MANAGEMENT SCIENCE AND ENGINEERING

Emeriti (Professors): James L. Adams, Kenneth J. Arrow, George B. Dantzig, Donald A. Dunn, B. Curtis Eaves, Frederick S. Hillier, Donald L. Iglehart, Alan S. Manne, Michael M. May, Robert V. Oakford, Henry E. Riggs, David A. Thompson
Chair: M. Elisabeth Paté-Cornell
Deputy Chair: Thomas H. Byers
Professors: Stephen R. Barley, Margaret L. Brandeau, Robert C. Carlson, Richard W. Cottle, Kathleen M. Eisenhardt, Peter W. Glynn, Warren H. Hausman, Ronald A. Howard, James V. Jucker, Hau L. Lee, David G. Luenberger, M. Elisabeth Paté-Cornell, William J. Perry, Robert I. Sutton, James L. Sweeney, Arthur F. Veinott, Jr.
Associate Professors: Nicholas Bambos, Samuel S. Chiu, Ross D. Shachter, Edison T. S. Tse
Assistant Professors: Diane E. Bailey, Meiring de Villiers, Pamela J. Hinds, Ozalp Ozer, James A. Primbs, Benjamin Van Roy
Professors (Research): Walter Murray, Michael A. Saunders, John P. Weyant
Professor (Teaching): Robert E. McGinn
Associate Professor (Teaching): Thomas H. Byers
Consulting Professors: Hung-Po Chao, Naushad Forbes, Thomas Kosnik, James E. Matheson, Robert R. Maxfield, Nimrod Megiddo, Peter A. Morris, D. Warner North, Sam Savage, Richard D. Smallwood
Consulting Associate Professors: Adam Borison, Samuel Holtzman, Gerd Infanger, Mike Lyons, Doug Mackenzie, Audrey MacLean, Behnam Tabrizi, Mukund Thapa, Adel Turki
Consulting Assistant Professors: Blake E. Johnson, Sara Tasker
Lecturers: Peter Haas, Burke Robinson
Visiting Professor: Debra Meyerson
Visiting Associate Professor: Yee-Tien Fu
Administrator of the Industrial Affiliates Program: Lorrie Papadakis
Affiliated Faculty: David Beach, Darrell Duffie, J. Michael Harrison, Charles A. Holloway, Kosuke Ishii, James G. March, David B. Montgomery, Evan L. Porteus, Balaji Prabhakar, Krishna Saraswat

In December 1999, the Board of Trustees authorized the creation of the Department of Management Science and Engineering from the Department of Industrial Engineering and Engineering Management and the Department of Engineering-Economic Systems and Operations Research. The department's mission is: "to conduct research and provide education associated with the development of the knowledge, tools, and methods required to make decisions and shape policies, configure organizational structures, design engineering systems, and solve operational problems associated with the information-intensive, technology-based economy."

Management Science and Engineering (MS&E) provides exceptionally strong programs of education and research by integrating three basic strengths: (1) substantial depth in conceptual and analytical foundations, (2) comprehensive coverage of functional areas of application, and (3) vigorous interaction with other Stanford departments, with Silicon Valley industry, and with many organizations throughout the world. The analytical and conceptual foundations include optimization, dynamic systems, stochastic systems, economics, organizational science, and decision and risk analysis. These foundations support the functional areas and provide the basis for further advance in the discipline. The functional areas of application include finance, production, information, organizational behavior, marketing, entrepreneurship, policy, and strategy. Programs in these functional areas emphasize both fundamental concepts and practical applications. Close associations with other engineering departments and with industry enrich the programs by providing opportunities to apply MS&E methods to important problems and by motivating new theoretical developments from practical experience. MS&E's programs also provide a basis for contributing to other important areas such as biotechnology, defense policy, environmental policy, information systems, telecommunications, and other areas where mastery of fundamentals, functional knowledge, and an engineering viewpoint are extremely valuable.

CAREERS IN MS&E

MS&E helps students prepare for a variety of professional careers in business, government, industry, non-profit institutions, and universities. Graduates have pursued successful careers in consulting, enterprise management, financial analysis, government policy analysis, industrial research, line management, product development, project management, strategic planning, and university teaching and research. Some have founded companies specializing in financial services, high technology products, management and systems consulting, or software. Other graduates have helped establish new analytical capabilities in existing firms or government agencies.

Many graduates have become leaders in technology-based businesses, which have an increasing need for well-educated, analytically oriented people who understand both business and technology. The Department of MS&E is attractive to people with engineering, mathematical science, and physical science backgrounds as it complements their technical abilities with the conceptual frameworks needed to analyze problems of investment, management, marketing, operations, production, and strategic planning in a technical environment.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

The program leading to the B.S. degree in Management Science and Engineering (MS&E) is stated earlier under the "School of Engineering" section of this bulletin, and more information is contained in the School of Engineering's *Handbook for Undergraduate Engineering Programs*. Students are encouraged to plan their academic programs as early as possible, ideally in the freshman or sophomore year. Please do not wait until you are declaring a major to consult with the department's Student Services staff.

The undergraduate curriculum in Management Science and Engineering provides students training in the fundamentals of engineering systems analysis to prepare them to plan, design, and implement complex economic and technological management systems where a scientific or engineering background is necessary or desirable. Graduates are prepared for work in a variety of career paths, including facilities and process management, investment banking, management consulting, or graduate study in industrial engineering, operations research, economics, public policy, medicine, law, or business.

The mission of the undergraduate degree program is to provide students with a basic understanding of management science and engineering principles, including analytical problem solving and communications skills, and to prepare them for practice in a field that sees rapid changes in tools, problems, and opportunities. Building on the strong humanities and sciences available at Stanford, development over an entire career, and the awareness, background, and skills necessary to become responsible citizens, employees, and leaders.

The program builds on the foundational courses for engineering, including calculus, science, and engineering fundamentals, with courses in computer science, finance, mathematical modeling, organization theory, probability, statistics, and either information science or a senior group project. To develop depth in a particular area, students choose a concentration in either financial and decision engineering, industrial engineering/operations management, operations research, technology and organizations, or technology and policy. The major in Industrial Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET).

The program builds on a strong engineering foundation. The required mathematics courses include calculus of single and multiple variables, linear algebra, probability, statistics, and stochastic models. At least 14 units of science are required, including chemistry, physics through electricity and a laboratory course.

The program includes three Engineering Fundamental courses, technically rigorous introductory courses in various engineering disciplines. Engineering 40 provides some background and laboratory experience in electrical engineering. Although students can choose any two other engineering fundamentals, it is strongly recommended that they take Engineering 25, which presents the basic science and engineering principles of biotechnology. These three courses are in addition to the three engineering fundamental courses included in the department core, Engineering 60, Engineering 62, and Computer Science 106A.

The Technology in Society requirement is satisfied by a subset of the courses approved by the School of Engineering, particularly those that emphasize social responsibility. Some of these courses are also included in some of the concentrations, but in those cases the same course can only count toward one requirement.

The Writing in the Major (WIM) requirement can be met by four restricted electives in the program. It is up to the students to ensure that their programs include at least one of them, either in their concentrations or their Technology in Society courses. Students can take more than one WIM course, and WIM courses can be used to satisfy other requirements.

The department core comprises courses in computer science, deterministic optimization, finance, organization theory, and either a senior project or information science. Through the core, mathematics, engineering fundamental, and Technology in Society courses, all students in the program are exposed to the breadth of faculty interests, and are in a good position to choose a concentration during the junior year.

The five concentrations are designed to allow a student to explore one area of the department in greater depth. Some of the courses require some prerequisites (Economics 1 or Psychology 1) not included in the degree program, but those courses could be used to satisfy the General Education Requirements (GERs).

1. *Financial and Decision Engineering:* focuses on the design and analysis of financial and strategic plans. It features accounting, decision analysis, economics, finance, investment science, stochastic models.
2. *Industrial Engineering/Operations Management:* focuses on the design and analysis of manufacturing, production, and service systems. A student completing this concentration with the project course can choose to receive a degree in Industrial Engineering from the Management Science and Engineering Department or receive a degree in Operations Management.
3. *Operations Research:* provides a more mathematical program, based on algorithms, theory, and applications in economics and operations.
4. *Technology and Organizations:* designed for students seeking a broad technological background coupled with an understanding of the behavior of individuals and groups. It features courses exploring different aspects of technology-based organizations.
5. *Technology and Policy:* designed for students seeking a broad technological background coupled with policy analysis. It features courses in microeconomics, public policy, ethics or the law, and applications in national security and commercial technology policy.

For information about an MS&E minor, see the "School of Engineering" section of this bulletin.

MS&E also participates with the departments of Computer Science, Mathematics, and Statistics in a program leading to a B.S. in Mathematical and Computational Science. See the "Mathematical and Computational Science" section of this bulletin.

GRADUATE PROGRAMS

The faculty have developed graduate degrees in Management Science and Engineering (MS&E). The graduate degrees in EES&OR and IEEM will be phased out, and no new students will be admitted to those programs.

MS&E, in collaboration with other departments of the University, offers programs leading to the degrees of Master of Science and Doctor of Philosophy. The department also offers a coterminal B.S./M.S. degree, a master's degree in Manufacturing Systems Engineering in cooperation with the Department of Mechanical Engineering (no applications are being accepted for this program for 2002-2003) and a dual master's degree in cooperation with each of the other departments in the School of Engineering.

Applicants for admission as graduate students in MS&E must submit the results of the verbal, quantitative, and analytical parts of the Graduate Record Examination. The deadline for application is February 1.

Except in unusual circumstances, admission is limited to the Autumn Quarter because courses are arranged sequentially with basic courses and prerequisites offered early in the academic year.

Assistantships and Fellowships—A limited number of fellowships and assistantships are awarded each year. Applicants admitted to the doctoral program, who have indicated on their application that they would like to be considered for financial aid, are automatically considered for these assistantships and fellowships.

Information about loan programs and need-based aid for U.S. citizens and permanent residents can be obtained from the Graduate Financial Aid Office.

MASTER OF SCIENCE

The M.S. degree programs require a minimum of 45 units beyond the equivalent of a B.S. degree at Stanford. All programs represent substantial progress in the major field beyond the bachelor's degree.

University requirements for the master's degree are described in the "Graduate Degrees" section of this bulletin.

MANAGEMENT SCIENCE AND ENGINEERING

The M.S. program in Management Science and Engineering (MS&E) prepares individuals for a lifelong career addressing critical technical and managerial needs in private and public decision making. Department requirements for the M.S. degree provide breadth across some of the areas of the department, and flexibility for meeting individual objectives of depth in a particular area of concentration. The master's degree may be a terminal degree program with a professional focus, or a preparation for a more advanced graduate program. The M.S. degree can normally be earned in one academic year (three academic quarters) of full-time work, although students may choose to continue their education by taking additional MS&E courses beyond that year. Background requirements, taken in addition to degree requirements, must be met by students who have had insufficient course work in mathematical sciences, computer science, engineering and/or natural sciences.

Students must take a minimum of 45 course units as follows:

1. At least five core courses.
2. At least three other courses in an area of concentration of their choice.
3. A course in probability, unless a college-level course in probability has already been passed.
4. A project course requirement.
5. The remaining units in elective courses.

Background Requirements—Students must have had or must take the following (or equivalent) courses before the M.S. degree is conferred: Mathematics 41, 42, 51 (Calculus, 15 units), Computer Science 106A (programming, 5 units), and an additional 15 units of engineering, mathematical sciences, or natural sciences. These courses do not count toward the 45 units of the M.S. degree. Courses taken to meet MS&E background requirements may be at either the undergraduate or graduate level, and may be taken as credit/no credit. These additional background requirements would typically be met by students who have a bachelor's degree in engineering, or mathematical or natural sciences. Students are notified at the time of admission of any remaining need to meet background requirements.

Core Courses—M.S. students must take at least five courses out of the following ten options:

Decision Analysis (MS&E 252), or Risk Analysis (MS&E 250A)
Dynamic Systems (MS&E 201) or Stochastic Decision Models (MS&E 251)
Economic Analysis (MS&E 241)
Global Entrepreneurial Marketing (MS&E 271)
Industrial Accounting (MS&E 140), Investment Science (MS&E 242), Financial Decisions (MS&E 245E), or Introduction to Finance (MS&E 245G)
Introduction to Stochastic Modeling (MS&E 221) or Simulation (MS&E 223)

Linear and Non-Linear Optimization (MS&E 211)
Organizational Behavior and Management (MS&E 280)
Production Systems (MS&E 261)
Strategy in Technology-Based Companies (MS&E 270)

Students may not waive core courses. They may, however, substitute an approved, more advanced course in the same area. Courses used to satisfy the core requirement must be taken for a letter grade, must be taken for a minimum of three units each and may not also be used to satisfy the concentration requirement.

Courses in an Area of Concentration—Students must complete a departmentally approved set of three or more letter-graded courses taken for a minimum of three units each, in an area of concentration of one of the following types:

1. An area of concentration in the MS&E department.
2. An area of concentration in one of the seven other departments of the School of Engineering.
3. In exceptional cases, a coherent area of concentration designed by the student. Petitions for student-designed concentrations must list the three proposed courses (taken for three units or more and at the 200-level or above) and include a brief justification. The petition must be submitted to student services no later than the fifth week of the quarter prior to graduation.

Project Course Requirement—Students must take either a designated project course or two designated integrated project courses. The project course(s) must be taken for letter grade, and must be taken for a minimum of three unites and may also be used to satisfy the core or concentration requirement.

Additional requirements are:

1. At least 45 units must be in courses numbered 100 and above, with the exception of Engineering Fundamentals courses (10, 14, 15, 20, 25, 30, 40, 50, 60, 62).
2. At least 27 units must be in courses numbered 200 and above in MS&E, taken for a letter grade and a minimum of three units each, and at least 36 units must be in MS&E or closely related fields. Closely related fields include any department in the School of Engineering, mathematics, statistics, economics, sociology, psychology, or business.
3. The degree program must be completed with a grade point average (GPA) of 3.0 or higher.
4. A maximum of three units of language courses.
5. A maximum of three units of 1-unit seminars, colloquia, workshops, etc., in any department, and a maximum of one unit of MS&E 208 Curricular Practical Training.
6. A maximum of 18 Non-Degree Option (NDO) units.
7. Courses in athletics may not be applied toward the degree.

Please see student services' office or department web site for complete listing of project, integrated project and approved concentrations.

ENGINEERING: MANUFACTURING SYSTEMS ENGINEERING

No applications are being accepted for this program for 2002-2003.

The M.S. in Engineering with a concentration in Manufacturing Systems Engineering addresses the need for engineers who combine management and design skills focused on manufacturing. There is a critical need for individuals who can deal directly with product design for manufacturability; design of integrated manufacturing systems; financial, organizational, and strategic management issues; and elements of automation technology such as computer-aided design, computer-aided manufacturing, robotics, and microprocessor control.

Manufacturing Systems Engineering is a joint effort of the departments of Mechanical Engineering, and Management Science and Engineering. The program seeks highly qualified students with strong educational backgrounds in engineering and provides a demanding curriculum that is strong in both hardware and engineering management. Successful applicants should have a minimum of one year of full-time industrial experience.

The hardware and engineering-design aspects of the program include:

Ambidextrous Thinking
Design for Manufacturability
Integrated Design for Marketability and Manufacturing
Manufacturing and Design
Microprocessor Applications
Robotics and Manipulation
Smart Product Design

The engineering management subjects include:

Engineering Economy
Industrial Accounting
Inventory Control and Production Systems
Management of New Product Development
Manufacturing Strategy
Manufacturing Systems Design
Marketing for Technology-Based Companies
Organizational Behavior and Management
Supply
Supply Chain Management

The hardware and engineering design courses provide hands-on training of these functions and the trade-offs that must be made in selecting alternative systems configurations.

The engineering management subjects provide a suitable perspective so that alternative system choices can be appropriately evaluated for their financial, organizational, and production impacts, as well as their impact on the firm's manufacturing policy.

Beyond the required core, the curriculum allows for elective courses chosen from a broad set of relevant electives providing additional training in engineering management, engineering-design hardware, and aspects of computer science. A student may follow individual interests and tailor the program to meet individual needs.

Students interested in a career focused on manufacturing management and product development may apply for the Dual Manufacturing Systems Engineering and the M.B.A. program. Minimum requirements can be met through six to seven quarters of study if the candidate matriculates in both programs simultaneously.

The detailed requirements for the M.S. in Manufacturing Systems Engineering are available from the MS&E Student Services office.

MANAGEMENT SCIENCE AND ENGINEERING (MS&E) AND ELECTRICAL ENGINEERING (EE)

Admission—For the dual degree, admission to both departments is required, but is coordinated by designated members of both Admissions Committees who make recommendations to the committees of their respective departments.

Advising—Every student in the dual degree program has one adviser in EE, and one in MS&E. In addition, a committee consisting of designated faculty from both departments serves as a review committee on performance and as an overseeing body of ongoing and graduating students of the program. The committee, consisting of designated members of both Admission Committees as described in the previous section, may initially serve as this overseeing body.

The Dual Degree Program—This dual-degree program enables a small, selective set of graduate students to obtain both the MS&E master's degree and the EE master's degree simultaneously. Students complete the course requirements for each department. A total of 90 units is required to complete the dual-degree.

PROFESSIONAL EDUCATION

The Stanford Center for Professional Development (SCPD) provides opportunities for employees of some local and remote companies to take courses at Stanford.

The Honors Cooperative Program (HCP) provides opportunities for employees of some local companies to earn an M.S. degree, over a longer period, by taking one or two courses per academic quarter. Some required courses are only offered on campus; HCP students must plan to attend those courses at Stanford to meet the degree requirements. It is not currently possible to complete this program as a remote HCP student. Students must apply for a degree program through the standard application process, and must meet the standard application deadline of February 1.

The Non-Degree Option (NDO) allows employees of some local companies to take courses for credit from their company sites before being admitted to a degree program. Students apply to take NDO courses each quarter through the Stanford Center for Professional Development.

For additional information about the NDO application process and deadlines, see http://scpd.stanford.edu, or contact the SCPD at (650) 725-3000.

The department offers a Certificate Program within the framework of the NDO program. A certificate can be obtained by completing three MS&E core courses, plus one MS&E elective course for the total of four courses. For further information, see: http://scpd.stanford.edu/ce/ndp/certificate.html.

DOCTOR OF PHILOSOPHY

University requirements for the Ph.D. degree are described in the "Graduate Degrees" section of this bulletin.

The Ph.D. degree in MS&E is intended for students primarily interested in a career of research and teaching, or high-level technical work in universities, industry, or government. The program requires three years of full-time graduate study, at least two years of which must be at Stanford University. Typically, however, students take about four to five years after entering the program to complete all Ph.D. requirements. The Ph.D. is generally organized around the requirement that the students acquire a certain breadth across some of the eight areas of the department, and depth in one of them. These areas are:

Decision analysis and risk analysis
Economics and finance
Information science and technology
Organization, technology, and entrepreneurship
Policy and strategy
Probability and stochastic systems
Production operations and management
Systems modeling and optimization

Doctoral students are required to take a number of courses, both to pass a qualifying exam in one of these areas and to complete a dissertation based on research which must make an original contribution to knowledge.

Each student admitted to the Ph.D. program must satisfy a breadth requirement and pass a qualification procedure. The purpose of the qualification procedure is to assess the student's command of the field and to evaluate his or her potential to complete a high-quality dissertation in a timely manner. The student must complete specified course work in one of the eight areas of the department. The qualification decision is based on the student's grade point average (GPA), on the one or two preliminary papers prepared by the student, and on the student's performance in an area examination. Considering this evidence, the department faculty votes on advancing the student to candidacy in the department at large. The Ph.D. requires a minimum of 135 units, at least 54 of which must be in courses of 3 units or more. At least 48 course units in courses of 3 units or more must be taken for a letter grade. Finally, the student must pass a University oral examination and complete a Ph.D. dissertation. During the course of the Ph.D. program, students who do not have a master's degree are strongly encouraged to complete one, either in MS&E or in another Stanford department.

Breadth Requirement—

1. The breadth requirement is to be satisfied by a choice of four courses spanning four out of the above mentioned eight areas of the department. The list of courses satisfying the breadth requirement is available from the MS&E Student Services office.
2. The Ph.D. candidacy form must contain four courses that satisfy the breadth requirement.
3. Courses chosen to satisfy the breadth requirement must be taken for letter grades.
4. At least one of the four courses chosen to satisfy the breadth requirement must be at the 300 level.

Qualification Procedure Requirements—The qualification procedure is based both on breadth across the department's disciplines and depth in an area of the student's choice. The qualification process must be completed by the end of the month of May of the student's second year of graduate study in the department. The performance of all doctoral students is reviewed every year at a department faculty meeting at the end of May or beginning of June. Ph.D. qualification decisions are made at that time and individual feedback is provided.

The Ph.D. qualification requirements comprise three elements:

1. *Grade Point Average:* a student must maintain a GPA of at least 3.4 in the four courses chosen to satisfy the breadth requirements, and a GPA of at least 3.4 in the set of all courses taken by the student within the department. In both cases, the GPA is computed on the basis of the nominal number of units for which each course is offered.
2. *Paper(s):* a student may choose between two options, either to be completed before the Spring Quarter of the student's second year. The first option involves one paper supervised by a primary faculty adviser in one area and a faculty consultant in another area. The objective is to permit a student who has decided on a principal thesis focus to concentrate early in that area while benefiting from the input (and broadening) afforded by the participation of a faculty member outside the primary area of research. This paper should be written in two quarters.

   The second option involves two shorter sequential tutorials in two different areas, with two different faculty advisers. Each tutorial should be completed in one quarter. In both options, the student chooses the faculty adviser(s)/consultant with the faculty members' consent.

   A student may register for up to three per tutorial and up to 6 units for a paper. These paper or tutorial units do not count towards the 54 course units required for the Ph.D., and letter grades are not given.
3. *Area Qualification:* in addition, during the second year, a student must pass an examination in an area of his or her choice, either in one of the eight department areas already defined by the faculty, or in a ninth area representing a mix of area specialties to be defined by a cognizant faculty group (including at least three faculty members) appointed by the department chair. This area examination is written, oral, or both at the discretion of the area faculty administering the exam.
4. *Area Course Requirement:* students must complete the depth requirements of one of the eight areas of the MS&E department. All courses used to satisfy depth requirements must be taken for a letter grade. The Ph.D. requirements for the eight areas of the MS&E department are available from the MS&E Student Services office.

COURSES

(AU) indicates that the course is subject to the University Activity Unit limitations (8 units maximum).

(WIM) indicates that the course meets the Writing in the Major requirements.

UNDERGRADUATE

22. The Flaw of Averages—(Formerly EES&OR 21.) A common cause of bad planning is the flaw of averages. This error occurs whenever an uncertain quantity is represented by a single average number. Examples of the flaw of averages may be obvious or insidious. The information age is changing our perspective of uncertainty. Seminar recognizes the flaw of averages, avoids it in everyday thinking, introduces recent information technologies for preventing the flaw of averages, and relates this new approach of dealing with uncertainty to traditional statistics.

2 units (Savage) not given 2001-02

41. Financial Literacy—(Formerly EES&OR 41.) Practical knowledge about personal finance and money management including budgeting, credit cards, banking, insurance, taxes, and saving. Real-life credit card bills, bank statements, paycheck stubs, and insurance policies.

1 unit, Win, Spr (Morrison)

60. Engineering Economy—(Enroll in Engineering 60.)
3 units, Aut, Win (Jucker)
Sum (Staff)

92Q. Stanford Introductory Seminar: International Environmental Policy—Preference to sophomores. Introduction to the science, using economics and the politics of international environmental policy. Current negotiations on global climate change are a case study. Lectures/materials are self contained and similar to material the instructor used in briefing international negotiations and the U.S. Congress, integrating the material more comprehensively in policy briefings on individuals, dimensions, or the problem and its potential solutions.
4 units, Win (Weyant)

101. Undergraduate Directed Study—(Formerly IE 191.) Directed study on a subject of mutual interest to the student and faculty member. Student must find a faculty sponsor and submit a one-page description of plan.
1 or more units (Staff)

107. Interactive Management Science—(Formerly EES&OR 137; graduate students register for 207.) Examines analytical techniques such as linear and integer programming, Monte Carlo simulation, forecasting, decision analysis, and Markov chains in the environment of the spreadsheet. Materials include spreadsheet add-ins for implementing these and other techniques. Emphasis is on building intuition through interactive modeling, and extending the applicability of this type of analysis through integration with existing business data structures. Project required of those enrolled in 207.
3 units, Aut (Savage)

108. Senior Project—(Formerly IE 180.) Restricted to MS&E majors in their senior year. Students participate in a major project in groups of four. Problem identification and definition, emphasizing data collection, synthesizing feasible solutions to real problems, and presentation of results. Prerequisites: 121, 180, 242 or 245G, 260; Computer Science 106B; Engineering 40, 60, 62. Limited Enrollment. Priority to students completing ABET accredited IE Concentration.
5 units, Win (Staff)

111. Introduction to Optimization—(Formerly EES&OR 111; enroll in Engineering 62.)
4 units, Aut (Friedlander)
Spr (Veinott)

120. Probabilistic Analysis—(Formerly EES&OR 120; graduate students register for 220.) Concepts and tools for the analysis of problems under uncertainty, focusing on model building and communication: the structuring, processing, and presentation of probabilistic information. Examples from legal social, medical, and physical problems provide motivation and illustrations of modeling techniques. Spreadsheets will be used to illustrate and solve problems as a complement to analytical closed-form solutions. Topics: axioms of probability, probability trees, random variables, distributions, conditioning, expectation, change of variables, and limit theorems. Prerequisite: Mathematics 51. Recommended: knowledge of spreadsheets.
5 units, Aut (Shachter)

121. Introduction to Stochastic Modeling—(Formerly EES&OR 121.) Stochastic processes and models in operations research. Discrete and continuous time parameter Markov chains. Queuing theory, inventory theory, simulation. Prerequisite: 120 or Statistics 116.
4 units, Win (Ward)

130. Information Systems—(Formerly IE 175.) Introduction to the design and use of computer-based information systems. Topics: software and hardware used in information systems, information requirements, database design, information system design, organizational aspects of information systems, and applications of information systems in different industries. Prerequisites: 180; Computer Science 106A, 106B.
4 units, Win (Ozer)

131. Information Science—Information science is presented in terms of five essential aspects of information (five E's): Information as entropy is the classical information theory concerning bits and bytes, channel capacity, bandwidth, coding, and encryption. Information as an economic commodity, unlike other commodities information generally, is not lost when it is consumed, and this has important consequences for how information is efficiently produced, priced, and distributed. Information as enlightening, where information can influence decisions made, and for this purpose has a value that can be calculated. Information as embodied in physical form, where vast quantities of information are stored in data bases and data warehouses, and transmitted through networks that package, encrypt, switch, and route it from location to location. Information as extracted from data, using data-mining and modeling techniques. Modern instances of these five information concepts.
3 units, Win (Luenberger)

140. Industrial Accounting—(Formerly IE 133.) Non-majors and minors who have taken or are taking elementary accounting should not enroll. Introduction to accounting concepts and the operating characteristics of accounting systems. The principles of financial and cost accounting, design of accounting systems, techniques of analysis, and cost control. Designed for the user of accounting information and not as an introduction to a professional accounting career. Interpretation and use of accounting information for decision making is stressed.
3-4 units, Aut (Turki)
Sum (Staff)

152. Introduction to Decision Analysis—(Formerly EES&OR 152.) How to make good decisions in a complex, dynamic, and uncertain world. People often make decisions that on close examination they regard as wrong. Decision analysis uses a structured conversation based on actional thought to obtain clarity of action in a wide variety of domains. Topics: distinctions, possibilities and probabilities, relevance, value of information and experimentation, relevance and decision diagrams, risk attitude. GER: 2b (WIM)
4 units, Spr (Shachter)

160. Analysis of Production and Operating Systems—(Formerly IE 260; graduate students register for 260.) Introduction to the design, operation, and control of production systems using mathematical, computational, and modern analytical techniques. Topics: determination of optimal facility location, determination of production lot sizes, optimal timing and sizing of production capacity expansion, and introduction to inventory control. Prerequisites: 120 and Engineering 62.
4 units, Aut (Brandeau)

164. Manufacturing Systems Design—(Formerly IE 125; graduate students register for 264.) The concepts and techniques of designing and improving productive systems. Emphasis is on the physical and organizational design of high-performance manufacturing systems. Multidisciplinary approach with the use of digital simulation as a tool for evaluating design alternatives. Prerequisites: 121, 169, 180. (WIM)
5 units, Spr (Bailey)

169. Quality Assurance and Control—(Formerly IE 121; graduate students register for 269.) Introduction to the concepts and statistical methods that companies use to manage and improve quality. Topics: sampling inspection, statistical process control, quality function deployment, cost of quality, and Taguchi's method for designing in quality. Prerequisites: 120 and Statistics 110 or 190.
4 units, Win (Garber)

180. Organizations: Theory and Management—(Formerly IE 100.) For undergraduates only, with preference to MS&E majors. Survey of classical and modern organization theory, covering the behavior of the individual, the work group, and the organization.

4 units, Aut (Eisenhardt)
Spr (Hinds)

181. Issues in Technology and Work for a Post-Industrial Economy—(Formerly IE 101.) Introduces undergraduates in industrial engineering and other engineering disciplines to the study of technology and work, exploring topics of contemporary concern and identifying challenges posed by a post-industrial workplace. Objectives: explore how changes in technology and organization are altering the way we work and live our lives; become acquainted with approaches to studying and designing work; and examine how a grounded understanding of work and work practices can assist engineers in designing better technologies and organizations. Representative topics: job design, distributed and virtual organizations, the blurring of boundaries between work and family life, computer supported cooperative work, trends in skill requirements and occupational structures, monitoring and surveillance in the workplace, downsizing and its effects on work systems, project work and project based lifestyles, the growth of contingent employment, telecommuting, electronic commerce, and the changing nature of labor relations.

3 units, Spr (Barley)

182. Work, Technology, and Society—(Formerly IE 170; fulfills the School of Engineering's Technology in Society requirement.) Seminar on work in contemporary society as influenced by rapid technological change. Causes and consequences of the current revolution in work, and policies for grappling with resultant problems. Focus is on the U.S., with attention to key trends in selected foreign countries. Topics: new technology in the workplace and its bearing on occupational and organizational changes, employer-employee relations, worker health and safety, economic competitiveness, women workers, workplace ethics, and the future of work. Limited enrollment.

4 units (McGinn) given 2002-03

193. Technology in National Security—(Formerly EES&OR 193; graduate students register for 293.) Examines critical decisions made by the U.S. in selected security and space programs, emphasizing current issues. Case studies illustrate the process by which technical, political, and economic issues are brought into the policy process; particularly, the way in which technical organizations in government, government committees, and science advisory boards interact to bring advice to senior policy makers. Some case decisions in other countries. (WIM)

3 units, Aut (Perry)

195. International Security in a Changing World—(Formerly EES&OR 195; same as Political Science 138.) Surveys the major international and regional security problems in the modern world. Interdisciplinary faculty lecture on the political and technical issues involved in arms control, the military legacy of the Cold War, regional security conflicts, proliferation of advanced weapons capabilities, ethnic conflicts, and peacekeeping efforts. GER:3b

5 units, Win (Blacker, May, Perry, Sagan)

196. Transportation Systems and Urban Development—(Formerly EES&OR 196.) Introduction to transportation systems and planning, and their roles in society. Analytical tools introduced at a conceptual level examine issues and evaluate alternatives. Policy implications and system effectiveness analysis of transportation in an urban context. Topics: economic analysis of transportation, supply and demand equilibrium analysis, urban transportation networks, congestion management, short and long term transportation planning, the impact of technology on transportation systems, land use and transportation, case studies and analysis of current transportation news items. Prerequisite: Mathematics 21.

3 units (Staff) not given 2001-02

197. Ethics and Public Policy—Ethical issues in science- and technology-related public policy conflicts. Develops the capacity for rigorous critical analysis of complex, value-laden policy disputes. Topics: the nature of ethics and morality; the natures of and rationales for liberty, justice, and human rights; and the use and abuse of these concepts in recent and current policy disputes. Cases from: biomedicine, environmental affairs, the technical professions, communications, and international relations. GER:3a (WIM)

5 units, Win (Jamieson)

PRIMARILY FOR GRADUATE STUDENTS

GENERAL AND SYSTEMS ANALYSIS METHODS

201. Dynamic Systems—(Formerly EES&OR 231.) Introductory; the goal is to train students to think dynamically in decision making, and recognize and analyze dynamic phenomena in diverse situations. Concepts: formulation and analysis; state-space formulation; solutions of linear dynamic systems, equilibria, dynamic diagrams; eigenvalues and eigenvectors of linear systems, the concept of feedback; nonlinear dynamics, phase plane analysis, linearized analysis, Liapunov functions, catastrophe theory. Examples: grabber-holder dynamics, technology innovation dynamics, creation of new game dynamics in business competition, ecosystem dynamics, social dynamics, and stochastic exchange dynamics. Prerequisite: Mathematics 103 or equivalent.

4 units, Win (Tse)

207. Interactive Management Science—(Formerly EES&OR 237; undergraduates register for 107; see 107.)

3 units, Aut (Savage)

208. Practical Training—(Formerly EES&OR 208.) Students obtain employment in a relevant industrial or research activity, chosen to enhance their professional experience, and consistent with the degree program they are pursuing. Students must submit a one-page statement showing relevance to degree program along with offer letter before the start of the quarter, and a one-page statement documenting the work done and relevance to degree program at the conclusion of the quarter. One unit counts toward the M.S. degree and 3 units toward the Ph.D. degree. Prerequisite: MS&E student.

1 unit, Aut, Win, Spr, Sum (Paté-Cornell)

OPTIMIZATION

211. Linear and Nonlinear Optimization—(Formerly EES&OR 211.) The fundamental concepts of linear and nonlinear optimization theory and modeling. The role of prices, duality, and problem structure in finding and recognizing solutions. Perspectives: problem formulation, analytical theory, and computational methods. Theory: finite dimensional derivatives, convexity, optimality, duality, and sensitivity. Methods: simplex and variations, gradient, Newton, penalty, and barrier. Team project using software package. Prerequisite: Mathematics 51.

4 units, Aut (Cottle)

212. Network and Integer Programming—(Formerly EES&OR 212.) Introduction to modeling and solving optimization problems on networks and problems with integer constraints. Flows, shortest paths, dynamic programming, extreme points, unimodularity, branching, bounding, cuts, tight formulations, AMPL-MINOS, AMPL-CPLEX, MATLAB, complexity. Applications: management of production and inventory systems, packaging, and scheduling. Corequisite: 211 or equivalent.

3 units, Win (Megiddo)

PROBABILITY AND STOCHASTIC SYSTEMS

220. Probabilistic Analysis—(Formerly EES&OR 221. Undergraduate students register for 120; see 120.)

4 units, Aut (Shachter)

221. Stochastic Modeling—(Formerly EES&OR 222.) Continuation of 220. Topics: limit theorems, discrete and continuous time Markov chains, renewal processes, queuing theory, and transform analysis.

Emphasis is on building a framework to formulate and analyze probabilistic systems. Prerequisite: 220 or consent of instructor.
3 units, Win (Weiss)

223. Simulation—(Formerly EES&OR 232.) Generation of uniform and non-uniform random numbers, discrete-event simulations, simulation languages, design of simulations, statistical analysis of the output of simulations, variance reduction, optimization via simulation, applications to modeling stochastic systems in computer science, engineering, finance, and operations research. Prerequisites: a working knowledge of FORTRAN, PASCAL, C, or C++; probability at the level of 120 or Statistics 116.
3 units, Spr (Staff)

224. Stochastic Models in Operations Research—(Formerly EES&OR 273.) Formulation and analysis of models in operations research involving stochastic processes. Topics: Markovian queues, queues with embedded Markov chains, general single server queue, queuing networks, diffusion approximations, queues in heavy traffic. Prerequisites: 221, 251, or equivalents.
3 units (Staff) not given 2001-02

INFORMATION SCIENCE AND TECHNOLOGY

230. Introduction to Computer Networks—(Enroll in Electrical Engineering 284.)
3-4 units, Aut (Tobagi)

232. Information Technology and Supply Chain Management—(Formerly IE 267.) Advancements in information technologies have enabled major innovations in the re-engineering of industry supply chains, redefining the ways companies operate their supply chains. New ventures have emerged to create values for business partners and the consumers in supply chain integration. How information technologies have advanced supply chain integration and coordination. The dimensions of business and process improvements. New opportunities using supply chain management concepts and emerging technologies. Enrollment limited. Prerequisite: 261.
3 units, Spr (Lee)

234. Organizations and Information Systems—(Formerly IE 275.) For graduate students interested in how information systems impact organizations and how organizations take control of information technology (IT) to gain a competitive edge. Topics: IT strategy, the fit between IT and corporate culture, IT architectural alternatives, changing technologies and organizational learning, the effect of IT on competition, and outsourcing as an offensive strategy. Student teams perform field studies based on situations in which information technology is creating a significant management problem or business opportunity. Case based. Enrollment limited.
3-4 units, Win (Tabrizi)

236. Pricing Next Generation Telecommunications Products and Services—(Formerly EES&OR 286.) Telecommunication products and services pricing as the key to success in a rapidly changing and highly competitive market. Interdisciplinary approach to position, price, and distribution of traditional/innovative telecommunication services. Topics: the telecommunication industry as driven by technological advances, policy choices, and explosive business opportunities; the pricing revolution and arbitrage opportunities in international voice created by data-voice convergence and liberalization; competitive aspects of service delivery channels; commoditizing of bandwidth and basic services; clearinghouses; financial risk hedging through futures/derivatives trading; the need to develop intelligent pricing and provisioning agents for product bundling; grade of service differentiation; positioning and revenue optimization by capturing consumer preferences. Group project in industrial participation.
3 units, Sum (Chiu)

237. Progress in Worldwide Telecommunications—(Formerly EES&OR 297.) Interdisciplinary study of topics in current worldwide developments and economic trends with the participation of prominent guest speakers from telecommunications organizations and industry. Topics: telecommunications services and networks, (de)regulation and market-driven competition, technology, standardization, international organizations, and the needs of the underserved parts of the world. Individual or team case study and a verbal presentation. May be repeated for credit.
3 units, Sum (Ivanek, Chiu)

ECONOMICS, FINANCE, AND INVESTMENT

241. Economic Analysis—(Formerly EES&OR 241.) Principal methods of the economic analysis of the production activities of firms (production technologies, cost and profit; perfect and imperfect competition); individual choice (preferences and demand); and the market-based system (price formation, efficiency, welfare.) Emphasis is on the analytical foundations and the practical applications of the methods presented. See 341 for continuation of 241. Recommended: 211.
4 units, Win (de Villiers)

242. Investment Science—(Formerly EES&OR 242.) Introduction to modern quantitative investment analysis: theory and practical application. How modern investment concepts can be used to evaluate and manage opportunities; structure portfolios; and use sophisticated investment products including stocks, bonds, mortgages, and annuities. Topics: deterministic cash flows (time-value of money, present value, internal rate of return, term structure of interest rates, bond portfolio immunization, project optimization); mean-variance theory (Markowitz model, capital asset pricing); dynamic and uncertain cash flows. Emphasis is on translating theory into actual procedures. Examples of applications for every major topic. Group project devoted to application of the theory. See 342 for continuation of 242.
3 units, Aut (Primbs)
Sum (Feinstein)

245E. Financial Decisions—(Formerly IE 235.) Models and techniques in financial decision making under uncertainty. Topics: portfolio and capital market theories, financial analysis and forecasting, cost of capital, project evaluation, and pricing of real and financial options. Prerequisites: 120 and Engineering 60. Recommended: 140, and Engineering 62; Statistics 110 or 190.
4 units (Turki) not given 2001-02

245G. Introduction to Finance—(Formerly IE 236; same as Business F221.) The foundations of finance, with applications in corporate finance and investment management. The process of valuation, which is central to many of the major financial decisions made by corporate managers and investors. Topics: criteria for making investment decisions, relationships between risk and return, market efficiency, and the valuation of derivative securities (e.g., options). The major financial instruments issued by corporations including short and long term debt, equity, and convertible securities. Conceptually rigorous; cases illustrate applications of the main concepts. Prerequisites: 120. Recommended: Economics 50 or equivalent.
4 units, Win (Admati)

247E. International Investment and Financing—(Formerly IE 237.) Builds on the concepts in 235, e.g., NPV, capital structure, and cost of capital estimation, and extends these concepts to an international setting where foreign exchange plays a key role. Topics: exchange rate determination theories, the performance of exchange forecasting models, exchange rate exposure and hedging, international borrowing and capital structure, and international project evaluation. Practical standpoint; however, an understanding of the theory is a necessity in real world applications. Prerequisite: 245.
3-4 units (Turki) not given 2001-02

247S. International Investments—(Formerly EES&OR 243.) Introduces international financial markets, their comparative behavior, and their interrelations. Focus is on the assets traded in liquid markets: currencies, equities, bonds, swaps, and derivatives. Topics: institutional arrangements, taxation and regulation, international arbitrage and parity conditions, valuation of target firms for cross-border acquisitions, international diversification and portfolio management, derivative instruments and dynamic investment strategies, international performance analysis, international capital flows and financial crises, and topics of current relevance and importance. Corequisite: basic finance theory (equivalent of 242 or 245).
3 units, Sum (Fu)

248. Economics of Natural Resources—(Formerly EES&OR 246.) Intertemporal economic analysis of natural resource use, particularly energy, and including air, water, and other depletable mineral and biological resources. Emphasis is on an integrating theory for depletable and renewable resources. Stock-flow relationships; optimal choices over time; short- and long-run equilibrium conditions; depletion/extinction conditions; market failure mechanisms (common-property, public goods, discount rate distortions, rule-of-capture); policy options. Prerequisite: 241 or Economics 51.
4 units, Win (Sweeney)

249. Growth and Development—(Formerly EES&OR 249.) How to assess new investment opportunities in the countries of the Pacific Rim and other fast growing economies. Useful for investors and those guiding their country's development choices. Topics: the mechanism of economic growth, the equation of interest, optimal growth, economic interpretation of the calculus of variations and optimal control theory results, uncertainty, tools for evaluating long-term growth rate, geometric moments, and exponormal distribution. Investment incentives, country risk indices. The long view: rule of law vs. rule of people. Practical cases from Ireland, E. European countries, China, and other E. Asian countries.
3 units, Sum (de La Grandville)

DECISION AND RISK ANALYSIS

250A. Engineering Risk Analysis—(Formerly IE 240.) The techniques of analysis of engineering systems for risk management decisions involving trade-offs (technical, humans, environmental aspects). Four parts: elements of decision analysis; probabilistic risk analysis (fault trees, event trees, etc.); economic analysis of failure consequences (issues of human safety and long-term economic discounting); and case studies (e.g., space, systems, nuclear power plants, liquefied natural gas terminals, and dams). Emphasis is on risk management issues in the public and private sectors. Prerequisites: 120 or Statistics 116, and Engineering 60, or equivalents.
3 units, Win (Paté-Cornell)

250B. Project Course in Engineering Risk Analysis—(Formerly IE 241.) Students, individually or in groups, choose, define, formulate, and resolve a real risk management problem, preferably from a local firm or institution. Oral presentation and report required. Scope of the project is adapted to the number of students involved. Three phases: risk assessment, communication, and management. Emphasis is on the use of probability for the treatment of uncertainties and sensitivity to problem boundaries. Enrollment limited, consent of instructor. Prerequisite: 250A.
3 units, Spr (Paté-Cornell)

251. Stochastic Decision Models—(Formerly EES&OR 251.) Efficient formulation and computational solution of sequential decision problems under uncertainty. Markov decision chains and stochastic programming. Maximum expected present value and rate of return. Optimality of simple policies: myopic, linear, index, acceptance limit, and (s,S). Optimal stationary and periodic infinite-horizon policies. Applications to investment, options, overbooking, inventory, production, purchasing, selling, quality, repair, sequencing, queues, capacity, transportation. MATLAB is used. Prerequisites: probability, linear programming.
3 units, Win (Veinott)

252. Decision Analysis I—(Formerly EES&OR 252.) Coherent approach to decision making, using the metaphor of developing a structured conversation having desirable properties, and producing actional thought that leads to clarity of action. Instruction is Socratic, with computational issues covered in problem sessions. Emphasis is on creation of distinctions, representation of uncertainty by probability, development of alternatives, specification of preference, and the role of these elements in creating a normative approach to decisions. Evaluates information gathering opportunities in terms of a value measure. Relevance and decision diagrams represent and clarify inference and decision. Principles are applied to decisions in business, technology, law, and medicine. See 352 for continuation.
4 units, Aut (Howard)

254. The Ethical Analyst—(Formerly EES&OR 254.) The professional analyst who uses technical knowledge in support of any individual, organization, or government is ethically responsible for the consequences. Students are sensitized to ethical issues, providing the means to form ethical judgments, questioning the desirability of physical coercion and deception as a means to reach any end. Exploration of human action and relation in society in the light of previous thought, and additional research on the desired form of social interactions. Attitudes toward ethical dilemmas explored by creating an explicit personal code. Issues from the range of human affairs test the student's framework for ethical judgment.
1-4 units, Spr (Howard)

PRODUCTION OPERATIONS, SERVICES, AND MANUFACTURING

260. Analysis of Production and Operating Systems—(Formerly IE 260, undergraduate students register for 160; see 160.)
4 units, Aut (Brandeau)

261. Inventory Control and Production Systems—(Formerly IE 261.) Topics in the planning and control of manufacturing systems. The functions of inventory, determination of order quantities and safety stocks, alternative inventory replenishment systems, item forecasting, production-inventory systems, materials requirements planning (MRP), just-in-time systems, master and operations scheduling, supply chain management, and service operations. Enrollment limited. Prerequisite: 120 or equivalent.
3 units, Win (Hausman)

262. Supply Chain Management—(Formerly IE 262.) Definition of a supply chain, coordination difficulties, pitfalls and opportunities in supply chain management, inventory-service tradeoffs, performance measurement and incentives. Supply chain network design, global supply chain management, the manufacturing/distribution interface, supplier management. Design and redesign of products and processes for supply chain management, tools for design, industrial applications, strategic alliances, current industry initiatives. Enrollment limited to 50 MS&E students. Prerequisite: 260 or 261.
3 units, Spr (Hausman)

264. Manufacturing Systems Design—(Formerly IE 225; undergraduates register for 164.) The concepts and techniques useful in the initial design and redesign of modern, high-performance manufacturing systems. Multidisciplinary approach considers the design of the physical and organizational aspects of manufacturing systems. Emphasis is on the use of simulation as a tool for design evaluation. Prerequisite: graduate standing in engineering.
4 units, Aut (Jucker)

265. Reengineering the Manufacturing Function—(Formerly IE 265.) Preference given to undergraduates. Student teams of four to six redesign the manufacturing and distribution system of a medium-sized manufacturer, focusing on the transportation system, inventory policies for a regional warehouse, design of a national distribution system, operational improvements of work flow, layout of the manufacturing plant, and

redesign of the planning and control system. Redesign is at an operational level consistent with a strategy of integrating the functions of manufacturing and distribution. Modular approach, with each module requiring analytical or game software. Data is provided. Groups meet twice per module with faculty; written report required. Topics: production planning, inventory theory, linear/integer programming, economic analysis, and applied probability. Modules are integrated via the focus on the customer; group learning is emphasized. Enrollment limited. Prerequisite: senior or graduate standing, 160; Engineering 60 and 62.
4 units (Carlson) alternate years, given 2002-03

266. Management of New Product Development—(Formerly IE 266.) Techniques of managing or leading the process of new product development that have been found effective. Emphasis is placed on how much control is desirable and how that control can be exercised in a setting where creativity has traditionally played a larger role than discipline. Topics: design for manufacturability, assessing the market, imposing discipline on the new product development process, selecting the appropriate portfolio of new product development projects, disruptive technology, product development at internet speed, uncertainty in product development, role of experimentation in new product development, creating an effective development organization, and developing products to hit cost targets.
4 units, Win (Carlson)

267. Innovations in Manufacturing—(Formerly IE 226.) Major innovations and trends in manufacturing as they have evolved over time. Emphasis is on understanding why changes occur in addition to what they entail. Topics: changes in the mode of production, performance objectives, sources of inspiration, factory set-up, work organization, arenas of competition, and information technology. Design implications for manufacturing systems.
4 units, Spr (Bailey)

268. Manufacturing Strategy—(Formerly IE 268.) Priority given to Manufacturing Systems Engineering students. The development and implementation of the manufacturing functional strategy. Emphasis is on the integration of manufacturing strategy with the business and corporate strategies of a manufacturing-based firm. Topics: types of manufacturing technologies and their characteristics, quality management, capacity planning and facilities choice, the organization and control of operations, and determining manufacturing's role in corporate strategy. Prerequisites: graduate student; 260 or 261.
3 units, Spr (Carlson)

269. Quality and Operations Management—(Formerly IE 221; undergraduates register for 169.) Quality is a means of survival and a strategic weapon for a firm. Using a case-based methodology, focus is on implementation issues and industrial trends from the strategic, operational, and organizational perspective. Manufacturing and service based industries. Topics: statistical process control, inspection, experimentation, quality philosophies, customer satisfaction, etc.
4 units, Win (Garber)

STRATEGY, ENTREPRENEURSHIP, AND MARKETING

270. Strategy in Technology-Based Companies—(Formerly IE 270.) For graduate students; priority given to IEEM. Introduction to the basic concepts of strategy, with emphasis on high technology firms. Topics: strategic alliances, standards setting, vertical integration, strategic choice, generic and hypercompetitive approaches, organizational capabilities, and complexity/evolutionary perspectives. Enrollment limited.
4 units, Aut (Staff)

271. Global Entrepreneurial Marketing—(Formerly IE 271.) Designed to equip engineers with the marketing skills needed to launch and lead a high-growth, high-tech venture, cultivating the skills needed to market new products to new customers, using new technology in startups and global high tech firms. Case method, working in teams. Students diagnose problems and opportunities; make decisions; analyze customers, competitors, and channels in their own company, and in the economic environments and ethical factors that affect their decisions; and reality test their recommended approach. Each student writes a strategic thinking paper. Prerequisites: 140, and Engineering 60. Recommended: 245.
4 units, Win (Kosnik)

272. Entrepreneurial Finance—(Formerly IE 272.) Primarily for graduate engineering students. Introduction to the concepts in and around the financing of entrepreneurial companies. Focus is on teaching future general managers how to use financial perspective to make better decisions in entrepreneurial settings, including selecting financial partners, evaluating financing vehicles, and financing companies through all growth stages, from startup through initial public offering. Prerequisites: 140, and Engineering 60. Recommended: 245.
3 units, Win (MacKenzie)

273. Technology Venture Formation—(Formerly IE 273.) Open to graduate students interested in high-technology entrepreneurship. Explores in detail the process of starting venture scale high-tech businesses. Coursework includes assessing opportunities, sizing markets, evaluating sales channels, developing R&D and operations plans, raising venture capital, managing legal issues, and building a team. The teaching team includes experienced entrepreneurs, venture capitalists, and distinguished guests. Student teams write a business plan and make a formal presentation to group of first tier venture capitalists. Enrollment limited. Recommended: 140, 270, 271, 272 or equivalent.
4 units, Aut (Lyons, MacLean)

274. Building Dynamic Entrepreneurial Organizations—(Formerly EES&OR 284.) Focus is on the dynamic development of corporate skills, knowledge, and infrastructure to compete in a changing global competitive environment due to rapid technology advancement, global economic development, changes in consumer's preference, and government regulations. Model analysis and case studies are used to develop a methodology in building dynamic entrepreneurial organizations in response to dynamic competitive requirements. Links between EES&OR core and the notion of managing change as a basis for a normative theory on entrepreneurial activities in new business creation and corporate expansion.
3 units, Spr (Tse)

275. Legal Strategy and Analysis—(Formerly EES&OR 281.) The principles of American law and legal reasoning. Topics: civil procedure, criminal law, contracts, consumer protection, international business transactions, intellectual property, torts, product liability, antitrust, corporations and law and finance.
3 units, Win (de Villiers)

276. Managing to IPO and Beyond—(Formerly IE 234; same as Business 352G.) The challenges facing companies from first round financing to IPO (or major liquidity event) and immediately beyond. The operation of the firm, its organization structure, its financial and non-financial systems, and its reward systems, emphasizing the role of support groups (e.g., law firms, PR firms, human resource firms, accounting firms, and stock option consultants) that increase the likelihood of success. These support groups are viewed as partners that help leverage resources; how to work best with these diverse partners. Students work with a startup. Limited enrollment.
4 units, Win, Spr (Foster)

277. Creativity and Innovation in Organization—(Formerly IE 201.) For master's students and undergraduates (seniors only). Individual, group, and organizational perspectives on what sparks and hampers innovation. Lectures, exercises, case discussions, and group projects. Prerequisites: 180, 280, or equivalent.
4 units (Sutton) not given 2001-02

ORGANIZATIONAL BEHAVIOR, MANAGEMENT, AND WORK

278. Startup Globalization Strategies–(Same as Business 354G.) The whether, when, and how issues for new ventures planning and executing global activities that cover all parts of the value chain including R&D, operations, marketing, and customer service. Infrastructure providers supporting global activities (i.e., VCs and consulting firms), exporting of proven business models to other parts of the globe, entry strategies in non-home base markets, managing global marketing for startups, and exit strategies. Cases. Guest speakers. Group project on a company.

4 units, Spr (Foster)

280. Organizational Behavior and Management—(Formerly IE 203.) Organization theory; concepts and functions of management; behavior of the individual, work group, and organization. Emphasis is on case and related discussion. Enrollment limited to 65 graduate students per section; priority given to IEEM majors.

4 units, Spr (Sutton)

281. Management and Organization of Research and Development—(Formerly IE 220.) The organization of R&D in industry and the problems of the technical labor force. Relevant theoretical perspectives from sociology, anthropology, and management theory on the social and pragmatic issues that surround technical innovation and the employment of scientists and engineers. Possible topics: organization of scientific and technical communities, industrialization of research, the nature of scientific and technical work, strategies for fostering innovation, careers of scientists and engineers, and managerial problems characteristic of R&D settings.

4 units, Spr (Barley) alternate years, not given 2002-03

284. Technology and Work—(Formerly IE 223.) Theory and research on the social implications of technology and technological change for workers at all levels. Alternate conceptions of technology as social phenomenon, approaches to the study of technology in the workplace, reactions of individuals and groups to technological change, the construction of a technology's social meaning, and the management of technological change. Emphasis is on automation, electronic data processing, and sophisticated microelectronic technologies, including CAD-CAM systems, telecommunication networks, medical imaging technologies, artificial intelligence, and personal computers.

4 units (Barley) alternate years, given 2002-03

PUBLIC POLICY ANALYSIS

290. Public Policy Analysis—Focus is on national security, health/medical, technology regulation/intellectual property rights, and energy/environment. Each student writes a short policy analysis brief in each of the four areas. Enrollment limited to graduate students in engineering.

3 units, Win (Weyant, Perry, Shachter, de Villiers)

293. Technology in National Security—(Formerly EES&OR 293. Undergraduates register for 193; see 193.)

3 units, Aut (Perry)

298. Technology, Policy, and Management in Newly Industrializing Countries—(Formerly IE 279; same as Science, Technology, and Society 279.) Technology as the key to development and prosperity in most parts of the world. Building technological capability in newly industrializing countries at the national and firm level. Government intervention, the concept of technology leader and technology follower environments, the transfer of technology from "leader" countries, indigenous technological capability, human capital, culture and innovation, the role of small firms and new enterprises in technological capability. Managing innovation in firms: how innovation is different in technology followers, organizing for shop floor innovation, building an innovation culture, the special role of R&D in followers, the role of design, technology strategy for followers. Cases from Korea, India, Brazil, Singapore, and other NICs. Enrollment limited to 50.

2-4 units, Aut (Forbes)

299. Voluntary Social Systems—(Formerly EES&OR 299.) Exploration of ethical theory, feasibility, and desirability of a social order in which coercion by individuals and government is minimized and people pursue ends on a voluntary basis. Topics: efficacy and ethics; use rights for property; contracts and torts; spontaneous order and free markets; crime and punishment based on restitution; guardian-ward theory for dealing with incompetents; the effects of state action-hypothesis of reverse results; applications to help for the needy, armed intervention, victimless crimes, and environmental protection; transition strategies to a voluntary society.

1-3 units, Win (Howard)

PRIMARILY FOR DOCTORAL STUDENTS

GENERAL AND SYSTEMS ANALYSIS METHODS

300. Ph.D. Qualifying Tutorial—(Formerly EES&OR 400.) Restricted to Ph.D. students assigned tutorials as part of the EES&OR and MS&E Ph.D. qualifying process. Enrollment Optional.

1-3 units, Aut, Win, Spr, Sum (Staff)

301. Thesis and Dissertation Research—(Formerly EES&OR 409, IE 301.) Work on dissertation for Ph.D. degree or thesis for Engineer's degree. Limited to students who have been advanced to candidacy for the degree of Ph.D. or Engineer degrees.

1 or more units, Aut, Win, Spr, Sum (Staff)

302. Optimal Dynamic Systems—(Formerly EES&OR 331.) Controllability and observability, stabilizing feedback. Optimal control theory and the Pontryagin maximum principle; problems with inequality constraints, transversality condition, discounting cost, infinite horizon problem; the Hamilton-Jacobi-Bellman equation; stochastic control. Applications: optimal economic growth, control of predator/prey systems, spread of product innovation. Prerequisite: 201.

3 units (Staff) not given 2001-02

OPTIMIZATION

310. Linear Programming—(Formerly EES&OR 318.) Formulation of standard linear programming models. Alternative techniques for solving linear programs. Theory of polyhedral convex sets, linear inequalities, alternative theorems, and duality. Variants of the simplex method, dual simplex method, product form of the inverse. Sensitivity analysis, economic interpretations. Large-scale linear programming, decomposition principle. Prerequisite: Mathematics 113 or consent of instructor.

3 units, Aut (Cottle)

311. Optimization—(Formerly EES&OR 311.) Applications, theory, and algorithms for finite-dimensional linear and nonlinear optimization problems with continuous variables. Elements of convex analysis, first- and second-order optimality conditions, sensitivity and duality. Algorithms for unconstrained optimization, linearly constrained optimization problems (including linear and quadratic programs), and nonlinearly constrained problems. Prerequisites: Mathematics 113, 115.

3 units, Win (Cottle)

312. Optimization Algorithms—(Formerly EES&OR 314.) Review of optimality conditions. Detailed description of algorithms for unconstrained, linearly constrained, and nonlinear constrained problems. Numerical linear algebra techniques required for practical implementations. Convergence, rate of convergence. Impact on the performance of algorithms due to the use of finite-precision arithmetic. Algorithms for large problems. Sparse matrix technology. Use of software. Recommended: 211, 311.

3 units, Aut (Murray)

313. Vector Space Optimization—(Formerly EES&OR 313.) Optimization theory from the unified framework of vector space theory, i.e., treating together problems of mathematical programming, calculus of variations, optimal control, estimation, and other optimization problems. Emphasizes geometric interpretation. Duality theory. Examples. Topics:

vector spaces, including function spaces; Hilbert space and the projection theorem; dual spaces and the separating hyperplane theorem; linear operators and adjoints; optimization of functionals, including theory of necessary conditions in general spaces, and convex optimization theory; constrained optimization, including Fenchel duality theory. Prerequisite: Mathematics 115.

3 units (Luenberger) alternate years, given 2002-03

316. Linear Complementarity—(Formerly EES&OR 316.) Theory of the linear complementarity problem, its applications, and algorithms for its solution. Elements of quadratic programming theory. Pivotal algebra, Schur complements, and matrix classes. Analytic existence theorems. Lemke's algorithm, the principal pivoting method and degeneracy resolution techniques. Indirect algorithms. Prerequisite: 311 or consent of instructor.

3 units (Cottle) not given 2001-02

317. Lattice Programming—(Formerly EES&OR 317.) Comparison of changes in optima and of Nash equilibria of non-cooperative games resulting from changes in parameters without computation. Representation of sublattices and subsemilattices. Subextremal and substarfunctions. Duality. Polynomial-time algorithms. Applications from discrete and dynamic programs, statistical decisions, cooperative games, inventories, transportation, economics, natural resources, marketing, queues, and reliability. Prerequisite: Mathematics 115, optimization theory, probability.

3 units (Veinott) not given 2001-02

PROBABILITY AND STOCHASTIC SYSTEMS

321. Stochastic Systems—(Formerly EES&OR 321.) Topics in stochastic processes, emphasizing applications. Markov chains in discrete and continuous time; Markov processes in general state space; Lyapunov functions; regenerative process theory; renewal theory; martingales, Brownian motion, and diffusion processes. Application to queuing theory, storage theory, reliability, and finance. Prerequisites: 221 or Statistics 217; Mathematics 113 and 115.

3 units, Spr (Weiss)

322. Stochastic Calculus and Control—(Formerly EES&OR 322.) Ito integral, existence and uniqueness of solutions of stochastic differential equations (SDEs), diffusion approximations, numerical solution of SDEs, controlled diffusions and the Hamilton-Jacobi-Bellman equation, statistical inference for SDEs. Applications to finance and queuing theory. Prerequisites: 221 or Statistics 217; Mathematics 113 and 115.

3 units (Glynn) alternate years, given 2002-03

323. Stochastic Simulation—(Formerly EES&OR 332.) Emphasis is on the theoretical foundations of simulation methodology. Generation of uniform and non-uniform random variables. Discrete-event simulation and generalized semi-Markov processes. Output analysis (autoregressive, regenerative, spectral, and stationary times series methods). Variance reduction techniques (antithetic variables, common random numbers, control variables, discrete-time, conversion, importance sampling). Stochastic optimization (likelihood ratio method, perturbation analysis, stochastic approximation). Simulation in a parallel environment.

3 units (Glynn) alternate years, given 2002-03

INFORMATION SCIENCE AND TECHNOLOGY

334. Network Architectures and Performance Engineering—(Same as Electrical Engineering 384S.) Introduction to the modeling and control methodologies used in network performance engineering: Markov chains and stochastic modeling, queuing networks, stochastic simulation, dynamic programming, network optimization algorithms, large-scale distributed computation for networking operations etc. The application of such methodologies to key design issues in high-performance network architectures for IP networking, wireless networks, and optical networks: traffic modeling, congestion control, IP network dynamics, TCP flow control, quality of service support, network admission control and operations management, power control and dynamic bandwidth allocation in wireless networks, wavelength routing and topology design of optical networks, server placement and capacity management, etc. Prerequisites: Electrical Engineering 284, basic understanding of probability.

3 units, Spr (Bambos)

335. Queuing Systems and Networks—(Formerly EES&OR 373.) Advanced stochastic modeling and analysis of systems involving queuing delays. Markovian queues. Stability analysis of the G/G/1 queue. Key results on single and multi-server queues. Approximation methods. Queuing networks. Introduction to controlled queuing systems. Applications to performance modeling, analysis, and evaluation of communication networks, computer systems, flexible manufacturing systems, service systems, etc. Prerequisite: 221 or equivalent.

3 units, Aut (Bambos)

336. Topics in Queuing Networks—(Formerly EES&OR 374.) Advanced efficient control and high-performance design of queuing systems involving job scheduling and resource (server) allocation. Dynamic and stochastic scheduling. Resource allocation in random environments. Real-time scheduling algorithms. Efficient control of queuing networks (routing, admission, flow control, etc.). Performance evaluation of complex queuing structures; identification of performance bottlenecks and techniques for alleviating them. General principles and methodology of high-performance design. Case studies and applications to the design of communication networks, high-speed switching, computer systems, flexible manufacturing systems, service systems, parallel and distributed processing networks, etc. Prerequisite: 335 or equivalent.

3 units (Staff) alternate years, given 2002-03

339. Neuro-Dynamic Programming and Reinforcement Learning—(Formerly EES&OR 319.) Dynamic programming. Value and policy iteration. The curse of dimensionality. Asynchronous distributed computation and real-time dynamic programming. Stochastic approximation and Q-learning. Value function approximation. Temporal-difference learning. Approximate policy iteration. Roll-out algorithms. Neural networks. Applications in game-playing, finance, combinatorial optimization, etc. Recent research topics in NDP/RL. Recommended: one course in optimization and one in stochastic processes.

3 units (Van Roy) not given 2001-02

ECONOMICS, FINANCE, AND INVESTMENT

341. Advanced Economic Analysis—(Formerly EES&OR 341.) Builds on 241 concepts. Market structure and industrial organization (oligopoly, strategic behavior of firms, game theoretic models); economics of uncertainty; general equilibrium theory and economic efficiency (formulation, Walras' Law, existence, uniqueness, duality between efficiency and general equilibrium; trade); intertemporal equilibrium and asset markets; macroeconomic analysis and economic growth (accounting identities, general equilibrium perspective); public goods, externalities. Background for additional advanced economics. Prerequisite: 241.

3 units, Spr (Sweeney)

342. Advanced Investment Science—(Formerly EES&OR 342.) Advanced topics and research in the theory and application of investment concepts. Topics: forwards and futures contracts, continuous and discrete time models of stock price behavior, geometric Brownian motion, Ito's lemma, basic options theory, Black-Scholes equation, advanced options techniques, models and applications of stochastic interest rate processes, and optimal portfolio growth. Computational issues and general theory. Teams work on independent projects that apply the principles. Prerequisite: 242.

3 units, Win (Luenberger)

345. Advanced Topics in Financial Engineering—Advanced modeling of assets for derivative pricing. Pricing and hedging of derivative securities, including exotic options and other structured securities. Risk management and analysis of portfolios with derivative securities. "Greek" analysis and analytic and numerical Value at Risk computation for static and dynamic portfolios. Prerequisites: 242, 220, 221 or permission of the instructor.

3 units, Spr (Primbs)

346. Economic Analysis of Market Organizations—(Formerly EES&OR 346.) For second-year or more advanced graduate students. Applies theories of microeconomics and management science to decision behavior and mechanism design in market organizations, emphasizing asymmetric information structures. Topics: game theory, economics of information, and nonlinear pricing. Applications: priority pricing of congested systems, emission trading of pollutants, design of competitive markets for electric power, competitive product pricing, etc. Prerequisites: basic knowledge of microeconomics, optimization, probability theory, and decision theory. Recommended: familiarity with mathematical modeling and skills in computer programming.

3 units, Aut (Chao)

348. Optimization of Uncertainty and Applications in Finance—(Formerly EES&OR 358.) How to make optimal decisions in the presence of uncertainty, solution techniques for large-scale systems resulting from decision problems under uncertainty, and selected applications in finance. Decision trees, utility, two-stage and multi-stage decision problems, approaches to stochastic programming, model formulation; large-scale systems, Benders and Dantzig-Wolfe decomposition, Monte Carlo sampling and variance reduction techniques, risk management, portfolio optimization, mortgage finance.

3 units, Win (Infanger)

349. Investment Science Frontiers—(Formerly EES&OR 349.) Advanced concepts of investment science with emphasis on theories and methods for solving practical problems: real options theory and practice; valuing and structuring projects, mergers, acquisition and contracts; designing portfolios for optimal growth; and managing risk and enhancing value within a complex business enterprise. Combination lecture, seminar, and project. No auditors. Prerequisites: 242, 342.

3 units, Aut (Luenberger) alternate years, not given 2002-03

DECISION AND RISK ANALYSIS

350. Doctoral Seminar in Risk Analysis—(Formerly IE 340.) Limited to doctoral students. Reading/review of the literature in the fields of engineering risk assessment and management. New methods and topics, emphasizing probabilistic methods and decision analysis. Applications to risk management problems involving the technical, economic, and organizational aspects of engineering system safety. Possible topics: treatment of uncertainties, learning from near misses, and use of expert opinions.

3 units, Spr (Paté-Cornell)

351. Dynamic Programming and Stochastic Control—(Formerly EES&OR 351.) Markov population decision chains in discrete and continuous time. Risk posture. Present value and Cesaro overtaking optimality. Optimal stopping. Successive approximation, policy improvement, and linear programming methods. Team decisions and stochastic programs; quadratic costs and certainty equivalents. Maximum principle. Controlled diffusions. Examples from inventory, overbooking, options, investment, queues, reliability, quality, capacity, transportation. MATLAB. Prerequisites: Mathematics 113, 115; Markov chains; linear programming.

3 units, Spr (Veinott)

352. Decision Analysis II—(Formerly EES&OR 352.) The extension of decision making from a system of thought about decisions to the considerations necessary for aiding other people and organizations in decision making: decision engineering. Topics: how to organize the decision conversation, the role of the decision analysis cycle and the model sequence, assessing the quality of decisions, framing decisions, the decision hierarchy, strategy tables for alternative development, creating decision diagrams that are spare and effective, understanding and overcoming biases in assessment, developing and using evocative and assessed knowledge maps, dealing with uncertainty about probability. Interpretation of various forms of sensitivity analysis, use of approximations, value of revelation, value of joint information, options, flexibility, bidding, assessing and using corporate risk attitude, risk sharing and scaling, and treating decisions involving health and safety. See 353 for continuation of 352. Prerequisite: 252.

4 units, Win (Howard)

353. Decision Analysis III—(Formerly EES&OR 353.) Decision analysis beyond the basic paradigm, emphasizing determining and extending the boundaries of systematic analysis of decisions. Topics: the concept of decision composite; probabilistic insurance and other challenges to the normative approach; the relationship of decision analysis to classical inference and data analysis procedures; the likelihood and exchangeability principles; inference, decision, and experimentation using conjugate distributions; developing a risk attitude based on general properties; examination of alternative decision-aiding practices like analytic hierarchy and fuzzy approaches. Students make presentations on current research. Object is to prepare doctoral students for research and to enable all to understand the discipline at the fundamental levels. Prerequisite: 352.

3 units, Spr (Howard)

355. Influence Diagrams and Probabilistic Networks—(Formerly EES&OR 355.) Network representations for reasoning under uncertainty: influence diagrams, belief networks, and Markov networks. Structuring and assessment of decision problems under uncertainty. Learning from evidence. Conditional independence and requisite information. Node reductions. Belief propagation and revision. Simulation. Linear-quadratic-Gaussian decision models and Kalman filters. Dynamic processes. Bayesian meta-analysis. Prerequisites: 220, 252, or equivalents; or consent of the instructor.

3 units, Win (Shachter)

PRODUCTION OPERATIONS, SERVICES, AND MANUFACTURING

361. Supply Chain Optimization—(Formerly EES&OR 375.) Characterization and computation of optimal and nearly optimal multiperiod supply chain policies with known or uncertain demands using dynamic, lattice, network, and convex and concave programming. Cooperation: sharing benefits of alliances. Competition. Leontief-substitution and network-flow models. Lattice programming: comparison of optima; existence and comparison of equilibria of non-cooperative games. Stochastic comparison. Invariant properties of optimal flows: graphical optimization of supply chains. Optimality of myopic policies. Prerequisites: Mathematics 115, optimization theory, probability.

3 units, Aut (Veinott)

362. Advanced Models in Production and Operations—(Formerly IE 362.) The design and operation of production-inventory systems, production scheduling, capacity planning, plant location, sequencing, assembly-line balancing, multigoal optimizations. Readings primarily from journal articles. Prerequisite: 260.

3 units, Spr (Carlson) alternate years, not given 2002-03

363. Advanced Models in Management Science—(Formerly IE 363.) Primarily for doctoral students. Theoretical treatment of advanced models for procurement, transportation, storage, and distribution problems in production systems. Topics: logistics models for global supply chain management, distribution network design, routing and routing/scheduling models, network models, and logistics management. Prerequisite: 260 or equivalent.

3 units (Ozer) alternate years, given 2002-03

364. Single and Multi-Location Inventory Models—(Formerly IE 364.) Theoretical treatment of control problems arising in inventory management, production, and distribution systems. Periodic and continues review inventory control for single and multi-location systems.

Emphasis is on operating characteristics, performance measures, and optimal operating and control policies. Introduction to dynamic programming and applications in inventory control. Prerequisite: Statistics 217 or equivalent, linear programming.

3 units, Win (Ozer) alternate years, not given 2002-03

367. Advances in Integrated Supply Chain Management—(Formerly IE 367.) The integration and coordination of material, information, and financial flows in a supply chain that spans suppliers, manufacturers, distributors, logistics providers, and customers. Recent advances prepare students for research. Topics: information distortion, postponement, centralized vs. decentralized control, vendor managed inventory, logistic restructuring, incentive issues, manufacturer and retailer interface, replenishment coordination, and value of information.

3 units (Lee) alternate years, given 2002-03

STRATEGY, ENTREPRENEURSHIP, AND MARKETING

374. Creativity and Innovation in Organizations—(Formerly IE 324.) Anthropology, economics, engineering, history, organizational behavior, psychology, and sociology are used to explore the meaning, determinants, and effects of creativity in organizations. Theory and research on individual creativity; creativity as a social process. Focus is on understanding, building, and testing scholarly theory about creativity. Enrollment limited to 12. Prerequisites: doctoral standing; Psychology 212, Sociology 360.

3 units (Sutton) not given 2001-02

375. Legal Strategy and Analysis II—Quantitative analysis of complex litigation; mathematical models of civil liability; finance-theoretic analysis of securities fraud and insider trading; principles of mergers and acquisitions; economic analysis of investment suitability. Prerequisites: 242 or 245G, 275.

3 units, Spr (de Villiers)

376. Strategy and Organization Doctoral Research Seminar—(Formerly IE 326.) Review of current research at the interface between strategy policy and organization theory. Topics: top management teams and strategic decision making processes; strategic boundary issues (e.g., strategic alliances, vertical integration, and diversification); reward structure and board relationships; evolution of strategies, technology, and populations of organizations. Enrollment limited and at the discretion of instructor. Prerequisite: Sociology 360 or equivalent.

3 units, Aut (Eisenhardt)

ORGANIZATIONAL BEHAVIOR, MANAGEMENT, AND WORK

380. Doctoral Research Seminar in Organizations—(Formerly IE 320.) Enrollment limited to Ph.D. students. Topics from current published literature and working papers. Content varies. Prerequisite: consent of instructor.

3 units, Aut (Sutton)

381. Doctoral Research Seminar in Work, Technology, and Organization—(Formerly IE 321.) Enrollment limited to Ph.D. students. Topics from current published literature and working papers. Content varies. Prerequisite: consent of instructor.

3 units (Barley) alternate years, given 2002-03

382. Organizations as Social Networks—(Formerly IE 322.) Social structures can be investigated as social networks. Organizational and inter-organizational structures may be analyzed as patterned relationships among individuals, groups, and other organizations. Such networks appear as predictors of a variety of social dynamics (attitude similarity, the diffusion of innovation, turnover, and the allocation of organizational resources). Methods for collecting and analyzing network data include graph theory, sociometry, clique detection, centrality analysis, blockmodeling, and the quadratic assignment procedure. Readings of recent published research, actual data sets, and relevant computer programs. Prerequisites: one or more courses in anthropology, organizational behavior, political science, psychology, or sociology. Recommended: course in statistics or research methods.

3 units (Barley) not given 2001-02

383. Doctoral Seminar on Ethnographic Research—(Formerly IE 323.) Designed for graduate students; upper-level undergraduates with consent of instructor. Ethnosemantic interviewing and participant observation is emphasized. Techniques for taking, managing, and analyzing field notes and other qualitative data. 15 hours per week outside of class collecting and analyzing own data. Methods texts and ethnographies offer examples of how to analyze and communicate ethnographic data. Prerequisite: consent of instructor.

6 units, Win (Barley) alternate years, not given 2002-03

385. Remote and Distributed Work—(Formerly IE 325.) Focus is on understanding how being remote from the objects on which one works or distributed from one's coworkers can affect productivity, interpersonal relationships, perceptions of work, information sharing, organizational structure, and other factors related to work and work effectiveness. Current research on distributed work and research in related areas that provide a theoretical foundation for understanding the impact of distance on work. Prerequisite: consent of instructor.

3 units (Hinds) not given 2001-02

PROJECT COURSES, SEMINARS, AND WORKSHOPS

401. Cases and Projects in Decision Engineering—(Formerly EES&OR 401.) The development of communication, organization, and modeling skills as they relate to decision making in operations, strategy, and policy. Student teams compete in cases and projects. Emphasis is on problem identification, yield consideration, teamwork, project scheduling, task definition, task allocation, task amalgamation, group behavior, technical writing, public speaking, critique and defense, and the use of software, literature, principals, and experts. Enrollment limited. Prerequisites: three courses in MS&E or equivalent. Corequisites: three more courses in MS&E or equivalent.

4 units (Staff) not given 2001-02

402. Sponsored Projects in Decision Engineering—(Formerly EES&OR 402.) Each student team addresses a project in operations, strategy, or policy as sponsored by a business, medical, or government client. Emphasis is on: team interaction with the sponsor, model construction and analysis, data collection, use of literature and experts, formulation of recommendations, and communication. Enrollment limited. Prerequisites: 401, six courses in MS&E or equivalent, consent of instructor. Corequisites: three more courses in MS&E or equivalent.

4 units (Staff) not given 2001-02

408. Directed Reading and Directed Studies—(Formerly EES&OR 408, IE 291.) Directed study and research on a subject of mutual interest to student and faculty member. Prerequisite: faculty sponsor.

1 or more units, Aut, Win, Spr, Sum (Staff)

411. Topics in Mathematical Programming Seminar—(Formerly EES&OR 457.) Presentations by students and invited speakers. Introduction to techniques for solving structured linear programs. A fundamental problem of the decision sciences is finding an optimal solution when some of the parameters of a planning or design problem (e.g., coefficients and right-hand sides of a linear program) are not known with certainty. Such problems, when converted to deterministic equivalent, were too large to solve in practice. Recent approaches that solve important classes of stochastic programs using decomposition and (importance) sampling techniques.

3 units, Spr (Infanger)

430. Contextual and Organizational Issues in Human-Computer Interaction—(Formerly IE 205; same as Computer Science 247B.) Focus is on the contextual issues associated with designing and using computer interfaces and technology, providing insights into, experience with, and ways of understanding issues in work and consumer settings that influence the design of computer interfaces. Student team projects develop skills in: observing individuals and groups of people in context, using models of work and other activity to extend their design capabilities, identifying constraints and tradeoffs on designs within the context of use, and observing and working with people in interdisciplinary design groups. Enrollment limited. Prerequisite: Computer Science 247A or consent of instructor.

4 units, Spr (Hinds)

444. Investment Practice—(Formerly EES&OR 444.) Projects enhance the student's abilities to formulate and design superior solutions to financial issues in industry and the financial services sector. Short projects illustrate the basic application and implementation of investment principles. Students complete a new project from industry. Enrollment limited to 30 EES&OR students. Prerequisites: 242, 342.

4 units, Spr (R. Luenberger)

446. Transportation, Energy, and Environment Research Roundtable (TEERR)—(Formerly EES&OR 446.) Presentations and discussions of research in progress or contemplated, focused on the interplay of transportation, energy, and environmental economics and policy issues. Students present either their own research or, subject to approval, recent research by others.

1 unit, Aut, Win, Spr (Sweeney)

452. Consulting for Business and Medical Decisions—(Formerly EES&OR 452.) A virtual consulting firm guided and directed by experienced professional consultants. Three-person project teams assist real decision makers facing current business, medical, non-profit, or government decision problems. Teams gain first-hand experience framing and structuring a decision, modeling it quantitatively, performing sensitivity analysis, assessing probabilities and preference trade-offs, determining key values of information and control, refining the decision model, recommending a course of action, and communicating effectively with all decision participants. Teams presentations receive class feedback. Lectures provide professional advice as needed. Previous projects: addressed capital investment, R&D, product development, labor, marketing, competition, and pricing decisions for companies from major industrial corporations to high-technology startups within and outside of the U.S. Medical projects have addressed diagnostic, treatment, and surgical decisions in cancer, gynecology, nephrology, pediatrics, pharmacology, psychiatry, and emergency medicine for physicians and their patients. Prerequisite 252 (or equivalent). Recommended: 352, 456, 458.

4 units, Spr (Holtzman, Robinson)

454. Decision Analysis Seminar—(Formerly EES&OR 454.) Discussion of current research in decision analysis and related topics presented by doctoral students and invited speakers.

1 unit, Aut, Win, Spr (Howard)

455. Intelligent Decision Systems—(Formerly EES&OR 455.) Students design their own intelligent decision system, extending the theory and practice of individual decision analysis to large classes of similar decisions. Economies of scale exploit the similarities among decisions within a class while reflecting each decision maker's unique circumstances and preferences to provide professional-quality decision analysis assistance of several orders of magnitude more quickly, less expensively, and more broadly than is possible with consulting methods. Lectures, examples, and term project. Topics: decision class analysis, relevance diagram formulation, assessment, evaluation, and interpretation; distribution trees; disjoint knowledge maps; preference model automation; expert systems for decision making; and consultation-system design. Other topics reflect student interests, e.g., auction bidding, colon cancer treatment, America's Cup sailing tactics, automobile purchasing, computer network design, Mars exploration, flu prevention and treatment, platoon mission design, custom manufacturing, leasing vs. buying, and oil-and-gas exploration. Prerequisite: 352. Recommended: 452 (concurrent), 458.

4 units, Spr (Holtzman)

456. Decision Making in Organizations—Seminar on how organizations make dynamic, complex, uncertain decisions, and how their decision processes can be improved. Experienced consultants combine lectures, case studies, and "war stories." Student teams critique decisions reported in news articles, review decisions in business school cases, and develop insights about real decisions facing business, medical, nonprofit, or government organizations, receiving class feedback on content and style. Lecture topics: characteristics of good and bad decision making, designing an agreed decision process, the role of decision making at all organizational levels, how decision processes affect reward-and-compensation systems, the use of decision power, distinguishing leadership and management, adapting the decision making process to the needs of different organizations, and anecdotes from the instructors' professional experience. Recommended: 252 (concurrent.)

2 units, Aut (Holtzman, Robinson)

458. Decision Framing and Structuring—(Formerly EES&OR 458.) Seminar on how to ask the right questions to frame and structure complex decision situations, developing the skills to recognize decision traps and practice using the appropriate tools to avoid them, and transforming murky messes into clear and effective decisions. Experienced consultants combine lectures, discussions, and industry examples. Student teams practice techniques for framing and structuring a variety of actual decisions, receiving class feedback on content and style. Lecture topics: decision hierarchies, strategy tables, relevance and decision diagrams, how to guide a creative team process, how to combine insider and outsider perspectives, how to account for organizational forces and surmount organizational barriers, how to determine the appropriate analysis depth, and how to communicate effectively throughout the decision process. Industry case studies compare how decisions are structured in the high-tech, pharmaceutical, medical, energy, transportation, and financial industries. Prerequisite: 252 (or equivalent). Recommended: 352 (concurrent), 456.

2 units, Win (Holtzman, Robinson)

459. Interdisciplinary Seminar on Conflict Resolution—(Formerly EES&OR 489; same as Economics 386, Law 611, Psychology 283.) Addresses problems of conflict resolution and negotiation from an interdisciplinary perspective. Presentations by faculty and scholars from other universities.

1-2 term units, Win, Spr semesters (Alexander, Arrow, Hensler, Ross, Wilson)

464. Global Project Coordination—(Formerly IE 264.) Students engage in projects that are global in nature, and which are related to the planning and design of supply chains and product development. Project teams from Stanford and an overseas university work on common projects using telephones, faxes, emails, internet, video conferencing, face-to-face meetings, etc. As part of the project, students travel to Hong Kong or the Netherlands. Applications due in Autumn Quarter.

3 units, Win (Tabrizi)
Spr (Staff)

472. Industry Thought Leaders Seminar—(Formerly IE 292.) Dialogue with leading entrepreneurs, corporate executives, venture capitalists, and technology leaders from Silicon Valley and around the world. A prominent entrepreneur or other industry thought leader provides cutting-edge ideas and pragmatic lessons, creating a gathering place for Stanford's extended entrepreneurial community. Autumn: strategy for technology companies. Winter: entrepreneurial marketing. Spring: entrepreneurial leadership.

1 unit, Aut, Win (Kosnik)
Spr (Byers)

473. Project Course in Strategy Modeling—(Formerly EES&OR 483.) The design and application of formal models in the study of strategic planning problems. Problems involving issues of technology development, resource management, and uncertainty in a corporate setting. Emphasis is on the integrated utilization of modeling tools drawn from diverse methodologies and the requirements for successful application in a policy making or corporate strategy context. Links between art, theory, and practice are emphasized.

4 units, Spr (Weyant)

478. Seminar: Topics in International Technology Management—(Enroll in Electrical Engineering 402A.)

1 unit, Aut (Dasher)

495. Quantitative Analysis of Public Policy Decisions—(Formerly EES&OR 495.) A current public policy problem is addressed as a single project team, completing the major phases of analysis during the quarter: framing, modeling, data gathering. evaluation, and communication. Instructor coaches the team and provides guidance on gaps in the team's knowledge. Past topics: environmental, health, technology, and transportation issues. Enrollment limited. Prerequisites: 211, 231, 241, 252, or equivalents, or consent of instructor.

3 units, Spr (Borison)

498. Medical Modeling Workshop—(Formerly EES&OR 498.) Discussion of current research in quantitative medical modeling by students, faculty, and invited speakers.

1 unit, (Shachter) not given 2001-02

This file has been excerpted from the *Stanford Bulletin, 2001-02*, pages 170-184. Every effort has been made to ensure accuracy; late changes (after print publication of the bulletin) may have been made here. Contact the editor of the *Stanford Bulletin* via email at arod@stanford.edu with changes, corrections, updates, etc.