

Course Catalog - Fall 2008

General Engineering

100 **Intro to General Engineering** credit: 1 hours.

Introduces the engineering profession and the curriculum in General Engineering. Laboratory activities introduce technical and business-related issues in engineering. Project emphasis is placed on creativity in the design process.

101 **Engineering Graphics & Design** credit: 3 hours.

Use of computer-aided design (CAD) software to model parts and assemblies. Use of parametric and non-parametric solids, surface and wireframe models. Part editing, two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques. Team design project. Credit is not given for both GE 101 and ME 170.

161 **Business Side of Engineering** credit: 1 hours.

Introduces the important elements and metrics of business and product development/management: customers; profits; prices; Boothroyd/Dewhurst Design for Assembly; intellectual property; product and business planning; time value of money; Failure Mode and Effect Analysis; team building. Student teams are formed to develop the concept and business plan for a new product of their own choosing.

199 **Undergraduate Open Seminar** credit: 1 to 5 hours.

May be repeated.

297 **Independent Study** credit: 1 to 4 hours.

Individual investigations of any phase of General Engineering selected by the students and approved by the department. May be repeated. Prerequisite: Consent of instructor.

298 **Special Topics** credit: 1 to 4 hours.

Lectures on special topics in selected areas of General Engineering. May be repeated in the same or subsequent terms to the maximum of 9 hours. Prerequisite: As specified for each topic offering; see Schedule or departmental course information.

310 **General Engineering Design** credit: 3 hours.

Fundamental concepts in the classical and computer-based analysis and design of structural and machine components and assemblies. External loads, internal forces, and displacements in statically determinate and indeterminate configurations: kinematics of linkages, gears, and cams; static forces in machines. Prerequisite: CS 101, MATH 225, TAM 212, and TAM 251.

311 **Engineering Design Analysis** credit: 3 hours.

Stress/strain conditions; analytical and numerical (CAD) solution techniques; analysis of various engineering materials and configurations as applied to the development and application of design analysis criteria. Prerequisite: GE 310; concurrent registration in GE 312.

312 **Instrumentation and Test Lab** credit: 1 hours.

Preparation for experimental projects; introduction to mechanical and electrical instruments; mechanical testing of materials; introduction to experimental stress analysis and photoelastic methods. Prerequisite: GE 310; concurrent registration in GE 311.

320 **Control Systems** credit: 4 hours.

Introduction to control systems and control systems technology. Sensors, actuators, modeling of physical systems, design and implementation of feedback controllers. Operational techniques used in describing, analyzing and designing linear continuous systems; Laplace transforms; response via transfer functions; stability; performance specifications; controller design via transfer functions; frequency response; simple nonlinearities. Credit is not given

for both GE 320 and either AE 353 or ME 340. Prerequisite: CS 101, MATH 285, and TAM 212; credit or concurrent registration in ECE 211.

330 **OR Methods for Profit & Value** credit: 3 hours.

Introduction to an operations-research approach to engineering decision making: economic analysis of alternatives; linear, integer, basic nonlinear, and dynamic programming with specific application to engineering problems in profit and value; decision theory. Credit is not given for both GE 330 and either IE 310 or CEE 201. Prerequisite: CS 101, GE 161, MATH 225, and MATH 231.

331 **Analyt Methods for Uncertainty** credit: 3 hours.

Basic concepts underlying important applications of probability and statistics to the analysis of data in the context of engineering design and decision making; point and interval estimation and hypothesis testing for sampled data; categorical data analysis and goodness of fit; linear models, including multivariate regression and analysis of designed experiments; quality methods including sampling, control charts, and process specification. Credit is not given for both GE 331 and either IE 300 or CEE 202. Prerequisite: CS 101, GE 161, MATH 225, and MATH 231.

361 **Emotional Intelligence Skills** credit: 3 hours.

Understanding emotions in ourselves and others. Assessing and improving interpersonal skills and emotional intelligence competencies including self-regulation, motivation, empathetic listening, communication, influence collaboration and cooperation, conflict management, leadership, teamwork, and managing change. One Saturday laboratory session is required.

397 **Independent Study** credit: 1 to 4 hours.

Individual investigations or studies of any phase of General Engineering selected by the students and approved by the department. May be repeated in same term. Prerequisite: Consent of instructor.

398 **Special Topics** credit: 1 to 4 hours.

Lectures on special topics in selected areas of General Engineering. May be repeated in the same or subsequent terms to the maximum of 9 hours. Prerequisite: As specified for each topic offering; see Schedule or departmental course information.

400 **Engineering Law** credit: 3 hours.

Nature and development of the legal system; legal rights and duties important to engineers in their professions; contracts, uniform commercial code and sales of goods, torts, agency, worker's compensation, labor law, property, environmental law, intellectual property. 3 undergraduate hours. No graduate credit. Counts toward campus Advanced Composition general education requirement. Prerequisite: RHET 105.

This course satisfies the General Education Criteria for a Advanced Composition course.

410 **Component Design** credit: 3 hours.

Design of basic engineering components: structural members, machine parts, and connections. Principles applied include: material failure (yield, fracture, fatigue); buckling and other instabilities; design reliability; analytical simulation. 3 undergraduate hours. No graduate credit. Prerequisite: GE 311 and GE 320.

411 **Reliability Engineering** credit: 3 or 4 hours.

Introduction to concepts in engineering design, testing, and management for highly reliable components and systems. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: GE 331 or IE 300.

412 **Nondestructive Evaluation** credit: 3 or 4 hours.

Introduces the concept of Nondestructive Evaluation (NDE), and provides a review of probability, the role of NDE in Design, and the role of NDE in manufacturing and in maintenance. The primary Nondestructive Testing and Evaluation (NDT&E) techniques, including visual methods, ultrasonic methods, acoustic emission, acousto-ultrasonics, radiological methods, electro-magnetic testing, eddy currents, penetrant methods, thermal methods, and holography, are introduced from the fundamental laws of physics. Includes industrial applications of these techniques towards flaw detection, material properties characterization, impact and fatigue damage evaluation, adhesion, etc. Current literature is examined. Prerequisite: TAM 324.

413 **Engineering Design Optimization** credit: 3 hours.

Focuses on the application of optimization techniques to engineering design problems. Emphasis is placed on problem formulation primarily in structural and mechanical engineering applications. Important theoretical results and numerical optimization methods are covered. Matlab programming assignments develop software for solving nonlinear mathematical programming problems. Prerequisite: GE 330 and GE 310.

420 **Digital Control Systems** credit: 4 hours.

Examines theory and techniques for control of dynamic processes by digital computer; linear discrete systems, digital filters, sampling signal reconstruction, digital design, state space methods, computers, state estimator, laboratory techniques. Prerequisite: GE 320.

421 **Introduction to Robotics** credit: 4 hours.

Same as CS 443, ECE 470, and ME 445. See ECE 470.

422 **Robot Dynamics and Control** credit: 4 hours.

Fundamental concepts and analytical methods for analysis and design of robot systems. Laboratory experiments complement the theoretical development. Same as ECE 489 and ME 446. Prerequisite: GE 320. Recommended: ECE 470.

423 **Mechatronics** credit: 3 hours.

Concepts and practice of mechatronics: computer interfacing of physical devices (sensors, actuators); data acquisition; real time programming and real time control; human-machine interfaces; design principles of mechatronics in manufacturing systems and in consumer systems. Same as MFGE 430. Prerequisite: GE 320.

424 **State Space Design for Control** credit: 3 hours.

Design methods; time domain modeling; trajectories and phase plane analysis; similarity transforms; controllability and observability; pole placement and observers; linear quadratic optimal control; Lyapunov stability and describing functions; simulation. Prerequisite: GE 320 and MATH 225.

450 **Decision Analysis I** credit: 3 or 4 hours.

Examines rules of thought that will transform complex decision situations into simpler ones where the course of action is clear. Practical application of decision analysis in large organizations; methods to generate insights into real-life decision problems, avoid the common pitfalls in decision processes, and overcome the possible barriers to implementing a high-quality decision-making process for individual and organizational decision making; graphical representations of decision problems such as decision diagrams and utility diagrams. Prerequisite: GE 311 or IE 300.

461 **Technology Entrepreneurship** credit: 3 hours.

Critical factors affecting technology-based ventures: opportunity assessment; the entrepreneurial process; founders and team building; preparation of a business plan including market research, marketing and sales, finance, and manufacturing considerations. Same as TE 461. Prerequisite: MATH 231.

490 **General Engineering Seminar** credit: 0 hours.

A series of lectures and discussions by department faculty and visiting professional engineers on ethics, professional registration, the role of technical societies, and the relation of engineering to such disciplines as economics, sociology, and government. 0 undergraduate hours. No graduate credit. Approved for S/U grading only.

494 **Senior Engineering Project I** credit: 3 hours.

Design of various engineering devices and systems. Teams of two to four students work toward the development of engineering solutions to problems supplied by industry. A midterm and final oral report summarize the work of the term for sponsor and faculty. All student team members receive an identical grade. 3 undergraduate hours. No graduate credit. Prerequisite: GE 311, GE 330, GE 331, and GE 424; credit or concurrent registration in one of GE 410, GE 413, GE 420, GE 423; concurrent enrollment in GE 495.

495 **Senior Engineering Project II** credit: 2 hours.

Design of various engineering devices and systems. Teams of two to four students work toward the development of

engineering solutions to problems supplied by industry. A midterm and final report summarize the work of the term for sponsor and faculty. Student team members may receive different grades. 2 undergraduate hours. No graduate credit. Prerequisite: Concurrent enrollment in GE 494.

497 **Independent Study** credit: 1 to 4 hours.

Advanced problems related to General Engineering. May be repeated in same term. Prerequisite: Consent of instructor.

498 **Special Topics** credit: 1 to 4 hours.

Lectures on special topics in selected areas of General Engineering. May be repeated in the same or separate terms if topics vary to a maximum of 9 undergraduate hours or 12 graduate hours. Prerequisite: As specified for each topic offering; see Schedule or departmental course information.

520 **Analysis of Nonlinear Systems** credit: 4 hours.

Same as ECE 528 and ME 546. See ECE 528.

521 **Multivariable Control Design** credit: 4 hours.

Same as AE 555. See AE 555.

522 **Robot Control Theory** credit: 4 hours.

Dynamics of rigid and flexible robots; geometric methods of control; feedback linearization; robust and adaptive control; Lyapunov design methods; singular perturbation and integral manifold methods; passivity and network approaches; force control; control of multiple and redundant robots; teleoperation. Same as ECE 589. Prerequisite: GE 540.

530 **Multiattribute Decision Making** credit: 4 hours.

Provides the background and practice in applying tools for subjective multiple attribute decision making when present or future states of nature are uncertain. Includes exploration of current research in developing computer aids to decision making. Discusses issues in descriptive versus normative approaches in the context of the interface between operations research and artificial intelligence. Covers multiattribute utility analysis from theoretical foundations through assessment procedures, practice, and pitfalls of potential cognitive bases. Same as CEE 536. Prerequisite: GE 331 or CEE 202.

531 **Genetic Algorithm Methods** credit: 4 hours.

Presents genetic algorithms search procedures that are based on the mechanics of natural genetics and natural selection and are finding increased application to the difficult problems of engineering, science, and commerce. Surveys what genetic algorithms are, where they come from, how they work, and how and where they have been applied. Prerequisite: CS 101 and MATH 241.

540 **Simulation of Dynamic Systems** credit: 4 hours.

Modeling and simulation of dynamic engineering systems; distinct modeling approaches for engineering devices; analog and digital computer simulation of dynamic systems; design criteria and performance and design measures. Case studies and projects are used extensively. Prerequisite: GE 320 and IE 485.

550 **Decision Analysis II** credit: 3 or 4 hours.

Continuation of GE 450. Fundamental requirements of a decision-making system; comparison of different decision-making methods, "paradoxes" in decision making; foundations and history of probability as a degree of belief; Bayesian vs. classical statistics; the entropy of a random variable; experimentation and optimal stopping; invariance formulations in utility and probability; one-switch preferences, and graph-based methods to incorporate dependence in multiattribute utility functions. Intended for those interested in pursuing research in decision analysis or wanting to deepen understanding of the foundations of the subject. Prerequisite: GE 450.

560 **Managing Advanced Technol I** credit: 1 hours.

Focuses on the business side of managing advanced technology in industry: strategic context of advanced technology; analytical financial tools used to estimate the potential value of advanced technology; legal concepts important in managing advanced technology; interpersonal issues related to leading, and advocating on behalf of

advanced technology groups. Same as TE 560.

561 **Managing Advanced Technol II** credit: 1 hours.

Continuation of GE 560. Deepens insights previously gained by the use of case studies in the strategic contexts of: advanced technology; analytical financial tools used to estimate the potential value of advanced technology; legal concepts important to managing advanced technology; interpersonal issues related to leading, and advocating on behalf of, advanced technology groups. Same as TE 561. Prerequisite: GE 560.

590 **Seminar** credit: 0 hours.

Presentations by graduate students, staff, and guest lecturers of current topics in research and development in General Engineering. Approved for S/U grading only. Required of all graduate students each term.

594 **Project Design** credit: 1 to 8 hours.

Engineering design projects emphasizing advanced engineering analysis, synthesis, optimization, and engineering economics. May be repeated to a maximum of 8 hours for credit toward the Master's degree.

597 **Independent Study** credit: 1 to 4 hours.

Advanced problems related to General Engineering. May be repeated. Prerequisite: Consent of instructor.

598 **Special Topics** credit: 1 to 4 hours.

Lectures on special topics in selected areas of General Engineering. May be repeated in the same or separate terms if topics vary to a maximum of 12 hours. Prerequisite: As specified for each topic offering; see Schedule or departmental course information.

599 **Thesis Research** credit: 0 to 16 hours.

Approved for S/U grading only. May be repeated to a maximum of 16 hours for credit toward the Master's degree.