

475. Introduction to Operations Research

Winter. 4(4-0) MTH 215, CPS 120. Interdepartmental with and administered by the Agricultural Engineering Department. Methodology and basics of operations research; formulation and analysis of probabilistic models of inventory, waiting line, and reliability processes; random process simulation and network planning models.

490. Special Topics in Systems Science

Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of department. Exposition of special topics in systems science.

495. Independent Study

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

801. Special Problems

Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 8 credits. Approval of department.

810. Introduction to Linear System Theory

Fall. 3(3-0) MTH 214. Interdepartmental with the Department of Computer Science and Social Science (College of). 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.

811. System Methodology and Simulation

Winter. 3(3-0) 810, STT 441. Interdepartmental with the Computer Science Department and Social Science (College of). 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.

813. System Project

Spring. 3(1-6) 811. Interdepartmental with the Computer Science Department and Social Science (College of). Individual or team application of simulation methods to system design and/or management.

820. System Dynamics and Control

Spring. 4(4-0) MTH 215; knowledge of matrices and Laplace transforms. Fundamentals of continuous and discrete dynamic control systems; feedback principles; transform and state variable design techniques; introduction to optimal control design.

826. Linear Concepts in Systems Science

Fall. 4(4-0) State-space and frequency domain models of interconnected systems; solution of continuous and discrete-time linear systems; response characteristics; stability.

827. Nonlinear Concepts in Systems Science

Winter. 4(4-0) 826. Existence, uniqueness and stability; autonomous systems and the phase space; linearization, perturbation, describing functions and harmonic balance procedures; numerical solutions.

828. Optimization of Static Nonlinear Systems

Summer. 4(4-0) Students may not receive credit for both SYS 828 and MGT 835. CHE 465 or knowledge of linear programming. Interdepartmental with the Department of Chemical Engineering. Problem formulation, classification, convexity and applications; Kuhn-Tucker theory in non-linear programming; constrained and unconstrained problems; techniques for quadratic, integer and geometric programming; gradient and search techniques.

841. Optimization of Urban Traffic Flow

Fall. 3(3-0) Approval of department. Interdepartmental with 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) 442 or ZOL 404. Interdepartmental with the Zoology Department. Groups of students from various biological and non-biological disciplines will synthesize and analyze models of selected biological systems. Projects should yield information relevant to solution of contemporary ecological problems.

847. Analysis of Stochastic Systems

Spring. 3(3-0) E E 846. Equilibrium properties of non-stationary random processes; problems of estimation, filtering and prediction; sequential and recursive decision schemes; applications of random process theory to system modeling.

899. Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

961. Optimal Control Theory I

Fall. 3(3-0) 827, 828 or approval of department; MTH 426. Formulation of the general control problem; controllability, observability and normality in discrete-state and continuous-state systems; performance functionals; typical control problems.

962. Optimal Control Theory II

Winter. 3(3-0) 961. Optimum control theory in continuous-state and discrete-state systems; necessary and sufficient conditions for optimal solutions, geometric interpretations relation to calculus of variations; typical applications.

963. Optimal Control Theory III

Spring. 3(3-0) 962 or approval of department. Topics selected among: computational methods for optimal controls (solution of selected two-point boundary value problems); stochastic control theory; state estimation, Kalman filtering and related statistical methods; differential game theory.

965. Special Topics in Optimal Process Theory

Spring of odd-numbered years. 3(3-0) 828 or approval of department. Interdepartmental with and administered by the Chemical Engineering Department. Continuation of 828 and special topics from the literature in non-linear, stochastic, and dynamic programming.

999. Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

ENGINEERING

EGR

College of Engineering

144. Orientation for Engineering Cooperative Education

Winter. 1(1-0) Applicants for the College of Engineering Cooperative Education program. Engineering careers, philosophy of cooperative education, rights and responsibilities of engineers.

160. Engineering Communications

Fall, Winter, Spring. 4(1-6) MTH 108 or 111 or concurrently. Engineering graphics, a means used by engineers to communicate their ideas to others. Freehand sketching, descriptive geometry, and graphical, numerical and computer problem solutions.

161. Mechanical Drawing

Fall, Winter, Spring. 2(0-4) Lettering and use and care of instruments. Orthographic projection, working drawings, machine sketching and isometric drawing.

162. Mechanical Drawing

Fall, Winter, Spring. 3(0-4) 160 or 161. Continuation of 161 with emphasis on freehand lettering and sketching, advanced working drawings.

200. Technology and Society

Winter. 3(3-0) One term of American Thought and Language. Interdepartmental with the Natural Science Department. An attempt to describe and analyze portions of current technology and its desired and undesired consequences; an exploration of avenues for assessing such consequences for future technologies.

IDC. Introduction to Environmental Systems

For course description, see Interdisciplinary Courses.

201. Introduction to Engineering Mechanics

Winter. 4(4-0) PHY 237. Interdepartmental with and administered by the Metallurgy, Mechanics and Materials Science Department. Laws of mechanics governing the behavior of rigid and deformable bodies emphasizing how these laws influence engineering design. Extensive use of demonstrations.

260. Engineering Drawing
Fall, Winter, Spring. 3(0-6)
The development of the ability to communicate graphically, pictorially, and orally. Orthographic projection, freehand sketching, oral reports and creative problem solving techniques are employed to enhance learning.

267. Architectural Drafting I
Fall, Winter, Spring. 3(0-6)
House construction detailing. Analysis and drawing of typical standard details.

270. Computer Graphics
Spring. 3(3-0) 160 or 161; CPS 110 or 120; or approval of department.
Use of computer controlled display systems for the solution of multidimensional problems.

300. Technology and Utilization of Energy
Winter. 3(3-0) Initial course in any sequence of courses in the Department of Natural Science. Interdepartmental with and administered by the Mechanical Engineering Department.
Problems of energy technology and its impact: energy sources, conversions, waste and environmental effects, future outlook for mankind.

322. Interior Lighting Design
Fall, Spring. 3(2-2) HED 213, approval of department. Interdepartmental with and administered by the Department of Human Environment and Design.
The basic principles and practices of interior design lighting, light control, distribution, quality and quantity of light as it affects man's near environment.

364. Architectural Drafting II
Winter. 3(0-6) 267.
Functional and standard procedure in the layout of floor plans in traditional and modern houses. Rendered plot plan and required details.

365. House Planning
Fall, Winter, Spring. 3(1-4)
Elementary house architecture. Drawing plans from sketches. Kitchen planning, house styles, elements of design, financing, heating, lighting.

366. Architectural Perspective Drawing
Fall. 3(0-6) Any engineering graphics course.
One-point and two-point perspective, revolved plan and measuring line methods. Pencil rendering, problems in shade and shadows. House model to scale, optional.

390. Value Engineering
Fall, Winter. 4(3-2) ME 280.
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. Technology Assessment
Spring. 3(3-0) Seniors or approval of department. Interdepartmental with the Natural Science Department.
Sociotechnical evaluation of impact of proposed technologies on economic, political, and cultural aspects of society. Identification of technical strategies and social goals. Techniques of assessment.

410. Systems Methodology
Winter. 3(3-0) IDC 201, MTH 113, CPS 110 or 120. Interdepartmental with and administered by Systems Science.
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) 410. Interdepartmental with and administered by Systems Science.
Completion of a systems study initiated in 410. The project may involve the design of hardware, simulation of a solution to an interdisciplinary problem, or development of a solution concept.

463. Architectural Drafting III
Spring. 3(0-6) 364 or 365.
Traditional and modern elevations. One- and two-point rendered perspective. Functional plans drawn in 364 or 365 required.

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

ENGLISH ENG
College of Arts and Letters

091. English for Foreign Students—Structures
Fall, Winter, Spring, Summer. Zero credits. [3(5-0)]† 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
(092A, 092.) Fall, Winter, Spring, Summer. Zero credits. [3(5-0)]† 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 drill, films, discussion, and practical conversations.

093. English for Foreign Students—Language Laboratory
Fall, Winter, Spring, Summer. Zero credits. [3(5-0)]† English language proficiency examination.
Language laboratory practice in small groups (determined by proficiency). Beginnings review and supplement 091, 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)]† English language proficiency examination.
Intensive and extensive reading in small groups (determined by proficiency). Beginners emphasize vocabulary development and practice in basic structures. Advanced classes include reading skills, wider reading, and specialized vocabulary.

095. English for Foreign Students—Writing
(092B, 092.) Fall, Winter, Spring, Summer. Zero credits. [3(5-0)]† 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 102 satisfactorily to make a substitution for the American Thought and Language requirement.
A writing workshop that concentrates on the student's personal writing voice and on his responses to the things, people, and institutions central to his experience.

102. Writing and Composing
Winter. 5(5-0) 101; Arts and Letters Freshmen only.
A continuation of 101 that develops the emphases of 101 and encourages students to write in more public and objective forms—narrative, critical analysis, and issue-oriented essays.

200H. Honors Work
Fall, Winter, Spring. 1 to 16 credits. Approval of department.

201. Nature of Language
Fall, Winter, Spring, Summer. 3(3-0)
Various aspects of language—phonology and orthography; morphology, semantics and the lexicon; syntax; and dialects—with special reference to American English.

205. Introduction to Shakespeare
Fall, Winter, Spring. 3(3-0) Not applicable to major or minor requirements.
A study of selected plays illustrating the powers of England's greatest writer.

206. Forms of Literature: Fiction
Fall, Winter, Spring, Summer. 3(3-0) Open to Freshmen.
Major forms of prose fiction, designed to reveal artistic problems met and solved by these forms. Prepares students for advanced literary study by acquainting them with the conventions of various literary forms, by providing a critical vocabulary and by furnishing experience in reading and writing critical evaluations of outstanding literary works from all historical periods.

207. Forms of Literature: Drama
Fall, Winter, Spring, Summer. 3(3-0) Open to Freshmen.
Major forms of drama, designed to reveal artistic problems met and solved by these forms.

208. Forms of Literature: Poetry
Fall, Winter, Spring, Summer. 3(3-0) Open to Freshmen.
Major forms of poetry, designed to reveal artistic problems met and solved by these forms.

210. Introduction to the Study of Literature I
Fall, Winter. 4(4-0) English majors or prospective English majors.
Exploration of the major forms of literature, the aims and process of literary study, the cultural and personal functions of literature, and the role of literary study in the University.

† See page A-2 item 3.