spring, Summer. 2(1-3) E E 474.
Integrated circuit design and fabrication. Laboratory fabrication of diffused resistors, diodes, capacitors, and simple MOS or bipolar integrated circuits. Yields, testing, and economic considerations.

480. Integrated Circuits: Operational Amplifiers
Fall, Winter. 3(3-0) E E 302.

484. Electric Devices Laboratory
Winter. 1(0-3) E E 474.
Measurement of semiconductor bulk properties; device fabrication; experimental study of selected electron devices and design; application based on principles discussed in E E 474.

490. Special Topics in Electrical Engineering
Spring, 1 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.
Exposition of special topics in electrical engineering.
847. Communication Engineering
Fall. 4(4-0) E E 456 or approval of instructor. Interdepartmental with Systems Science.

848. Communication Theory

849. Microwave Electronics
Spring of odd-numbered years. 3(3-0) E E 835. E E 875.
Microwave gaseous, solid-state and vacuum devices, active microwave integrated circuits and systems, waves in solid-state plasma and their applications, parametric amplifier. Design of microwave amplifiers, oscillators and communication systems.

850. Electrodynamics of Plasma 1
Fall. 3(3-0) E E 835 or PHYS 448. E E 874. Interdepartmental with the Department of Physics and Astronomy.
Boltzmann equation; moment equations; two-fluid theory of plasma; waves in cold and anisotropic infinite plasma; waves in bounded plasma structures; energy flow in anisotropic plasmas.

851. Microprocessor-based System Design
Spring. 4(2-8) E E 431 or CPS 423.
Microprocessor-based system design methodology; performance measures; single-chip computer organization alternatives; local networks of processors; applications in signal processing control and instrumentation.

863. Analysis of Stochastic Systems
Analysis and modeling of stochastic signals and systems. Basic topics include Markov models, description of processes, stationarity, ergodicity, correlation and power spectrum, linear stochastic systems, harmonic analysis, Markov processes, Poisson processes.

871. Integrated Circuit Engineering
Winter. 3(3-0) E E 474.
Fabrication and design of integrated circuits. Physics and chemistry of processing. Comparison of current bipolar and MOS technologies, and their limitations. VLSI design methodology and layout examples.

874. Physical Electronics
Fall. 4(4-0) Approval of department.
Application of quantum mechanics in solids; band theory of semiconductors, electrical transport phenomena, induced current concept, charged particle dynamics, electron optics.

875. High Speed Solid-State Devices
Winter. 3(3-0) E E 474.
Formulation of operating properties and appropriate models of devices formed with semiconductors and solid state materials. Emphasis is on performance limitations of high speed integrated circuit unipolar and bipolar devices.

876. Semiconductor Power Devices
Spring of even-numbered years. 3(3-0) E E 474.
Formulation of operating properties and appropriate models of devices formed with semiconductors and solid state materials. Performance limitations of semiconductor power devices due to voltage, temperature and power considerations.

880. Signal Analysis
Winter. 3(3-0) Approval of department. Interdepartmental with Systems Science.

899. Master’s Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

911. General Automata Theory I
Fall of odd-numbered years. 3(3-0) CPS 423 or SYS 827 or approval of department. Interdepartmental with and administered by the Department of Computer Science.
Characterization of machines and programs as automata; mathematical decomposition of finite automata.

912. General Automata Theory II
Winter of even-numbered years. 3(3-0) CPS 911. Interdepartmental with and administered by the Department of Computer Science.

913. General Automata Theory III
Spring of even-numbered years. 3(3-0) CPS 912. Interdepartmental with and administered by the Department of Computer Science.

921. Advanced Computer Systems I
Fall. 3(3-0) Two graduate level courses in computer system design (hardware or software). Interdepartmental with and administered by the Department of Computer Science.

922. Advanced Computer Systems II
Winter. 3(3-0) CPS 921. Interdepartmental with and administered by the Department of Computer Science.
Design and characterization of parallel algorithms. Matching of algorithms with appropriate hardware configurations. Programming languages which support parallel computation.

926. Antenna Theory I
Winter of even-numbered years. 3(3-0) E E 835.
Wire antennas as radiating, receiving and scattering elements; analytical and numerical integral equation methods; coupled antennas and arrays; transient phenomena.

927. Antenna Theory II
Spring of even-numbered years. 3(3-0) E E 926.
Radiation by equivalent aperture fields; aperture antennas, slot antennas, horn and reflector antennas, frequency independent antennas; pattern theory; scattering from various objects.
404. Biological and Ecological Concepts for Engineers and Mathematicians
Winter. 3(3-0) Approval of department. Interdepartmental with and administered by the Department of Zoology. Biological and ecological concepts important to formal analysis of living systems, vital properties, processes, and limitations: population dynamics, selection competition, and predation; ecological community structure and function; industrialized ecosystem.

410. Systems Methodology
Winter. 3(3-0) MTH 113, CPS 110 or CPS 120. The systems approach in multidisciplinary large scale problem solving. The development of useful systems analysis tools; systems design; feasibility study; computer simulation for feasibility evaluation.

411. Systems Project
Spring. 2(3-0) SYS 410. Completion of a systems study initiated in SYS 410. The project may involve the design of hardware, simulation of a solution to an interdisciplinary problem, or development of a solution concept.

412. State Models, Analysis, and Simulation
Spring. 3(3-0) SYS 311, MTH 310. MTH 334. Interdepartmental with Electrical Engineering. Vector-matrix state-space models of dynamic systems: exponential matrix, transform solutions, convolution, stability, controllability, observability, simulation, computational techniques, extensions to nonlinear systems.

413. Analysis of Control Systems
(313.) Fall. 4(4-0) E E 301, E E 355. Interdepartmental with Electrical Engineering. Control system characteristics, performance criteria, transient and steady-state responses, error analysis, stability, root locus and frequency response techniques. Controller design using root locus and frequency response methods.

414. Control Systems Laboratory
(484.) Winter. 1(0-3) E E 231, E E 304, E E 413. Interdepartmental with and administered by Electrical Engineering. Experimental investigations of feedback systems. Study of solid state controllers. Properties and applications of phase lock loops. Introduction to digital control.

415. Digital Control Systems
Winter. 3(3-0) E E 231, SYS 311, SYS 412. Interdepartmental with and administered by Electrical Engineering. Organization of digital control systems, classical and modern techniques for the design of digital control systems. Hardware and software considerations with emphasis on microprocessor implementation.

416. Deterministic Communication Systems
(455.) Fall, Spring. 3(3-0) E E 301, MTH 214. Interdepartmental with and administered by Electrical Engineering. Communication systems. Representation of signals in time and frequency domain. Processing of signals by linear, simple nonlinear and time-variant systems. Linear and nonlinear analog and digital modulation and demodulation; for example, AM, FM, PCM.

419. Digital Control Systems
Winter. 3(3-0) Approval of department. Interdepartmental with and administered by Electrical Engineering. Digital Control Systems, emphasis on modeling and analysis of behavior through numerical solutions.

425. Process Optimization Methods
Fall. 3(3-0) MTH 310. Interdepartmental with and administered by the Department of Chemical Engineering. Methods for determining optimum design and operating policies of systems of varying complexity. Includes classical methods, mathematical programming and modern methods.

495. Independent Study
Fall, Winter, Spring, Summer. 1 to 3 credits. Permission of instructor. May be repeated for a maximum of 6 credits in SYS 495 and E E 485 combined. Approval of department. Independent study of a topic in systems science of particular interest to the student.

499. Undergraduate Research
Fall, Winter, Spring, Summer. 1 to 3 credits. May enroll for a maximum of 6 credits in SYS 495 and E E 485 combined. Approval of department. Independent undergraduate research in contemporary areas of systems science.

501. Special Problems
Fall, Winter, Spring. 1 to 4 credits. May enroll for a maximum of 8 credits. Approval of department.

510. Introduction to Linear System Theory
Fall. 3(3-0) MTH 214. May not be used for graduate credit by Electrical Engineering and Systems Science majors except Operations Research/Systems Science. Interdepartmental with the College of Social Science. A first course in system theory for students from a range of disciplines. Mathematical representation of system variables, transform and state space method of analysis, introduction to control theory, applications to physical, economic and social systems.

511. System Methodology and Simulation
Winter. 3(3-0) SYS 830, STT 441. Interdepartmental with the College of Social Science. Problem definition, design of abstract models for system design and control, simulation of systems described by differential and difference equations, generation of random variables, simulation of discrete object stochastic systems, simulation languages, applications to physical, economic and social systems.

513. System Project
Spring. 2(2-0) SYS 811. Interdepartmental with the College of Social Science. Individual or team application of simulation methods to system design and/or management.

514. Advanced System Methodology and Simulation
Spring. 3(3-0) SYS 811. Simulation of a class of time-varying distributed parameter processes; organization and design of large simulation models; optimization and parameter estimation in large simulation models; applications to economic, social and biological systems; other topics of current interest.

526. Advanced Linear Systems Analysis
Fall. 4(4-0) MTH 330, MTH 334. Interdepartmental with Electrical Engineering. Unified analysis of linear continuous-time and discrete-time systems for both time-invariant and time-varying models; mathematical descriptions, transfer functions, state models; transition matrices; solution techniques; controllability; observability; stability.

527. Nonlinear Concepts in Systems Science
Winter. 4(4-0) SYS 826. Existence, uniqueness and stability in nonlinear systems; autonomous systems and the phase space; linearization, perturbation, describing functions and harmonic balance procedures; numerical solutions.

529. Modern Control Systems
Spring. 4(4-0) STT 841, SYS 826. Stochastic processes and white noise; analysis of linear continuous-time control systems; state feedback design; state observer design; optimal linear control and Kalman filter; linear discretetime control systems.

535. Nonlinear Optimization Models
Summer. 4(4-0) MTH 215; MGT 834 or CHE 465. Students may not receive credit for both MTH 835 and MGT 835. Nonlinear optimization examples and applications. Kuhn-Tucker Theory. Saddle point optimality conditions. Algorithms for problems with constraints. Unconstrained optimization; introduction to search methods.

538. Feasibility Analysis of Energy Systems
Spring. 3(3-0) STT 441. Methods for selecting energy conversion and transmission facilities with emphasis on electric utilities. Demand forecasting system reliability; selection of size, type and location of conversion facilities; cost analysis.

541. Optimization of Urban Traffic Flow
Fall of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with and administered by Civil Engineering. Traffic Flow models used in design of computerized traffic control systems. Optimal freeway ramp metering algorithms. Offline and online optimization of traffic signal timing.

543. Ecosystem Analysis, Design and Management
Spring. 3(3-0) SYS 442 or ZOL 404. Interdepartmental with the Department of Zoology. Groups of students from various biological and nonbiological disciplines will synthesize and analyze models of selected biological systems. Project should yield information relevant to solution of contemporary ecological problems.

547. Communication Engineering
848. Communication Theory

851. Modeling of Engineering Systems I
Fall, 3(3-0) M E 458 or E E 415. Interdepartmental with and administered by the Department of Mechanical Engineering. Modeling of engineering components and dynamic systems; mechanical, electrical, fluid, thermal, and transducer effects. Linear state-space responses, impedance methods. Simulation of linear models. Design project.

852. Modeling of Engineering Systems II
Winter, 3(3-0) M E 551. Interdepartmental with and administered by the Department of Mechanical Engineering. Continuation of M E 551. Modeling of nonlinear dynamic systems. Applications of phase-plane and linearization methods. Simulation of nonlinear systems. Design project.

863. Analysis of Stochastic Systems
Winter, 3(3-0) E E 415, E E 456. Interdepartmental with Electrical Engineering. Analysis and modeling of stochastic signals and systems. Topics include stochastic models, description of processes, stationarity, ergodicity, correlation and power spectrum, linear stochastic systems, harmonic analysis, Markov processes, Poisson processes.

880. Signal Analysis
Winter, 3(3-0) Approval of department. Interdepartmental with and administered by Electrical Engineering. Continuation of M E 880. Analysis and modeling of stochastic signals and systems. Topics include stochastic models, description of processes, stationarity, ergodicity, correlation and power spectrum, linear stochastic systems, harmonic analysis, Markov processes, Poisson processes.

ENG

College of Engineering

1255. Orientation to Engineering Careers
Winter, 2(2-0) Credits earned in this course are included in computation of GPA and MAPS but are not included in the 180 credits required for graduation. Engineering careers, history and philosophy of engineering profession, present and future challenges, industrial job functions, employment trends.

200. Technology, Society and Public Policy
Winter, 3(3-0) Twelve credits from natural science or engineering. Interdepartmental with the Department of Natural Science. Description and analysis of certain current technologies and their consequences; exploration of avenues for assessing such consequences as an aid to formulation of public policy.

290. Selected Topics
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits if different topics are taken. Experimental course developments or special topics appropriate for freshmen and sophomores.

344. Engineering Cooperative Education
Fall, Winter, Spring, Summer. Zero credits. [3 credits—See page A-1, item 3.] May reenroll for a maximum of six terms. Employment assignment approved by College of Engineering. Pre-professional employment in industry and government related to student's major.

390. Value Engineering
Fall, Winter, Spring, 4(4-0) MMM 290 or approval of department. The basis of value engineering is function, value, and a group of special techniques developed to aid in isolating and identifying problems created by our complex society and technology.

401. Engineering and Public Policy
Spring, 3(3-0) Seniors or approval of department. Interdepartmental with the Department of Natural Science. Sociotechnical assessment of impact of technology on society, with analysis of the role of engineering and natural science in contributing to public policy formulation.

ENGLISH

College of Arts and Letters

091. English for Foreign Students—Structures
Fall, Winter, Spring, Summer. Zero credits. [3(5-0) See page A-1 item 3.] English language proficiency examination. Explanation and intensive practice of basic grammatical structures of English. Students are tested and then placed in small groups, from beginning to advanced, depending on their need.

092. English for Foreign Students—Speaking and Listening
Fall, Winter, Spring, Summer. Zero credits. [3(5-0) See page A-1 item 3.] English language proficiency examination. Intensive speaking and listening practice of spoken English in small groups (determined by proficiency). For beginners, practice is largely drill. Advanced groups use drills, films, discussion, and practical conversations.

093. English for Foreign Students—Language Laboratory
Fall, Winter, Spring, Summer. Zero credits. [3(5-0) See page A-1 item 3.] English language proficiency examination. Language laboratory practice in small groups (determined by proficiency). Begins review and supplement ENG 091, ENG 092. Advanced groups use carefully prepared lectures, speeches, and presentations to practice structures and vocabulary.

094. English for Foreign Students—Reading
Fall, Winter, Spring, Summer. Zero credits. [3(5-0) See page A-1 item 3.] English language proficiency examination. Intensive and extensive reading in small groups (determined by proficiency). Begins emphasis on vocabulary development and practice in basic structures. Advanced classes include reading skills, wider reading, and specialized vocabulary.

095. English for Foreign Students—Writing
Fall, Winter, Spring, Summer. Zero credits. [3(5-0) See page A-1 item 3.] English language proficiency examination. Frequent controlled and free writing in small groups to reduce errors and practice using structures and vocabulary to express ideas. Advanced classes include writing styles used in academic course work.

101. Responses Through Writing
Fall, 4(4-0) Arts and Letters Freshmen only. Students must enroll in and complete ENG 101 satisfactorily to make a substitution for the American Thought and Language requirement. A writing workshop that concentrates on the students' personal writing voice and on their responses to the things, people, and institutions central to their experience.

A-71