827. Nonlinear Systems Analysis
Spring. 4(4-0) SYS 826, MTH 424.
Existence, uniqueness and stability in nonlinear systems; autonomous systems and the phase space; linearization, perturbation, describing functions and harmonic balance procedures; numerical solutions.

829. Linear Multivariable Control Systems
Winter. 4(4-0) SYS 826, STT 441, SYS 413.
Linear continuous time and discrete time multivariable control systems; state and output feedback; observers; eigenstructure placement; asymptotic tracking; optimal linear control; stochastic processes; Kalman filter; LQG optimal control.

835. Static Optimization Methods
Summer. 4(4-0) MTH 424. Students may not receive credit for both SYS 835 and MGT 835.
Linear and nonlinear optimization examples and applications; Kuhn-Tucker theory; saddle point optimality conditions; algorithms for problems with constraints; unconstrained optimization; introduction to search methods.

841. Optimization of Urban Traffic Flow
Fall of even-numbered years. 3(3-0) C E 346, STT 351 or 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.

843. 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.

847. Communication Engineering
Fall. 4(4-0) E E 457. Interdepartmental with and administered by Electrical Engineering.
Communications in probabilistic channels. Measures in system performance. Channel models. Optimal reception of analog and digital signals. Coding for various channel models. Detection of targets. Signal solution.

848. Communication Theory
Spring. 3(3-0) SYS 863. Interdepartmental with and administered by Electrical Engineering.
Hypothesis testing, decision theory and parameter estimation in communications and signal processing. Optimal filtering techniques. Communication in non-white noise. Communication in non-Gaussian noise. Quantum detection 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 851. Interdepartmental with and administered by the Department of Mechanical Engineering.
Continuation of M E 851. 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) SYS 826, STT 441, MTH 424. 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. Digital Signal Processing
Winter. 3(3-0) E E 456 or STT 441. Interdepartmental with and administered by Electrical Engineering.
Discrete time signals and systems, random discrete time signals. Basic principles of estimation theory, spectral estimation. Digital filter design techniques.

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

947. Topics in Communications
Fall of odd-numbered years. 3(3-0) May reenroll for a maximum of 6 credits. E E 848. Interdepartmental with and administered by Electrical Engineering.
Advanced treatment of a topic or group of topics of current research interest in the field of communications, information theory and signal processing.

961. Optimal Control Theory
Fall of odd-numbered years. 3(3-0) SYS 829, MTH 424.
Optimal control, performance measures, principle of optimality, dynamic programming, Hamilton-Jacobi-Bellman equation, variational approach, constrained extrema, Pontryagin principle, necessary conditions, solution techniques, singular cases.

962. Computational Techniques for Optimal Control
Winter of even-numbered years. 3(3-0) SYS 961.
Computational methods of optimal controls, steepest descent, variation of extremals, quasilinearization, gradient projection, dynamic programming, convexity techniques, support functions for reachable sets, current literature.

963. Dynamic System Identification
Winter of odd-numbered years. 3(3-0) SYS 863.
Review of stochastic system modeling; identifiability; canonical forms; spectral factorization; least squares and maximum likelihood identification methods and their properties, consistent estimators; closed-loop system identification, recursive algorithms; experiment design.

964. Large Scale Dynamic Systems
Spring of even-numbered years. 3(3-0) SYS 827, SYS 829.
Topics will be drawn from: model reduction and aggregation; stability of interconnected systems; multiple time scale decomposition; decentralized control; hierarchical control.

965. Adaptive Control
Spring of odd-numbered years. 3(3-0) SYS 827, SYS 829, SYS 963.
Model reference adaptive control in continous time and discrete time; Lyapunov and hyperstability approaches; adaptive observers; self tuning regulators; design using pole-zero assignments, minimum variance control and LQG control.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

ENGINEERING EGR

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 ten terms. Employment assignment approved by College of Engineering.
Pre-professional employment in industry and government related to student's major.

390. Value Engineering
Fall. 4(4-0) Engineering Arts juniors, 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.