Offered by the School of Industrial

Management. See Management course list for faculty.

Econ 265

Microeconomics 3-0-3

The theory of price determination and resource allocation under various market structures. The theory of demand, production, costs, factor and product pricing, income distribution, market failure, implications of government intervention in the market, and comparison of the free enterprise and alternative systems. Students who have received credit for SS 201 may not subsequently receive credit for Econ 265. (formerly SS 205)

Econ 266

Macroeconomics 3-0-3

The theory of national income determination. The determinants of aggregate production, employment and prices, as well as money and banking, business cycles and monetary and fiscal policy. Students who have received credit for SS 201 may not subsequently receive credit for Econ 266. (formerly SS 206)

Econ 360

Managerial Economics 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. The internal and external influences on business enterprises and the methods by which business evaluates and reacts to these influences. Economic models pertaining to demand forecasting, market strategy, pricing, competition, and profit behavior. (formerly SS 301/IM 445)

Econ 421

Commercial Banking 3-0-3

Prerequisite: Fin 320 or Fin 321. The operations of banking institutions, the regulation of banking activities, and the role of commercial banks in the economy, including a general introduction into corporate, real estate, and personal lending. (formerly SS 413)

Econ 460

Contemporary Economic Issues 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. The major problems and policy issues confronting the U.S. economy in the 1990s. Topics include: inflation, unemployment, the dollar in foreign exchange markets, economic growth and productivity, energy and the economy, international trade and investment, urban economic problems, health care, taxation and public expenditures, and national resource policies. (formerly 0S 454)

Econ 463

International Economics 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. The structure and organization of the international economic system. The role and importance of trade in developed and developing countries. The mechanics of trade and an international financial and monetary

system; foreign exchange; the transfer of funds. The role of multinational companies, the World Bank, the International Monetary Fund, the European Economic Community and OPEC. (formerly SS 420)

Econ 465 Mathematical Foundations of Economic Theory 3-0-3

Prerequisites: Econ 360 and either Math 111 or Math 138. Analytic insights into the theories of consumer demand, production, cost functions, and market structure. Mathematical models of constrained optimization and displacement of equilibrium. This course may not be used to satisfy the Hum/SS/STS General University Requirement. (formerly SS 417)

Econ 466

The Economics of Consumption 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. Economic concepts as applied to issues that are involved in consumption and marketing. The special role of consumption in both micro and macro economic theory. The changing structure of the U.S. economy and how it affects consumers, including issues such as anti-trust, technology, and innovation. The unique characteristics of the U.S. market in terms of demographic trends, income distribution, and consumer buying patterns. (formerly SS 401)

Econ 467

Aggregate Economics 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. The factors determining national income, consumption, savings, employment, price level and interest rates in developed countries. Issues of policy analysis and applications and the impact of differing schools of economic thought on policy formulation and implementation. Using appropriate macroeconomic paradigms to address current economic problems. (formerly SS 302)

Econ 511

Economics of Energy 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. The demand for energy, its sources and determinants (elasticity measures); trends in patterns of energy use and future prospects; international aspects. The supply of energy; alternative sources (coal, nuclear, geothermal, solar); economic analysis of shifts among sources; industrial and market structures in the energy production sector; significance for supply elasticities and energy prices. The "energy crisis"-analysis and evaluation. The economics of long-range energy decisions-new sources, conservation, and environmental protection; evaluating costs and benefits; decision model for energy technology assessment; the breeder deferment decision; energy economy interactions; energy sector share of GNP; impact of energy cuts on GNP; alternative economic techniques for reducing energy consumption. (Co-listed as SS 511)

Econ 565

Managerial Economics

Covers managerial decision making in different types of markets. Includes structure of industry, vertical integration, conglomerate firms, multinational firms, theory of contestable markets, entry deterrence, estimating demand and cost functions, price discrimination, agency theory, X-trade, theory of regulation, market signaling and hiring, and theory of share economy. A student who satisfactorily completes Econ 265 and Econ 266 or SS 201 must obtain the approval of the graduate advisor before registering for this course.

Electrical Engineering

Offered by the Department of Electrical and Computer Engineering

Chairperson: Jacob Klapper Associate Chairpersons: Edwin Cohen, Stanley S. Reisman (graduate) Assistant Chairpersons: Peter Engler (graduate), Kenneth Sohn (undergraduate) Sponsored Chairs: William Carr (microelectronics), Walter F. Kosonocky (optoelectronics and solid-state circuits) Distinguished Professors: Bar-Ness, Denno, Friedland, Kosonocky Distinguished Research Professor: Gordon

Director for Computer Engineering: Anthony Robbi

Professors: Ball, Carr, Cohen, Cornely, Klapper, Kuo, Meyer, Reisman, Rosenstark, Sohn, Strano, Thomas, Whitman Associate Professors: Clements, Engler, Frank, Grebel, Hubbi, Lu, Manikopoulos, Niver, Robbi, Sosnowski, Troop Assistant Professors: Akansu, Ansari, Carpinelli, Hou, D. Misra, Pandey, Shi, Siveski, Wang, Zelano, Zhou, Ziavras Visiting Professors: Messer, Panayirci

EE 231

Circuits and Systems | 3-0-3

Prerequisites: CIS 101, Phys 121, Math 112. The basic concepts of electric circuit theory and system analysis. Topics include basic circuit elements, loop and node analysis, network theorems, sinusoidal steady-state analysis, power, resonance, three-phase circuits, mutual inductance, and ideal transformers.

EE 232

Circuits and Systems II 3-0-3 Prerequisite: EE 231. Corequisite: Math 222. A continuation of circuits and systems with special emphasis on transient response. Topics include Laplace transform analysis, transfer functions, convolution, Bode diagrams and Fourier series.

EE 251

Digital Design 3-0-3

Prerequisite: Phys 121. Prerequisite or corequisite: CIS 101. Combinational and sequential circuit design followed by an introduction to register transfer logic and the computer. Topics include Boolean algebra, combinational circuit design, minimization with Karnaugh maps, logical design of adders, comparators, decoders, multiplexers, counters, arithmetic logic units and memories.

EE 271

Electronic Circuits | 3-0-3

Prerequisite: EE 231. Electronic circuits and devices, particularly junction diodes, bipolar transistors and field-effect transistors. Solidstate device physics is studied in sufficient detail to understand the basic models of semiconductor devices for dc, ac and transient analysis.

EE 291

Electrical Engineering Laboratory I 0-3-1 Prerequisite: EE 231. Corequisites: EE 251, EE 232. Laboratory work in the areas covered in EE 231, EE 232 and EE 251. Emphasizes the construction, testing and analysis of both digital and analog circuits. Basic measurement techniques are emphasized throughout. Introduction to the use of PSpice for solving dc, ac and transient problems on the personal computer.

EE 305

Electrical Engineering Principles 3-2-4

Prerequisite: Phys 121. (No credit for EE students.) This course is for non-electrical engineering majors. The course content is similar to that of EE 405 with the addition of a laboratory which includes measurement techniques, ac circuits, electronic circuits and motor performance.

EE 310

Co-op Work Experience | 3 additive credits Prerequisites: completion of the sophomore year, approval of the department, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report.

EE 321

Random Signals and Noise 3-0-3

Prerequisite: EE 232. Corequisite: EE 333. Random processes occurring in electrical engineering. An introduction to probability and random variables is followed by stochastic processes and noise. Topics in-clude auto- and cross-correlation functions, power spectral density, response of linear systems to random signals, and noise figure calculations.

EE 333

Circuits and Systems III 3-0-3

Prerequisites: EE 232, Math 222. A continuation of circuits and systems with special emphasis on discrete systems. Topics include Fourier transforms, discrete and analog filtering, sampling, recursion equations, z-transforms and an introduction to digital filter design and digital signal processing.

EE 341

Energy Conversion 3-0-3 Prerequisite: EE 231. Magnetic materials and their applications are discussed. Included are the design of singly- and multiply-excited

magnetic circuits and transformers, as well as the steady-state performance of dc and ac electromechanical energy converters.

EE 352

Microprocessors 3-0-3

Prerequisite: EE 251. The basic concepts of microprocessors and programmed logic. Microprocessor architectures, microcomalgorithmic processes, puter systems, software development hardware and methods, D-A and A-D conversion methods are among the topics covered. Students receiving degree credit for CIS 453 cannot receive degree credit for EE 352.

EE 361

Electromagnetic Fields | 3-1-3 Prerequisites: EE 231, Math 213, Phys 231. An introductory engineering course in electromagnetic theory. Topics include vector analysis, static fields, time-dependent fields, Maxwell's equations and plane waves.

EE 362

Electromagnetic Fields II 3-0-3

Prerequisite: EE 361. This course covers the circuit aspects of distributed parameter transmission lines and the application of Maxwell's equations to guided waves. Topics include transient and steady-state conditions in lossless and lossy transmission lines, reflection and refraction of plane waves in isotropic media and transmission modes in waveguides.

EE 372

Electronic Circuits II 3-0-3

Prerequisites: EE 232, EE 271. The basic characteristics and circuit applications of operational amplifiers are studied and feedback concepts are introduced. The analysis and design of digital circuits using bipolar and MOS transistors, including TTL, CMOS and other logic circuit families, are also studied. Other topics include timing, memories and logic arrays.

EE 373

Electronic Circuits III 3-0-3

Prerequisites: EE 372, EE 392. Topics include operational amplifier fundamentals, linear op-amp circuits, instrumentation amplifiers, op-amp system design, active filters, feedback theory, stability analysis and compensation of feedback amplifiers, oscillators, and waveform generators.

EE 392

Electrical Engineering Laboratory II 1-2-2 Prerequisite: EE 291. Corequisite: EE 372. A continuation of laboratory work into the areas covered in EE 271 and EE 372. Some of the work involves the student with the design, construction and testing of circuits to meet certain given specifications utilizing their own components.

EE 393

Electrical Engineering Laboratory III 1-2-Prerequisites: EE 352, EE 392. Corequisite EE 373. A continuation of laboratory wor into the areas covered in EE 352 and EE 373 Students design, build and test circuits to meet given specifications utilizing their ow components.

EE 405

Electrical Engineering Principles 3-0-3 Prerequisite: Phys 121. (No credit for EE stu dents.) This course is for non-electrica engineering majors. Topics include basic d and ac circuits, basic electronics, an ir troduction to dc and ac electromechanica energy converters and an introduction t feedback and control theory.

EE 411

Co-op Work Experience II 3 credits Prerequisites: EE 310, approval of the depar ment, and permission of the Division of Co operative Education and Internships Provides major-related work experience a co-op/internship. Mandatory participation i seminars and completion of requirement that include a report and/or project. Ma count as EE or approved elective.

EE 415

Electrical Engineering Project 3-0-3 Prerequisites: EE 373, EE 494. A synthesi and focusing of the student's previous ex perience, in and out of college, upon one of more electrical engineering projects selecte by the student. Library research, design, cos analysis, construction and testing are in volved. Class members become aware of other projects through seminar discussions

EE 416

Independent Study 3-0-3

Prerequisites: senior standing and de partmental approval. This course can b taken by students in lieu of EE 415 or as a EE elective with the approval of the depart ment chairperson. Students work on variou individually selected projects guided by th EE department staff. The project(s) of eac student must be completed and professiona ly presented by assigned due dates for ap propriate review and recording of a complishment. An oral presentation will b made at a meeting of all students and facult advisors involved in the course. A formal wri ten report will be presented to the facult advisor at the end of the course. If the cours is used in lieu of EE 415, the project w consist of library research, design, con analysis, construction and testing.

EE 450

Electromechanical Energy Conversion 3-0-3

Prerequisite: EE 341. Equivalent circuits of induction and synchronous machines are de rived and applied to steady-state and tran sient problems. The theoretical work of th course is supplemented by the demonstra tions using machines having specially de signed information windings.

EE 451

Direct Power Generation 3-0-3

Prerequisite: EE 231 or EE 305 or EE 405; a course in thermodynamics. Principles of direct modes of electrical power generation and their environmental impacts. These methods include electrochemical, nuclear, thermionic and magnetohydrodynamic systems. Emphasis is on performance, system behavior and characteristics of such methods of generation.

EE 452

Computer Application to Power Networks 3-0-3

Prerequisite: EE 232. Corequisite: EE 488. This is a basic course to develop the techniques of computer applications in solving problems encountered most frequently in power system analysis. It is assumed that the student has a general understanding of elementary power system analysis.

EE 453

Power Electronics 3-0-3

Prerequisite: EE 373. Electronic devices and circuits used to energize various apparatus and systems. Topics covered include rectifier circuits, freewheeling diodes, thyristors, firing and commutation of silicon-controlled rectifiers, converters, cycloconverters, dc choppers, inverters, power supplies.

EE 457

Microwave and Integrated Optics 3-0-3 Prerequisite: EE 362. After a brief review of basic field theory and transmission line analysis, the study of rectangular, circular and surface waveguides will be undertaken. A circuit theory for waveguiding systems will be developed and utilized in the study of resonators, filters, and passive microwave devices such as alternators, phase changers, and directional couplers. Techniques used in the study of microwave systems will then be applied to the technology of integrated op-tics. The field of integrated optics is devoted to the development of microscopic optical circuits. Waveguides of integrated optics and optical fibers, the transmission media of op-tical communications are discussed.

EE 462

Semiconductor Circuits 3-0-3

Prerequisite: EE 373. Topics include characteristics of FET and bipolar transistors, low and high frequency analysis of FET and bipolar transistors, feedback in semiconductor circuits, linear integrated circuit (IC) building blocks, the IC operational amplifier, linear IC's for communications, transistor logic gates, and digital IC building blocks.

EE 463

Microelectronic Devices and Circuits 3-0-3

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Prerequisite: EE 372. The basic principles of semiconductor electrical behavior (particularly as applied to the PN junction, the MOS field effect, and optoelectronic phenomena) are studied thoroughly to provide the background for understanding the operation and characteristics of devices and circuits. Among the devices whose characteristics are studied are Schottky barrier and PN junction diodes, solar cells, photoconductive and photovoltaic infrared detectors, bipolar and FET transistors, semiconductor lasers and LED's, and microwave sources. Device characteristics important for circuit design, e.g., dynamic switching, behavior, are emphasized. Fabrication technologies used in the manufacture of optoelectronic devices and systems are also studied.

EE 470

Active Network Design 3-0-3

Prerequisite: EE 373. Topics include use of operational amplifiers and analog integrated circuits in designing second-order active RC low-pass, high-pass, band-pass and notch filters. Included are the basic Sallen-Key and Delyiannis-Friend designs, and the State-Variable and Tow-Thomas universal designs. Active higher-order filters are designed to have Butterworth, Chebyshev, Elliptic or Bessel response. Cascade and ladder realizations of these filters include the use of generalized impedance converters and frequency-dependent negative resistances. Switched-capacitor circuit designs include second-order universal filters, higher-order ladder filters and an introduction to in-strumentation applications.

EE 471

Pulse Techniques 3-0-3

Prerequisite: EE 373. This course deals with the analysis of circuitry for the generation and shaping of waveforms. Fundamental applications are covered, including linear and diode waveshaping, compensated amplifiers, clipping and clamping circuits, switching circuits, signal generators, nonlinear circuit applications and other selected topics.

EE 478

VLSI Semiconductor Circuits 3-0-3

Prerequisite: EE 372. Topics include MOSFETs, their characteristics and use in analog and digital circuit design, static and dynamic circuits; memory cells; differential stages; symbolic layout of NMOS and CMOS circuits; fundamentals of silicon processing technology and associated design rules and methodology; calculation of chip performance including power, speed and area; logic arrays.

EE 480

Simulation of Physiological Systems 3-0-3 Prerequisite: EE 333 or permission of instructor. A course introducing the student to applications of engineering techniques to solu-tions of biological problems. Basic concepts of physiology are presented, followed by a discussion of various modeling techniques applied to specific biological systems. Examples of feedback control systems in biology are presented.

EE 481

Communications Systems 3-0-3

Prerequisites: EE 321, EE 333, EE 373. An introduction to communications systems and modulation theory. The following topics will be discussed: AM and FM systems, including methods of generation and detection, signal spectra and bandwidth requirements; thermal noise, calculation of signal-to-noise ratios and the effect of noise on the communications system analyzed; pulse code modulation systems with consideration given to bandwidth requirements, quantization noise and the effects of transmission errors.

EE 482

Control and Instrumentation Systems 3-0-3

Prerequisites: EE 333, EE 341, EE 352, EE 373. This course builds upon the student's background in mathematics and electrical engineering science to analyze and design feedback control and instrumentation systems. Performance specifications, stability and modeling are emphasized. The computer is used as an essential design and analysis tool.

EE 484

RF/Fiber Optics Systems Elective 3-0-3 Prerequisite: EE 362. Corequisite: EE 457 or permission of instructor. Topics include dielectric waveguides and optical fibers, semiconductor optical sources and detectors; rf/microwave modulation and demodulation of an optical carrier; design concepts in optical transmitters and receivers; and usage of CAD software tools for rf/ microwave simulations.

EE 485

Communications Systems Elective 3-0-3 Prerequisites: EE 481. A continuation of the study of communications systems with selected topics from different areas of communications theory such as sampled-data communications, information theory and noise.

EE 486

Control Systems Elective 3-0-3

Prerequisites: EE 482. A continuation of the study of control systems with selected topics from different areas of control theory such as discrete systems and nonlinear systems analysis and design.

EE 487

Computer Systems Elective 3-0-3

Prerequisites: EE 352, EE 393. A continuation of the study of computer systems as presented in the microprocessor course. Topics covered include general CPU design, ALU design, bit-slice design and microprogramming.

EE 488

Power Systems Elective 3-0-3 Prerequisite: EE 341. Corequisite: EE 482. A continuation of the study of energy conversion and power systems as presented in the energy conversion course. The electrical energy system control problem is discussed including both steady-state and dynamic systems analysis.

EE 489

Medical Instrumentation Systems Elective 3-0-3

Prerequisite: EE 482. A study of some of the interfaces between the medical sciences and engineering. The emphasis is on instrumentation applied to the measurement of low frequency or physiological signals. Transducers and signal processing devices are studied, as well as the problem of detecting, extracting and processing physiological data.

EE 493

RF/Microwave and Fiber Optics Systems Laboratory 0-4-2

Prerequisite: EE 393. Corequisites: EE 484; EE 457 or EE 630. Laboratory work in characterization of rf/microwave transmission structures and optical fibers, sources and detectors, spectral and time domain (OTDR) measurements in microwaves and optics. Experimental investigations of microwave and fiber optic links. Usage of CAD software tools for rf/microwave simulations.

EE 494

Electrical Engineering Laboratory IV 1-2-2 Prerequisites: EE 341, EE 373, EE 393. A continuation of laboratory work into the areas covered in EE 341, EE 352 and EE 373.

EE 495

Communications Systems Laboratory 0-4-2

Prerequisites: EE 393, EE 481. Corequisite: EE 485. Laboratory work in the design and synthesis of communications systems, closely coordinated with the communications systems elective.

EE 496

Control Systems Laboratory 0-4-2

Prerequisites: EE 482, EE 494. Corequisite: EE 486. Laboratory work in the design and synthesis of control systems, closely coordinated with the control systems elective.

EE 497

Computer Systems Laboratory 0-4-2 Prerequisite: EE 494. Corequisite: EE 487. Laboratory work in the design and synthesis of computer systems, closely coordinated with the computer systems elective.

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EE 498

Power Systems Laboratory 0-4-2

Prerequisites: EE 482, EE 494. Corequisite: EE 488. Laboratory work in the design and synthesis of power systems, closely coordinated with the power systems elective.

EE 499

Medical Instrumentation Systems Laboratory 0-4-2

Prerequisites: EE 393, EE 482. Corequisite: EE 489. Laboratory work in the design and synthesis of medical instrumentation systems, closely coordinated with the medical instrumentation systems elective.

EE 530

Electomagnetic Field Analysis 3-0-3

Prerequisite: undergraduate vector analysis or equivalent. The course covers electrostatic fields, magnetostatic fields, Maxwell's equations, the Poynting vector, relationship between circuit theory and Maxwell's equations, some low-frequency and high-frequency applications of the equations, retarded potential type of solutions, wave equations, the plane waves. Not for undergraduate EE or CoE students.

Engineering Graphics

Offered by the Department of Mechanical and Industrial Engineering. See Mechanical Engineering and Industrial Engineering course lists for faculty.

EG 101

Engineering Graphics 1-2-2

Engineering students are introduced to the fundamentals of engineering graphics. Representative topics covered are descriptive geometry, dimensioning, and technical sketching. In addition, students are taught the principles of charts and graphs including graphical calculus. Applications in the various engineering disciplines are studied by means of graphical vectors in force analysis, piping diagrams, electrical circuits and plot plans. Computer graphics, using a CAD software package, is implemented in solving orthographics and applicational engineering problems.

EG 101H

Honors Engineering Graphics 1-2-2

Prerequisite: admission to the Honors Program or permission of the instructor. An honors course parallel to EG 101.

EG 102

Basic Computer Graphics for Engineering 1-2-1

A four-week mini-course that introduces computer graphics in two-dimensional form using a commercial CAD software package applied to descriptive geometry and applicational engineering drawings. It is intended for students who have already completed an engineering graphics course which did not include computer graphics.

Engineering Technology

Offered by the Department of Engineering Technology

Chairperson: Robert English Program Coordinators: William Barnes (computer and electrical), Joshua Greenfeld (surveying), Steve Kotefski (manufacturing), Benedict Sun (mechanical), Harold Tepper (construction and contracting) Professor: English

Associate Professors: Barnes, Kopf, Sun, Tepper

Assistant Professors: Fabiano, Kalley, Kotefski, Koutouras, Miller, Shufelt

(Courses listed in this section are not available for engineering students without special permission of their advisors.)

CONSTRUCTION AND CONTRACTING ENGINEERING TECHNOLOGY

CET 301

Construction Surveying 2-3-3 Prerequisite: basic surveying. Corequisite: CET 317. All aspects of horizontal and vertical control measurements and settings and layouts applied to various construction problems.

CET 313

Construction Procedures I 4-0-4

Corequisite: CET 317. An introduction to heavy construction practices. Emphasis is on construction equipment, site preparation, piles, drilling and blasting, and concrete construction. Case studies in heavy construction are used. Construction safety practices are covered.

CET 314

Construction Procedures II 4-0-4

Prerequisite: CET 313. Corequisite: CET 317. An introduction to building construction practices and building materials. Emphasis is on structural systems, construction materials and detailed finishing operations required to make a serviceable structure. Building code requirements for the above areas are covered.

CET 317

Construction Computing 3-0-3

Prerequisites: CIS 101 or equivalent; basic courses in steel design, fluids/hydraulics, surveying, and soil mechanics; use of a personal computer is also needed. An introduction to construction computing. Programming for construction using a computer language. Application of available software to construction-related computing problems, including: strength of materials, structural analysis, steel design, fluids/hydraulics, surveying, scheduling, and soil mechanics.

CET 322

Hydraulic and Hydrologic Problems in Construction 3-0-3

Prerequisite: applied mathematics. Corequisite: CET 317. A study of fluid flow as it applies to construction problems. Pumping, rainfall runoff, stream flow, pipe flow, hydrostatic pressure systems, scour, and seepage are among the subjects covered.

CET 331

Structural Systems 3-3-4

Prerequisite: strength of materials. Corequisite: CET 317. Study of types and behavior of modern structures using both analytical and intuitive techniques. Examples will include beam and column, one- and two-way slab systems, wood and masonry systems.

CET 411

Cost Estimating and Scheduling 3-0-3 Prerequisites: CET 313, CET 314. Take off of quantities of materials from typical building and highway projects. Pricing for labor, materials, and equipment. A CPM schedule will be developed for the estimated projects. Crew sizes, productivity and manpower leveling are examined. Computerized cost estimating and take off methods are introduced.

CET 415

Building Construction 3-0-3

Prerequisite: CET 314. Planning and control of all operations employed in construction of buildings. Typical buildings will be studied in detail. Preparation of building procedures and cost estimates will be made.

CET 416

Heavy Construction 3-0-3

Prerequisite: surveying and CET 313. Practices unique to heavy construction are studied in detail. Typical structures considered include bridges, tunnels, highways, dams, and utilities.

CET 431

Construction Testing 2-2-3

Prerequisite: CET 331. Exposure to a variety of construction related field tests and field testing equipment. Included will be concrete mix design, concrete testing, soil density and compaction, asphalt tests, load testing of wood and steel, construction noise and vibration control, and field testing and monitoring associated with quality control and worker safety at hazardous waste cleanup sites.

CET 435

Design of Temporary Structures for Construction 3-3-4

Prerequisite: CET 331. Analysis of loadings on, and design of, temporary structures required in construction. Formwork, shoring and scaffolding systems, temporary bridges, trenching, and temporary retaining walls are among the subjects covered. Construction safety associated with temporary structures is stressed.

CET 441

Solls and Earthwork 3-0-3

Prerequisite: strength of materials, CET 317. A study of the significant soil types and tests. Problems are investigated relating to soil mechanics, soil supported foundations for engineering structures. Appropriate field trips are made.

CET 490

Senior Project 3-0-3

Prerequisite: senior standing in construction and contracting engineering technology. The student works on one or more individually selected projects guided by the department staff. The project must be construction related and may include planning, research (library or lab), engineering report, and statistical, analytical, or field investigation. Any of these may follow class-inspired direction, or the students may branch out on their own. The project(s) of each student must be completed and professionally presented by assigned due date for appropriate review and recording of accomplishments. Critiques will be held and students will present their work to other students having similar interests.

CET 497

Co-op Work Experience 3 additive credits Prerequisites: approval of the department, and permission of the Division of Cooperative Education and Internships. Provides majorrelated work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project.

ELECTRICAL ENGINEERING TECHNOLOGY EET 300

Circuit Analysis—Transform Methods 3-0-3

Prerequisites: DC and AC circuit analysis (AAS level). Corequisite: Math 322. The principles, theorems and techniques of circuit analysis are reviewed. The technique of waveform and circuit transforms is introduced. Laplace transforms are studied and applied in the solution of circuit problems with a variety of input functions. Fourier analysis also is introduced.

EET 303

Circuit Measurements 1-3-2

Prerequisite: electronics laboratory experience (AAS level). Lecture and laboratory sessions are designed to develop techniques for the measurement of various circuit parameters as well as the theoretical prediction of these parameters. Computer circuit analysis is introduced.

EET 305

Integrated Circuit Applications 2-2-3

Prerequisites: EET 300, EET 303. A course providing a working knowledge of the characteristics and applications of integrated circuits. Topics include how linear ICs work, the most common circuit configurations in which ICs are used, and how to design the most commonly needed circuits with ICs, using manufacturers' specification sheets.

EET 309

Electric Circuits and Machines 2-2-3

Prerequisites: basic physics; calculus (AAS level) or equivalent. This course is for nonelectrical technology students who have no circuit and machinery background. The course includes a study of electric and magnetic circuits, motors and motor applications, transformers and power distribution in single phase and balanced polyphase systems. Demonstrations of subject matter and laboratory experiments are used to emphasize the basic principles for applying electricity to industrial situations.

EET 310

Introduction to Microprocessors 2-2-3 Prerequisite: course in digital logic circuits (AAS level). An introduction to microprocessors and their applications. The architecture and instruction set of a popular microprocessor are studied in detail. Representative data-handling problems are solved and the solutions tested in the laboratory. Simple interfacing aspects are introduced.

EET 344

Numerical Computing for Engineering Technology 2-0-2

Prerequisite: CIS 105. Corequisite: Math 322. An introduction to the use of a computer to analyze and solve problems common in engineering technology. Students write original programs in the language "C", sometimes integrating existing mathematical routines in their programs. Practical applications as well as mathematics and programming are stressed in assignments.

EET 365

Digital Logic and Circuit Design 3-0-3

Prerequisite: a course in digital logic. Develops the mathematics and minimization techniques together with the circuit implementation for the design of combinational and sequential digital solid-state logic circuits. Elementary computer and control circuits are used as examples. Projects employing computer simulation of digital circuits will be assigned.

EET 395

Co-op Work Experience I 3 additive credits Prerequisites: approval of the department and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report.

EET 406

Control Systems and Transducers 3-3-4 Prerequisite: EET 305. This course is a class

and laboratory study of analog and digital automatic control. Using Laplace transforms, principles of analysis and design of control systems are introduced. Transducer characteristics and their application in instrumentation and control are investigated.

EET 408

Electrical/Computer Technology Project 1-3-3

Prerequisite: EET 305, EET 410. Corequisite: EET 406. In this laboratory course, students will construct and analyze a project of their own choice. The project may be of the small equipment design or measurement system type.

EET 410

Microprocessor Applications 2-2-3 Prerequisites: EET 310 or equivalent and some programming experience. This course covers the operations, breadboarding, and interfacing of devices peripheral to microcomputers. Also, emphasis is placed on the applications of these microcomputers in industrial measurement and control. Advanced topics in the operation of microprocessors and their interface properties with peripheral devices are included. Typical applications are studied.

EET 411

Energy Conversion Devices 3-0-3

Prerequisite: EET 300. A study of various energy conversion devices, including dc and ac equipment which converts mechanical energy to electrical energy and vice versa. Demonstrations will be used to emphasize important aspects of the theory and application of electric machinery.

EET 412

Power Generation and Distribution 3-0-3 Prerequisite: EET 300. Electrical power generation systems, including hydroelectric, steam, and nuclear plants. Substation and transmission line topics will also be included as part of distribution system.

EET 413

Pulse and Digital Circuits 3-0-3

Corequisite: EET 305. Analysis and design of circuits and digital systems for the generation and shaping of waves. Applications include multivibrators, switching and counting circuits, and voltage and current sweeps.

EET 414

Communication Systems 2-2-3

Corequisite: EET 305. A study of amplitude modulation, frequency modulation, and pulse modulation systems of transmission and reception. Applications of these systems in radio, television, and telemetry will be included.

EET 415

Fundamentals of Applied Telecommunications 3-0-3

Prerequisite: EET 414 or equivalent. A course covering the concepts required to understand the design of telecommunications networks and equipment carrying voice, data, video, facsimile, telemetry or a composite of each. Includes local and long distance switching, analog and digital trans-mission, network design and signaling requirements and systems (e.g., CCITT #7 etc.). Open systems interconnection (OSI) and its implications are treated thoroughly. as are LANs, ISDN and Inter-Network protocols (e.g., CSMA, X.25, TCP/IP).

EET 417.

Fiber Optics Technology 2-2-3

Prerequisite: EET 305. Basic physical principles, characteristics and applications of fibers. Topics include preparation, cabling and bundling of fibers; testing of fibers, sources and detectors; fiber optic link components and design of optical links; fiber optic sensors and optical spectroscopy. Classroom demonstrations and student projects will be carried out throughout the course.

EET 495

Co-op Work Experience II 3 additive credits Prerequisites: EET 395 or its equivalent, approval of the department, and permission of the Division of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project.

EET 499A

Special Projects in EET 1.5 credits

Special projects course for EET students with subject matter to be arranged by instructor and approved by the department chairman.

EET 499B

Special Projects in EET 3 credits. See EET 499A.

MANUFACTURING ENGINEERING TECHNOLOGY

MNET 303

Advanced Techniques in CAD/CAM 2-2-3 An applications course including hands-on experience with CAD/CAM systems. Emphasis is on understanding how displayed objects are represented and manipulated on the computer. Laboratory experiences contribute to an understanding of the advantages and limitations of CAD/CAM systems.

MNET 315

Industrial Statistics 2-2-3

Introduction to data collection and analysis and the concepts of probability. Data collection will include the basis of sampling while data analysis will include calculation and interpretation of measures of central tendency and variation, and statistical testing of hypotheses.

MNET 317

Manufacturing Operations Analysis 2-2-3

A course in manufacturing based on the use of the computer to solve manufacturing problems. A variety of topics concerning manufacturing are covered. Hands-on laboratory experience will enable the student to become proficient in computer use.

MNET 318

Manufacturing Process Design 2-2-3

A development of the principles of production, methodology and economics in view of production requirements with respect to materials, tolerances and finish. Production processes are matched to the product requirements. Laboratory work supports the lecture. Computer problem solving is in-corporated in the course.

MNET 395

Co-op Work Experience | 3 additive credits Prerequisites: completion of the sophomore year, approval of the department, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments are facilitated by the Co-op Division. Mandatory participation in seminars and completion of a report.

MNET 405

Numerical Control for Machine Tools 2-2-3 Corequisite: MNET 416. Designed as a first course in numerical control. The course prepares the students in the understanding of the fundamental concepts of numerical control systems and components as well as learning "how to" program. Hands-on ex-perience is gained through assigned projects requiring program preparation, program input via manual, tape, and computer. Program verification is accomplished via use of CNC equipment.

MNET 414 Industrial Cost Analysis 3-0-3

An introduction to general and cost accounting, and project selection on the basis of minimum cost is treated. Cost control techniques are discussed. Problems involving the time value of money are treated.

MNET 416

Production Scheduling 3-0-3

Prerequisite: computer science. A study of manual and computerized methods for setting schedules. Gantt charts, CPM, PERT, PERT/COST, and Line of Balance are some of the topics treated. Problems of line balancing and machine loading are discussed.

MNET 419

Work Measurement Techniques 3-0-3 (Not to be taken by manufacturing technology students.) Work measurement and methods appraisal techniques for industrial

and clerical operations. Charting, micromotion study, stop watch analysis, element analysis, rating and leveling, practice studies of hand and machine operations, work sampling, predetermined times.

MNET 420 Quality Control 2-2-3

Prerequisite: basic statistics. The management of industrial quality control, development and treatment of the operational and statistical principles of acceptance sampling and process control, and problems in control chart operations.

MNET 421

Contracts and Specifications 3-0-3

Legal aspects of construction contracts and specifications; scope, format, and use of various types of specifications such as descriptive, outline, and performance.

MNET 422

Tool Design 2-2-3

Prerequisite: MNET 405. Introduction to the design of cutting tools with emphasis on speeds, feeds, and power requirements. De-sign of jigs, fixtures, punch and dies, gaging and inspection tooling are covered with emphasis on current industrial practices.

MNET 423

Motion and Time Study Techniques 2-2-3 A study of the basic principles of motion study concerning work place design and related techniques involving process analyses, man-machine charts and micromotion study. Stop watch time study techniques covered as well as predetermined time standards, work sampling and wage incentive system.

MNET 424

Facilities Planning 1-2-2

Prerequisites: MNET 318, MNET 423. Operational principles and techniques of plant design. Topics are: plant organization, plant location, layout, materials handling, production planning and control, inspection, methods and standards.

MNET 426

Manufacturing Project 1-3-2

Prerequisite: senior standing. A "capstone" project course requiring a formal written report and oral presentation.

MNET 495

Co-op Work Experience II 3 additive credits Prerequisites: MNET 395 or its equivalent, approval of the department, and permission of the Division of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project.

MNET 499A

Special Projects in MNET 1.5 credits Special projects course for MNET students with subject matter to be arranged by instructor and approved by department chairman.

MNET 499B

Special Projects in MNET 3 credits See MNET 499A.

MECHANICAL ENGINEERING TECHNOLOGY

MET 301

Analysis and Design of Machine Elements | 3-0-3

Prerequisites: elementary strength of materials, calculus (AAS level). Corequisite: CIS 102 or equivalent. The applications of principles of mechanisms and strength of materials are applied to mechanical design. Topics include theories of failure, fatigue, weldments, fasteners, springs and other machine elements subject to static and dynamic loadings.

MET 302

Analysis and Design of Machine Elements II 3-0-3

Prerequisite: MET 301. A continuation of MET 301, including the design of power screws, brakes, clutches, belt and chain drives, gears, gear trains, bearings, thick-wall cylinders, and other machine elements.

MET 303

Applied Thermodynamics 3-0-3

Prerequisite: calculus (AAS level). Core-quisite: CIS 102 or equivalent. The topics discussed in this course are the basic principles of thermodynamics and their applications to internal combustion engines, turbines, compressors, power generating and refrigeration systems.

MET 304

Applied Fluid Mechanics 2-2-3

Prerequisite: calculus (AAS level). Corequisite: CIS 102 or equivalent. An introduction to fluid statics and the basic laws of fluid flow; conservation of mass, momentum and energy. Applications of the basic laws to internal and external incompressible flow, including specific topics in pipe flow systems, centrifugal pumps and fans, streamlining, and fluid flow meters.

MET 307

Plastics Technology 2-2-3

An introduction to the basic concepts of plastics conversion, resin classification, processing techniques, and significant engineering properties.

MET 308

Plastics Processing Techniques 2-2-3

A study of the various commercial plastics procussing techniques for both thermoset and thermoplastic materials. Included are extrusion, injection molding, blow molding, compression molding, and RIM processes.

MET 314

Dynamics of Machinery 3-0-3

Corequisites: Math 309; dynamics or mechanisms or equivalent; CIS 102 or equivalent. Acquaints students with motion and forces in machines. Topics include velocities and accelerations in linkages, gears, cams and other machine systems; static and inertial forces and torques in machines; and critical speeds.

MET 395

Co-op Work Experience I 3 additive credits

Prerequisites: completion of the sophomore year, approval of the department, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report.

MET 404

Applied Heat Transfer 3-0-3 Prerequisites: Math 322, MET 303, MET 304; CIS 102 or equivalent. An introduction to the fundamental theory and applications of heat transfer. Physical understanding and practical problem solving are emphasized in covering the three fundamental modes of heat transfer: conduction, convection and radiation.

MET 407

Structural Design 3-0-3

Prerequisites: CIS 102 or equivalent; elementary strength of materials. Acquaints students with the fundamentals of structural design. Topics include: design and analysis of axial, bending, torsion and shear loading on structural members; deflection of structural members; truss analysis; timber and reinforced concrete beam design.

MET 408

Mechanical Design Project 1-3-3

Prerequisites: MET 302, 303, 304, 314, 415, 416; CIS 102 or equivalent; EET 309. Project and lecture course applies the principles learned in all mechanical engineering technology courses to more advanced design situations. Typical mechanical engineering systems are designed by individual student or by small groups. A formal report is required.

MET 409

Air Conditioning and Refrigeration 3-0-3

Prerequisite: MET 303. Calculation of building cooling and heating loads, psychrometric charts, air distribution and duct design. Topics also include compression and absorption refrigeration cycles and automatic control of refrigeration systems.

MET 410

Electro-Mechanical Equipment 3-0-3

Prerequisite: EET 309. Topics cover the applications of mechanical vibration, electric circuits and heat transfer concepts to the principles of design, selection, and operation of common electro-mechanical devices.

MET 415

Automatic Control Systems 3-0-3

Prerequisites: Math 322; CIS 102 or equivalent. An introduction to the basic concepts of automatic control systems. Topics include process characteristics, closed and open loop responses, frequency response and stability.

MET 416

Mechanical Instrumentation Laboratory 2-2-3

Prerequisites: Eng 342, CIS 102 or equivalent; EET 309, MET 304 or equivalent. A laboratory and lecture course in instrumentation and measurement for mechanical technology students. Basic techniques in measurements of displacement, pressure, temperature, flow, etc., are covered. Formal laboratory reports are required.

MET 426

Mechanical Engineering Technology Laboratory 2-2-3

Prerequisite: MET 416. A laboratory course designed for MET seniors. Provides applied experience on the basic principles and applications selected from the areas of thermodynamics, fluid mechanics, vibrations, refrigeration, heat transfer, stress analysis and numerical control. Formal laboratory reports are required.

MET 439

Applied Mechanical Vibrations 3-0-3 Prerequisites: Math 322, MET 301; CIS 102 or equivalent. An introduction to the fundamental theory of mechanical vibrations. Topics include undamped and damped vibrational systems and vibrations with harmonic forcing functions, magnification factor, transmissibility and vibration isolation.

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MET 450

Mechanical and Electrical Systems 13-3-4 Prerequisite: college physics. This course provides a technical working knowledge of the various systems used in the building construction industry. Such topics as site work; thermal control systems including plumbing, heating, ventilating and air conditioning; electrical power distribution and lighting are discussed in detail. Lectures presented using residential, industrial and commercial applications from industry. Class projects included in the laboratory. Not for MET students.

MET 451

Mechanical and Electrical Systems II 3-0-3 Prerequisite: MET 450. A continuation of MET 450 from a more advanced viewpoint. Specifications will be studied along with mechanical and electrical designs as related to overall architectural studies. These comprehensive designs will require decisions of a more sophisticated nature. Not for MET students.

MET 495

Co-op Work Experience II 3 additive credits Prerequisites: MET 395, approval of the department, and permission of the Division of Cooperative Education and Internships. Fulltime work experience for approximately one semester. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or proiect.

MET 499A

Special Projects in MET 1.5 credits

Special projects course for MET students with subject matter to be arranged by instructor and approved by department chairman.

MET 499B

Special Projects in MET 3 credits See MET 499A.

SURVEYING ENGINEERING TECHNOLOGY

SET 301

Route Surveying (Surveying III) 3-3-4

Prerequisite: Two courses in surveying (AAS level). Horizontal and vertical curves computation and layout with regard to highway design. Special emphasis on complex curves. Topics include control, positioning, error analysis, highway design problems, and layout. Also included is a review of the concepts of right of way surveys.

SET 302

Geodetic Control Surveying (Surveying IV) 3-3-4

Prerequisite: SET 301. A study of the higher order methods and techniques of surveying with observations of 1st, 2nd and 3rd Orders of Accuracy along with the requisite computations to reduce these observations to measurements and the applications of these measurements to the State Plane Coordinate systems and the geoid.

SET 303

Photogrammetry and Aerial Photo Interpretation 3-3-4

Prerequisite: junior standing. A review of the principles of photography, including the physical science of optics as related to the use of aerial photos, to engineering and land surveying projects. Includes the necessary mathematics of photogrammetry and the process of designing and establishing the required data for proper acquisition of photogrammetric information.

SET 304

Adjustment Computations I 4-0-4

Prerequisites: SET 301, Math 305. A course designed to give the student the necessary knowledge to reduce survey observations to measurements; to analyze the data to determine the relationship of adjusted measurements to the observations; to verify that the mathematical constraints have been met; and to introduce approximate and least squares adjustments of surveying observations.

SET 307

Boundaries and Adjacent Properties 3-3-4 Prerequisite: junior standing. A course on legal principles regarding boundaries and the constructive solutions of the problems of boundary surveying by a consideration of deed descriptions and examples of their application to surveying.

SET 401

Fundamentals of Geodesy (Surveying V) 3-0-3

Prerequisite: SET 302. A course in geodesy and its relation to surveying and other disciplines. Topics include geometric, physical and satellite geodesy. Also includes the concept of map projection.

SET 404

Adjustment Computations II 4-0-4

Prerequisite: SET 304. An introduction to the concepts of observations and models. A continuation of the theory of least squares and the mathematical weighting of observations. Also included is the statistical evaluation of least square results.

SET 407

Boundary Line Analysis 3-3-4

Prerequisite: SET 307. A course developing the analytical synthesis of real property law, land surveying procedures, and scenario development compatible with current case law decisions for the development of most probable scenarios of boundary location for the court's consideration.

SET 420

Land Information Systems 3-0-3

Prerequisites: course in CADD, SET 407, or permission of instructor. Topics include the function and design of multipurpose cadastre systems; the components of a digital Geographical/Land Information System (GIS/LIS); overview on design, implementation and evaluation problems of LIS.

SET 435

Land Surveying Field Exercise 0-8-3

Prerequisite: SET 302. A "real world" surveying project is carried out, presented with a descriptive request for a survey, similar to a common work order from a client. The student prepares a survey (work) plan, carries out the survey, completes data processing and submits a final map. The map will have two forms, a hardcopy surveying plate and a database in an LIS format.

SET 490

Senior Project in Surveying 2-0-2

Prerequisite: senior standing. The student works on an individual surveying project guided by the department staff. The project should concentrate on a specific aspect of surveying, not necessarily on field measure-ments. Project includes library research, written report and oral presentation of findings.

English

Offered by the Department of Humanities. See Humanities course list for faculty.

Eng 096-097

English as a Second Language I & II 3 additive credits

These courses offer instruction in the basic skills of English as a second language with emphasis on the writing and, to a lesser extent, the speaking of English. In addition, collateral reading and extensive study of vocabulary are provided. Placement in these courses is determined by performance on standardized composition and reading comprehension tests. Students should take Eng 097 in the semester immediately following Eng 096.

Eng 098-099

Basic Skills Reading and Writing I & II 3 additive credits

These courses deal with the reading and writing skills necessary for success in a college curriculum. Eng 098 emphasizes reading comprehension, vocabulary develop-ment, and written and oral summaries of expository readings. Eng 099 emphasizes clarity of expression, correct syntax, grammar, diction, basic organizational principles, and practice in reading and writing longer, more complex material. Placement in these courses is based on performance on standardized composition and reading tests.

Eng 111

English Composition 3-0-3

Required of all freshmen. The course aims to promote the student's proficiency in English composition through systematic practice and appropriate readings. There will also be practice in oral expression.

Eng 111H

Composition and Literature 3-0-3 Prerequisite: departmental approval. An honors course parallel to Eng 111. The course is designed for students whose skill in writing and interest in literature are greater than those of the average student.

Communicating in Organizations 3-0-3

Prerequisite: Eng 111. The modern organization thrives on clear communication. This course allows students to understand the need for writing in an information-based corporate culture. Students write intensively in a variety of forms for a variety of audiences. Attention is given to editing, graphic design, communications ethics, and desktop publishing. At the conclusion of the course, students prepare a portfolio of their work.

*Eng 238

Advanced Composition 3-0-3

Prerequisites: Eng 111, Hum 112. This advanced course in written and oral communication involves writing assignments in a variety of rhetorical modes. Emphasis is on the writing process and on word processing as a tool for better writing.

*Eng 337

Practical Journalism 1-0-1 See Eng 339.

*Eng 338

Practical Journalism 2-0-2 See Eng 339.

*Eng 339

Practical Journalism 3-0-3

Prerequisite: Eng 111. These variable credit journalism courses include a descriptive and analytic survey of news systems. Assignments include practice in writing straight news items, sports writing, feature writing, science writing, interviewing, and editingwith emphasis on understanding methods. The survey of printed and broadcast news systems includes the influence of technological, economic, legal, ethical, and historical factors.

*Eng 340

Oral Presentations 3-0-3

Prerequisites: Eng 111, Hum 112. This course provides instruction and practice in effective oral presentations. Students will deliver a wide range of presentations adapted to the needs of a variety of audiences. Topics include voice and diction, presentational skills, the effective use of visual aids, reporting technical material, audience analysis, and relaxation techniques.

*Eng 342

Technical Report Writing 3-0-3

Prerequisite: Eng 111. An advanced course in written and oral communication, including instruction and practice in preparing technical reports of various types, in writing business letters, and in speaking before groups on technical subjects. Required by some de-partments. Does not fulfill Hum/SS/STS requirement.

*Students should check their department curriculum requirements before registering for 200-level and 300-level English courses.

Environmental Engineering

Offered by the Department of Civil and Environmental Engineering. See Civil Engineering course list for faculty.

EnE 360

Environmental Engineering 3-0-3

Prerequisites: Chem 115 and junior standing. The object of this course is to train students in the methods used for water pollution control. Topics include the chemical, physical, and biological processes which occur in waste treatment design and in receiving waters; modeling schemes are assigned to determine allowable loadings in various bodies of water, and waste treatment processes used for water pollution control are examined.

EnE 361

Environmental Problems 3-0-3

Prerequisite: Chem 115. The object of this course is to expose students to the area of air pollution control, solid waste disposal, and radioactive waste disposal. Topics include the chemistry of contaminated atmospheres: the influence on meteorological conditions of dispersion of pollutants; abatement processes used in the control of emissions; classification and nature of solid waste, and solid waste disposal techniques; sources and methods for the disposal of radioactive contaminants; and related health effects.

EnE 560

Environmental Chemistry 3-0-3

Prerequisite: Chem 116 or equivalent. Basic physical and chemical principles applicable to environmental and sanitary engineering are presented. The laboratory is used to complement the lectures and illustrate the principles discussed. Laboratory fee.

Finance

Offered by the School of Industrial Management. See Management course list for faculty.

Fin 315

Principles of Financial Management 3-0-3 Prerequisites: Acct 115, Acct 116. The principles and problems of funding the enterprise. Access to capital, means of long- and shortterm financing, instruments of equity and debt, capital budgeting, and analysis of financial statements. (formerly IM 442)

Fin 317

Investment Analysis 3-0-3

Prerequisites: Econ 265 and Econ 266, or SS 201; Acct 317. Introduction to analytical procedures employed in the making of investment decisions involving commitment of funds. Private and government instruments, including common stock, bonds, options, commercial paper, mortgages, federal, state, and municipal obligations. Consideration of these in the context of the needs of cash management by corporation, investment of surplus funds, pension fund administration, and investment portfolios. (formerly IM 484)

Fin 320

Money and Banking 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. Nature and functions of money. The commercial banking system. The Federal Reserve System. Demand for money, its behavior, and relation to income. Monetary and fiscal policy, inflation, international finance. (formerly SS 411)

Fin 321

The Financial System 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. The financial system, especially com-mercial banks and their role in industrial organization in the United States. Bank lending, investments, and trusts operations, financial intermediaries, and the role of the government. The technological changes that have faced the banking industry over the last 30 years. (formerly SS 412)

Fin 322

Public Finance 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. Financial principles and methods of funding that are applicable to public projects. Funding sources, administration of projects and the relationship of governmental agencies in the construction and maintenance of public projects. Case studies in public agency and municipality fiscal planning. (formerly IM 333)

Fin 416

Corporate Finance 3-0-3

Prerequisite: Fin 315. Contemporary advanced corporate finance. The financial services sector, empirical and theoretical procedures under conditions of uncertainty to optimize the sources and uses of funds, capital structure, budgeting decisions.

Fin 417

Advanced Portfolio Analysis 3-0-3 Prerequisite: Fin 317. Advanced comprehensive analysis of the contemporary theory of portfolio analysis and management. Training in advanced portfolio analysis. Financial and economic factors that affect asset price fluctuations, comparison of competing valuation models, evaluation of portfolio and investment performance.

Fin 420

Monetary Theory and Policy 3-0-3 Prerequisite: Fin 320. Historical and conternporary theoretical, empirical, and practical aspects of monetary theory and policy formulation and implementation. The quantity theory of money; classical, neo-classical, Keynesian and monetarist theories of the relationship between monetary and real variables; the portfolio approach to holding money; the neoclassical-Keynesian synthesis of monetary theory; money and the theory of interest rates and the loanable-fund theory of interest; comparison of the roles of monetarism, rational expectations, and Keynesianism in stabilization policy.

Fin 422

International Finance 3-0-3

Prerequisite: Fin 315. Introduction to the international financial management of the firm. The management of assets and liabilities in an international context. Raising of funds in different currencies; capital budgeting internationally; country risk management; management of foreign exchange risk; reasons for foreign direct investment; goals of firms in the international arena; balance of payments accounting; exchange rate determination and evaluation of foreign investments.

Fin 423

Risk Management 3-0-3

Prerequisite: Mgmt 390. The management of risk in the enterprise. The factors that can cause liability to the firm and the methods that can be employed to minimize these costs. Fire, property and liability insurance, workers' compensation, product liability, OSHA, insurance administration. (formerly IM 352)

Fin 424

Financial Simulation Seminar 3-0-3

Prerequisites: Acct 317; HRM 306; Econ 265 and Econ 266, or SS 201. An exercise in financial analysis and control. An enterprise, using a management game, will be simulated on a digital computer to measure the process of growth, requiring the generation of new funds. Students in groups of "management teams" select financial sources and measure administrative effectiveness by use of ratio analysis techniques as profitability and liquidity indicators. Capitalization structures and securities management are seminar subjects. (formerly IM 449)

Fin 428

Seminar in Special Topics in Finance 3-0-3 Prerequisites: Fin 315, Fin 317, and Fin 416. Several topics of corporate, governmental, and international finance will be chosen for intensive study. These topics will vary each semester. Some of the likely topics will be: capital budgeting, financial analysis and forecasting; working capital management, foreign exchange exposure and management; political risk analysis and management; dividend policy, federal reserve and treasury policy, and influence on financial institutions and markets; personal financial planning; bankruptcy or reorganization; pension fund principles and policies; mergers and acquisitions.

Fin 435

Budgeting and Control 3-0-3

Prerequisite: Acct 317. An introduction to budgeting and control in the firm. The course concerns itself with such responsibilities as design and maintenance of accounting records, internal audit systems, budgets, payrolls, profit planning, and cost control. (formerly IM 483)

Fin 516 Principles of Financial Management

The course presents the student with the fundamental objectives of financial management. It is divided into two segments. The first is concerned with investment analysis. Relevant topics include: time value of money, stocks and bond evaluation models, structure of financial markets, market efficiency, statement analysis and portfolio theory. The second section deals with the topics in corporation finance: sources and uses of funds, optimal capital structure, net present value and internal rate of return criteria for project valuation and dividend policy. A student who satisfactorily completes Fin 315 must obtain the approval of the graduate advisor before registering for this course.

History

Offered by the Department of Humanities. See Humanities course list for faculty.

Hist 441

The American Experience 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. American history from the colonies to the 20th century, with concentration on several selected themes basic to an understanding of the changing cultural patterns and social values of American civilization.

Hist 443

Aspects of African-American History 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. The rise of Afro-America, including the relations of West African Kingdoms with Europe in the 15th and 16th centuries, Caribbean and North American slavery, post-Civil War socio-economic and political gains and losses of the freedmen, and the urban dilemmas and political renaissance of the late 20th century.

Hist 445

Communication through the Ages 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. Modes of communication, ancient and modern, in their social and cultural contextfrom cave painting to computers. Topics include literacy and economic development in the West; the technological revolution in media beginning with Daguerre, Samuel Morse, and Alexander Graham Bell; the institutional development of mass media and popular culture; and contemporary trends in world communication and interaction.

Hist 451

Ancient Greece and the Persian Empire 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. The political, institutional, and cultural developments of Ancient Greece and the Persian Empire from the Mycenean period to the King's Peace (386 B.C.).

Hist 452

The Hellenistic States and the Roman **Republic 3-0-3**

Prerequisites: Eng 111, Hum 112, Hum 231. The political and cultural developments of the Hellenistic states and their influence on the Republic of Rome to 30 B.C.

Hist 459

History of the Middle East I 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. The political, cultural, and institutional de-velopments in the Middle East from the Parthians to the capture of Constantinople by the Ottoman Turks. Four periods will be analyzed: the Parthian, the Sassanid Persian, the Caliphate, and the Seljuk and Ottoman Turks.

Hist 460

History of the Middle East II 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. The political, cultural, and institutional developments in the Middle East from the capture of Constantinople by the Ottoman Turks to the impact of the Arab-Israeli conflict on the world today.

Hist 461

The Founding of the American Nation 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. North America in the colonial and revolutionary periods, with emphasis on patterns of cultural and institutional development from early settlement through the ratification of the Constitution.

Hist 463

The United States as a World Power 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. American domestic and foreign policy in the 20th century. Topics include imperialism, the Progressive Era, the Depression, the New Deal, World Wars I and II, the Cold War, America and the world today.

Hist 472

Contemporary Europe 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. European society in the 20th century, Nationalism, imperialism, totalitarianism, movements toward European unity, and prominent cultural developments.

Hist 474

Modern Russian Civilization 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Russia under the last tsars, the 1917 upheavals, rise of the Soviet state to world power under Lenin, Stalin, and others, until the collapse of the communist dictatorship.

Hist 477

Cities in History: From the Ancient to the Industrial City 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231 Urbanization in the Near East, Europe, and Americas from ancient citadels and medieva towns to 18th century Baroque capitals and 19th century industrial cities.

Hist 478

Cities in History: City, Suburb, and Metropolis in the 20th Century 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231 The growth of cities, suburbs, an metropolitan regions in Europe, the Amer cas, and the less developed world, with special attention to the interactions betwee technology and urbanization and to th Newark region.

Hist 482

War and Society 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. The evolution of warfare and the impact of war on political, economic, cultural, and social institutions, including the two World Wars and post-1945 conflicts.

Hist 483

The Making of Modern Thought 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. The formation of contemporary images of man, nature, and society since the mid-19th century. Emphasis on Marx, Darwin, and Freud and their legacy to 20th century thought.

Hist 485

Technology and Society in Western Europe Since the Middle Ages 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. An introduction to the social history of technology in Western Europe from the agricultural revolution of the Middle Ages to the second Industrial Revolution of the late 19th century. Emphasis on such themes as the process of technological innovation, the nature of technological systems, the diffusion of technological improvements, the changing relations of science and technology, and the role of technology in broader historical movements.

Hist 486

Technology in American History 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Survey of the history of American technology emphasizing the social and economic environments of technological change. Topics include the transfer of technology in building canals and cities, the rise of the factory system, the emergence of the American system of manufacture, and the development of major technological systems such as the railroad, telegraph, electric light and power, and automobile production and use. Focus on the professionalization of engineering practice, the industrialization of invention, and the growing links between engineers and corporate capitalism in the 20th century.

Hist 488

Britain in the 20th Century 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. A survey of British history from the death of Queen Victoria to 1964 with emphasis on the social and political transformation resulting from Britain's declining economy and world position. Topics include: the causes and impact of the two World Wars, the transition from liberal democracy to welfare state, the turn from Empire to Europe, social and economic trends as well as foreign relations.

Hist 489

Population and History 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Deals with the interrelation between population, economy, and society in the Western World since 1500. Typical areas considered include the effects of disease, war, and diet on populations and on civilization; the roots of the population explosion; and the impact of demographic and economic change on the daily life of common people.

Hist 490

Historical Problems of the 20th Century Through Film 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. A study of selected problems in the 20th century using film as a "window into history." Such topics as the rise of Nazi Germany, America in the thirties, World War II and American society, the development of cities, and the emergence of the "Third World" will be considered. In any one semester only two topics will be selected for study. The material for the course will include documentary films, newsreels, TV news films, and theatrical feature films as well as selected readings.

Required Courses offered at Rutgers-Newark

American History 512:395 History of Science I 3-0-3 History of science in the U.S. from colonial times.

American History 512:396 History of Science II 3-0-3 History of science in the U.S. to the midtwentieth century.

Humanities

Offered by the Department of Humanities

Chairperson: Karl Schweizer

Associate Chairperson: Charles Krantz Distinguished Professors: Lyngstad Professors: Lynch, O'Connor, Opie, Schweizer Associate Professors: Goldberg, Elliot, Krantz, Lee, McMahon, R. Sher, Steffen-Fluhr, Stiller, Tobias Assistant Professors: Badenhausen,

Donahue, Hilt, Hodge, Katz, Peterson, D. Sher

Special Lecturers: Bodner, Copolla, Fleischer, Gile, Kimmelman, Marshall, Paris Visiting Professor: Heine

A broad understanding of the liberal arts is indispensable to a quality education. For this reason, all undergraduate degree programs at NJIT include courses in the humanities. NJIT's General University Requirements call for all students to take lower division humanities courses (Eng 111, Hum 112, and Hum 231) which provide background for upper division electives. In some cases, students may be required to take introductory courses (Eng 096, Eng 097, Eng 098, Eng 099) before taking Eng 111 and Hum 111; placement is based on the results of tests taken prior to the beginning of the freshman year. Students are urged to review individual program listings in the catalog and consult with their advisors to learn about General University Requirements in the humanities.

Hum 112

Culture and History I: From the Greeks to the Renaissance 3-0-3

view of themselves and their world as seen in the history, literature, arts, and philosophy of past eras, from ancient times through the Renaissance. An interdisciplinary approach.

Hum 112H

Honors Culture and History I: From the Greeks to

the Renaissance 3-0-3

Prerequisites: Eng 111, departmental approval. An honors course parallel to Hum 112.

Hum 231

Culture and History II: From the Reformation to the Present 3-0-3

Prerequisites: Eng 111, Hum 112. People's changing view of themselves and their world as seen in the history, literature, arts, and philosophy of past eras, from the 17th century through the contemporary world. An interdisciplinary approach.

Hum 231H

Honors Culture and History II: From the Reformation to the Present 3-0-3

Prerequisites: Eng 111, Hum 112, departmental approval. An honors course parallel to Hum 231.

Hum 251

Ethical Issues in Business 3-0-3

Prerequisite: Eng 111. An examination of the ethical problems and moral foundations of business from the perspective of moral philosophy. Among the questions explored are: What are the rights of employees and employers in the workplace? Do corporations and managers have an obligation to society at large? What is the relationship between personal and business morality? Is there a moral justification for the free market? This course does not satisfy Hum/SS/STS General University Requirements.

Hum 308

Technology and Global Development: Introduction to STS 3-0-3 See description for STS 308.

Hum 310

Technology and Human Values 3-0-3 See description for STS 310.

Hum 401-402

Independent Studies in Humanities 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. These courses allow students to pursue areas of a special interest in humanities not covered in regular electives. Students will be assigned readings and and write reports under the guidance of a member of the humanities faculty. Students must receive permission of the humanities department before registering for these courses.

Hum 491H-499H

Honors Seminars in the Humanities 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231 and permission of the instructor. The subjects will be announced at the time of registration. Each seminar is limited to 16 students.

Human Resources Management

Offered by the School of Industrial Management. See Management course list for faculty.

HRM 301

Organizational Behavior 3-0-3

Prerequisite: upper division standing. A foundation in theories and research from individual and group behavior. Processes such as perception, motivation, leadership, group dynamics, power, and conflict are examined in relation to behavior in work settings. How to critically read and evaluate behavioral research as well as develop analytic and problem-solving skills regarding organizational behavior problems.

HRM 303

Human Resources Management 3-0-3

Background and operating concepts governing the management of human resources in business, industry, and government. Recruitment, selection, training, motivation, wage and salary administration, employment stabilization, personnel records and re-search, and the management of relations with organized employees. (formerly OS 381)

HRM 304

Industrial Safety Administration 3-0-3

Prerequisites: upper division standing. The planning for and appraisal of safety performance. The fundamentals of accident prevention, job safety analysis, accident investigation, and sources of hazards. Federal and state standards and occupational health and safety legislation. (formerly IM 336)

HRM 305

Supervision and Employee Relations 3-0-3 The nature of supervision, particularly at the first line. Qualifications, duties, and responsibilities of supervisors. Planning the job, making work assignments, progressing, and controlling employees. Techniques of employee relations, such as conducting job instruction, maintaining discipline, appraising performance, and handling grievances. The supervisor's interrelationships with upper management and labor union represen-tatives. The conference method and case study techniques are utilized. (formerly OS 371)

HRM 307

Industrial Psychology 3-0-3

Prerequisite: SS 210 or equivalent. The many applications of psychology to the industrial scene. Industrial environments, personnel psychology, people and machines, special groups in industry, and social interaction and adjustments. (formerly SS 311)

HRM 308

Labor Economics and Industrial Relations 3-0-3

Development of unionism and collective bargaining in the United States. Government regulation of labor-management relations. The labor force, wages and hours, wage

structure, determinants of wages and employment, productivity, unemployment and inflation, equal employment opportunity, and manpower analysis. Public policy with respect to labor market problems. (formerly SS 202)

HRM 402

Administration of Equal Employment **Opportunity Programs 3-0-3**

Prerequisite: Mgmt 390 or HRM 303. Organizational programs and problems in the field of equal employment opportunity and affirmative action. The fundamental laws, regulations, and guiding principles relative to EEO and AA. Management's responsibilities in handling discrimination complaints. The impact of EEO and AA on organizational selection and testing programs. Affirmative action: program planning and development goals, time tables, progress, and evaluation procedures. Case studies and role-playing are utilized. (formerly OS 484)

HRM 405

Organizational Strategies for Productivity Improvement 3-0-3

Prerequisite: Mgmt 390. Productivity: definition and trends. Job analysis and design. Use of selection and assignment profiles. Designing organizations for dynamic productivity improvement. Management by objectives: goal setting, management and employee training, performance appraisal, and project and team organization development. New techniques for measuring and monitoring productivity. Motivational dynamics for productivity, including quality of work pro-grams, human resource assessment centers, and group incentive programs such as the Scanlon Plan. Use of staff specialists such as interaction and change agents. (formerly OS 475)

HRM 406

Wage and Salary Analysis 3-0-3

Prerequisite: Econ 265 and Econ 266, or SS 201. Investigation of the remuneration of groups of workers and study of formulation of policy or decisions which must take into account numerous economic and organizational relationships which are part and parcel of the practical problems of wage and job control. Particular emphasis is placed on job evaluation techniques. The nature of incentives, particularly for jobs in a highly mechanized production operation. Multiple factor incentive plans. (formerly OS 481)

HRM 407

Social Insurance and Employee Benefits 3-0-3

Prerequisites: Econ 265 and Econ 266, or SS 201. The causes of economic insecurity in an urban, industrial society and the personal and social consequences. Social Security, unemployment insurance, workers' compensation, public assistance, and other government programs. Private programs of employee benefits. Analysis of trends in coverage, benefits, and benefit levels, and the impact of demographic, economic, and technological developments on the viability of present and proposed programs. (formerly SS 403)

HRM 410

Group Development and Dynamics 3-0-3 Prerequisite: HRM 301. The study of individual needs in relation to the formation of groups in business and industry. Introduction to interaction analysis and group life. A review of several major behavioral studies upon which the field of group dynamics is founded. An analysis of group process as it is applied in sensitivity training, encounter groups, and action research. (formerly OS 461)

HBM 411

Training and Development 3-0-3

Prerequisite: HRM 303. Analysis of programs of manpower planning and development to strengthen the organization's capability by improving its human resources. Planning employee and management development programs to provide the individual the opportunity for advancement consonant with the requirements of the organization. The process involved in identifying training needs, the design of training programs, simulations and use of evaluation systems for determining the effectiveness of training programs. (formerly OS 482)

HRM 412

Labor-Management Relations 3-0-3

Prerequisite: HRM 303 or HRM 308. Unions, collective bargaining, management prerogatives, the settlement of disputes, and legislative controls. The role of the supervisor in dealing with employees as members of organized groups, particularly with respect to handling employee grievances. (formerly OS 391)

HRM 413

Industrial Relations Policy 3-0-3 Prerequisites: HRM 301 and HRM 303. Government regulation of labor-management relations and company internal labor market policies. How public policy has transformed the relationship between employer and employees. The development of public policy and the roles of legislation, administrative regulation, and court decisions in shaping it Policies in the areas of wages, hours and benefits, training, health and safety, hiring and firing, and equal employment opportunity, the reactions to them, and their effects. Criticism that policy has failed to keep pace with economic and technological changes.

HRM 414

Labor Market Analysis 3-0-3

Prerequisites: Econ 265 and Econ 266, or SS 201; upper division standing. Nature of a free labor market. Concepts and measurements of labor force, participation rate, employment and unemployment. The impact of technolo gy and economic changes on the structure of employment. Women and minorities in the labor market. Structure of labor markets and special problems of urban labor markets Recruitment and development of a labo force by a firm; internal labor markets. Wag structure, sources of wage information, an importance of productivity. Students conduction actual labor market surveys. (formerly S 402)

HRM 415

Contemporary Labor Issues 3-0-3

Prerequisites: Econ 265 and Econ 266, or SS 201; HRM 308. The major problems affecting the relationship of labor with management and the total society. Labor market issues and their impact on the nation's economy; productivity, wages and inflation, unemployment, minimum wages, Social Security, equal employment opportunity, and manpower policy. (formerly OS 453)

HRM 419

Project and Seminar I 3-0-3

Prerequisite: senior standing in the management program with an elective concentration in human resource management. A comprehensive experience with practical problems in industrial relations/human resources. The student must become immersed in one or more of the industrial relations/human resources functions in a public or private organization in areas such as recruitment and placement, equal employment opportunity and affirmative action, labor relations, wage and classification, training, and overall industrial relations/human resources organization and evaluation. Attendance at appropriate seminars required. Student progress evaluated through written reports and/or oral conferences with instructing staff. The student is required to submit a comprehensive report summarizing ac-cumulated experimental data in relation to professional growth. (formerly OS 490)

HRM 420

Project and Seminar II 3-0-3 A continuation of HRM 419. (formerly OS 491)

Industrial Engineering

Offered by the Department of Mechanical and Industrial Engineering

Chairperson: Bernard Koplik

Associate Chairperson: Layek Abdel-Malek Assistant Chairperson: Carl Wolf (graduate) Professors: Abdel-Malek, Wolf Associate Professors: Bladikas, Gage, McDermott Assistant Professors: Bengu, Chao, Das, Nanthavanij, Park

IE 203

Applications of Computer Graphics in Industrial Engineering 1-2-2

Prerequisites: CIS 101, EG 101. A graphics course for industrial engineering students where particular stress is given to those areas of graphical communication which relate to manufacturing and production. This course provides students with a knowledge of graphical standards necessary to meet the requirements of today's industrial engineering practices. Students are introduced to the use of up-to-date software for computeraided graphics, data bases, and spreadsheet analysis.

IE 221

Introduction to Industrial Engineering 3-0-3 Open to second-year students. This course gives a broad and fundamental view of the field of industrial engineering in both its traditional and contemporary aspects. Topics include human factors, engineering economy, motion and time study, operations research, production and inventory control, etc. Applications in both industrial and service environments are also discussed.

IE 224

Production Process Design 2-2-3

Open to second-year students. Introduction to the theory and practice of manufacturing processes. Study covers the fabrication of metallic, plastic, and electrical products, operation of NC and other automatic equipment, and economics of the design and production process.

IE 310

Co-op Work Experience I 3 additive credits Prerequisites: IE 221, IE 224, junior standing, approval of co-op faculty advisor, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the Co-op Division and approved by the co-op faculty advisor. Mandatory participation in seminars and completion of a report.

IE 331

Applied Statistical Methods 3-0-3

Prerequisite: Math 222. A presentation of statistical analysis techniques and their applications. Topics include the statistical measures describing data, frequency distributions, probability distributions, hypothesis testings, regression analyses and analyses of variance. Special emphasis is placed on their application to industrial fields.

IE 334

Engineering Economy and Capital Investment Analysis 3-0-3

Prerequisite: junior standing. Introduction to the principles of engineering economics for utilization and evaluation of capital investments. These include time value of money, depreciation, cost of capital, life cycle cost, net present value, and payback. Decisions involving multiple choice replacement, uncertainty, and risk will be considered.

IE 335

Engineering Cost Analysis and Control 3-0-3

Prerequisite: junior standing. The intent of this course is to provide an understanding of the tools and techniques applicable for cost analysis and control. These include standard costs, variance analysis, cost volume relationships, cost estimation, and utilization of accounting data for control of operations.

IE 339

Work Measurement and Standards 2-2-3

Prerequisites: IE 221, IE 224. This course emphasizes the measurement and evaluation of existing work methods and how improvement can be achieved. Topics include visual and micromotion study techniques, motion economy, time study, and work sampling. The development and use of standard data and computerized techniques will also be covered. The student gains hands-on experience through a series of laboratory experiments.

IE 355

Human Factors 3-0-3

Prerequisite: junior standing. Humanmachine systems analysis including study of workplace layout, measurement of employee efficiency and productivity, criteria for tool and fixture design or selection, industrial fatigue, environmental influences on performance including the effects of illumination, noise, vibration, thermal, and other atmospheric factors. Basic ideas of industrial hygiene; the impact of OSHA; and special techniques for experimenting with human subjects, via demonstrations and supervised experiments.

IE 411

Co-op Work Experience II 3 credits

Prerequisites: IE 310, approval of co-op faculty advisor, and permission of the Division of Cooperative Education and Internships. Fulltime work experience of approximately one semester's duration. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and an oral presentation to IE faculty.

IE 436

Cost Analysis and Engineering Economics 3-0-3

Prerequisite: junior or senior standing. Not open to industrial engineering students. A course focusing on the economic factors which are of concern to manufacturing engineers. Major topics include justification of proposed capital expenditures, equipment retirement and replacement decisions, cost determination, profitability studies, and manufacturing budget construction and utilization for cost control.

IE 439

Deterministic Models in Industrial Engineering 3-0-3

Prerequisite: Math 337. Topics include the applications of linear, nonlinear, integer, and dynamic programming methods and network flows analysis to solve industrial engineering problems.

IE 440

Probabilistic Models in Industrial Engineering 3-0-3

Prerequisites: IE 331, Math 337. Topics include the applications of Markov chains, queueing and inventory control models to analyze and evaluate industrial systems performance.

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IE 441 Information and Knowledge Engineering Systems 3-0-3

Prerequisite: junior or senior standing. Introduction to recent advances in the application of computers in industrial engineering. Description of methods for organizing data, database modeling, information storage and retrieval. Applications of intelligent systems' concepts and techniques; representation and interpretation of knowledge on a computer; relevant search strategies and control.

IE 443

Senior Project | 2-2-3

Prerequisite: senior standing. Introduction to senior design project. Selection of specific system design for the project, establishment of initial contacts, preliminary collection and analysis of system data. Concepts of system design analysis emphasizing simulation modeling and analysis, model verification, and model validation.

IE 444

Senior Project II 1-4-3

Prerequisite: IE 443. Senior design project course where the concepts of industrial engineering systems, principles, and procedures are integrated and applied in industrial projects or case studies.

IE 445

Industrial Simulation 3-0-3

Prerequisites: CIS 101, IE 331 or equivalent. This course introduces the application of simulation modeling for the analysis of complex industrial and manufacturing systems, using case examples in warehousing, material handling, etc. Continuous systems simulation applications will be illustrated. Applications of combined discrete-continuous simulation modeling will also be discussed.

IE 447

Legal Aspects of Engineering 3-0-3

Prerequisite: junior or senior standing. Familiarizes the student with laws and regulations applicable to professional relationships involving the engineer. Coverage includes contracts, governmental regulatory bodies such as OSHA, EPA and NRC, professional liability, and role of codes and standards. Both common and statutory laws applicable to professional relationships between the engineer and other parties are studied.

IE 449

Industrial Robotics 2-2-3

Prerequisites: CIS 101, Phys 121, junior or senior standing. A course designed to provide students with a knowledge of robotics in manufacturing systems. The field of robotics is studied with emphasis given to the role of programmable robots in manufacturing. Through laboratory experience students become familiar with hardware and software necessary for various industrial robot systems.

IE 450

Product Engineering Standards 3-0-3 Prerequisite: senior standing. A course designed to aid the engineer in developing and using standards in the design, manufacturing, and use of products. Topics included are economics of parts standardization, drawing and assembly techniques, and use of national and international standards. The role of standards-setting bodies and methods for the development of product testing standards used in industry and commerce will be reviewed.

IE 451

Industrial Measuring Systems 3-0-3

Prerequisite: IE 331. The course reviews contemporary measuring systems and provides a basic understanding of the various methods, their accuracy, reliability, and relative costs to perform. It includes measuring methods needed for compliance evaluation in accordance with occupational and safety legislation, industrial processes, and product design.

IE 453

Computer Integrated Manufacturing 2-2-3 Prerequisite: junior or senior standing. The components of computer integrated manufacturing (CIM) including the design of information frameworks and network protocols required to orchestrate full manufacturing automation are examined, first individually, then as a single macro system. Process planning, MC programming, CAD/ CAM interfacing, and database systems are studied in the context of a CIM environment. Exposure to state-of-the-art CIM software and hardware is provided.

IE 456

Introduction to Industrial Hygiene 3-0-3 Prerequisite: IE 355. Analysis of the effects of various environmental stressors on people at work, including their interference with performance and the development of acute and chronic health problems. Study of how numerous airborne contaminants, noise, thermal extremes, ionizing and nonionizing radiation, etc., affect workers alone and in combination. Topics include: measurement and evaluation techniques, TLV's, control methodologies, legal requirements for employers.

IE 459

Production Planning and Control 3-0-3

Prerequisites: IE 221, junior or senior standing. A study of the components and functioning of integrated production, planning, and control systems. Consideration is given to material, equipment, and manpower requirements for optimizing continuous and intermittent manufacturing operations. The use of a computer to simulate such models is introduced.

IE 460

Measuring Techniques and Quality Control 3-0-3

Prerequisite: basic probability. Not open to industrial engineering students. This course discusses various types of control charts and acceptance sampling systems and procedures. These techniques are widely used in industry to improve product quality and reduce costs. The effective use of these techniques depends on their being understood by engineers, production and inspection supervisors, and management.

IE 461

Product Quality Assurance 3-0-3 Prerequisite: IE 331. Methods used to achieve higher product quality, to prevent defects, to locate chronic sources of trouble,

achieve higher product quality, to prevent defects, to locate chronic sources of trouble, to measure process capability, and to use inspection data to regulate manufacturing processes are emphasized. Preparation of statistical control charts and selection of suitable sampling plans are also discussed.

IE 466

Materials Handling and Facilities Layout 3-0-3

Prerequisite: IE 439. Analysis of organized human activities typified by industrial and office operations. Modern methods are applied to location and layout of facilities so that they may be utilized in a healthful and effective manner. Logistics of motion of people and materials, flow analysis, plant layout, and material handling techniques are included.

IE 469

Reliability in Engineering Systems 3-0-3 Prerequisites: IE 331 or equivalent, senior standing. This course provides an understanding of reliability in engineering systems. It emphasizes the determination of systems reliability from a knowledge of characteristics and reliability of individual system components. Topics covered include: reliability concepts, failure rates, systems analysis, optimization, maintenance, etc. Techniques for the formulation and evaluation of reliability models are also discussed.

IE 472

Product Liability Engineering 3-0-3

Prerequisite: junior or senior standing. A presentation of the techniques available to the engineer to minimize the hazards of design and manufacturing which result in product liability cases. The effect of legal precedents on design, manufacturing, advertising, marketing, and using a product are discussed within developing technical disciplines such as: reliability prediction and analysis methods, assuring the quality of manufactured products, loss control systems, safety engineering precepts, human factors principles and design review. A review of government regulations for safety and protection is included.

IE 473

Safety Engineering 3-0-3

Prerequisite: junior or senior standing. The principles and practices of safety engineering in product and facilities design. Among the topics treated are safe practices and hazard control, safety standards and codes, inspection procedures, the role of insurance, governmental regulations, and safety statistics. The student will participate in current safety engineering research studies. The Occupational Safety and Health Act and related legislation will be examined.

IE 480

Special Studies in Industrial Engineering for Non-Majors 3-0-3

Prerequisite: permission of the IE faculty advisor. Not open to industrial engineering students. This course is intended to provide individual investigations under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering problems. Students will explore in depth an area in which they have an interest and will report in a seminar setting, including the submission of a written project report.

IE 481

Investigations in Industrial Engineering I 3-0-3

Prerequisites: junior or senior standing, permission of the IE faculty advisor. Individual investigation under faculty guidance through consultation, readings, and visits with recognized authorities and institutions, dealing with specialized industrial engineering design problems. Students will explore in depth an area in which they have an interest and will report in a seminar setting, including the submission of a written project report.

IE 482

Investigations in Industrial Engineering II 3-0-3

Prerequisites: IE 481, permission of the IE faculty advisor. Further individual investigations, a continuation of IE 481.

IE 492

Engineering Management 3-0-3

Prerequisite: junior or senior standing. An introductory course for engineering students seeking to learn the fundamentals of engineering economics and gain an understanding of the management process for engineering and development. Major topics covered include capital investment justification methods, project organization, scheduling and control techniques, legal, quality and staffing issues.

IE 501

Fundamentals of Industrial Engineering 3-0-3

Prerequisite: senior standing. Not open to industrial engineering students. Basic concepts of industrial engineering for students who want to build necessary background for pursuing a graduate degree in industrial engineering. Topics covered include: different manufacturing processes, work methods and measurement concepts, basics of human factors, quality control, facilities design, production planning, operations research tools, and simulation models.

Information Systems Management

Offered by the School of Industrial Management. See Management course list for faculty.

MIS 246

Microcomputer Applications for Managers 3-0-3

Prerequisite: CIS 103 or CIS 113. The course is intended to give management students an understanding of what a computer is and how it works, and basic competence in the use of microcomputers. The course explores the use of microcomputers as tools to organize information, increase productivity, analyze problems, and support management decisions. Standard systems software and applications software packages are studied. Hands-on experience in using the microcomputer is emphasized.

MIS 345

Management of Information Systems 3-0-3 Prerequisites: CIS 113 and MIS 246. Training managers or entrepreneurs to use and manage information systems. The evolution of the computer as a management information tool and a demonstration of how this tool can be used to improve both the effectiveness and efficiency of managers.

MIS 350

Computerized Management Control 3-0-3 Prerequisite: MIS 246. A treatment of the managerial functions of planning, operating and control in which the computer is used as an information source and an operating device. Applications to order processing, warehousing, machine and process control, forecasting, scheduling, and management reporting. Special problems in manpower scheduling using PERT and CPM techniques. (formerly IM 339)

MIS 390

Requirements Analysis and Systems Design 3-0-3

Prerequisite: CIS 350. The design and evaluation of the human-computer interface in interactive computer systems. Approaches to interface design such as menus, commands, direct manipulation; screen layout strategies; metaphor models; models of human information processes; evaluation approaches such as protocol analysis, interactive monitoring, use of surveys; and requirements for documentation and help. The student will be expected to design interface mockups and evaluate them. (cross-listed CIS 390)

MIS 450

Seminar on MIS Application 3-0-3

Prerequisites: MIS 246 and MIS 345. MIS applications in many disciplines. How MIS fits in throughout the organization. The various management disciplines and the application of MIS within each of them, including finance, human resources, marketing and operations. Current issues in MIS. Case studies will be used to reinforce key concepts.

MIS 545

Management Information Systems

This course covers the tools and techniques of management information systems and how they can be used to improve the quality of management decisions. It introduces computer-based solutions to management problems in office automation, budgeting, communications, and decision support. It provides an in-depth introduction to the major features of the hardware and software components of a computer system. It explores the major issues at each stage in the design of a system. Various technical tools ranging from flowcharts and decision tables to automated design are discussed. A student who satisfactorily completes MIS 345 must obtain the approval of the graduate advisor before registering for this course.

Literature

Offered by the Department of Humanities. See Humanities course list for faculty.

Lit 442

Fiction: Themes, Techniques, Traditions 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Readings in the short story and the novel from different countries and eras; study of representative themes and styles; discussion of significant ideas, narrative methods, and socio-cultural attitudes.

Lit 444

Approaches to Poetry 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. An exploration of the properties, devices, and techniques of the art of poetry—sound, rhythm, meter; diction and tone; connotation, metaphor, symbol—as a means of demystifying the reading of poems. Familiarization with the contemporary English and American lyric prior to study of the less accessible poems of earlier centuries. Discussion of the place and purpose of poetry in a technological society.

LIT 449

The Bible as Literature 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Selections from the Bible, emphasizing the literary and historical characteristics of the Old and New Testaments. Several narratives from the Apocrypha are included to introduce students to non-canonical biblical literature.

Lit 451

Greek and Roman Classics in Translation 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Masterpieces of classical literature: the epics of Homer and Virgil; Greek comedy and tragedy; selections from the philosophical work of Plato and Lucretius; some Greek and Roman lyric poems, and examples of Roman satire. These works are studied primarily as literary masterpieces in their own right, but some account is given of their historical setting and of their influence upon subsequent literature.

Lit 453

20th Century American Literature to 1950 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Maturing America's struggle to find itself is surveyed through representations of regionalism, the turmoil of cities, and our new awareness of Europe. The course presents the prose, poetry, and drama of the period through such writers as James, Adams, London, Dreiser, Lewis, Dos Passos, Stein, Hemingway, Faulkner, Frost, Eliot, and O'Neill.

Lit 455

20th Century European Fiction 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Study of novels by such writers as Albert Camus, Max Frisch, Günter Grass, Milan Kundera, Pär Lagerkvist, and Christa Wolf. Themes range from war and occupation, revolution, Fascism, and Communism to individual liberation and self-discovery, existentialism, absurdism, and feminism.

Lit 456

Modern Continental and British Drama 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. An examination of some of the dramas from the late 19th and 20th centuries with the purpose of gaining some understanding of how dramatists, in both subject matter and technique, reflect the spirit of the times. Representative playwrights include Ibsen, Shaw, Wilde, Strindberg, Synge, Chekhov, O'Casey, Pirandello, Anouilh, Brecht, lonesco, and Pinter.

Lit 457

American Literature Since 1950 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Fiction, drama, and poetry of the outstanding post-war writers, with emphasis on long and short fiction. In drama, Williams, Miller, Albee; in poetry, Ginsberg, Dickey, Ferlinghetti, Bly, and others; in fiction, Bellow, Mailer, Malamud, Kesey, Cheever, and Vonnegut.

Lit 459

20th Century American Drama 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. An examination of the development of 20th century American drama with emphasis upon the ways, often experimental, in which the playwrights reflect the spirit of the times. A brief survey of American musical theater will be included.

Lit 460

Non-Western Drama 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Students pursue areas of interest in classical and contemporary world drama not ad-dressed in other electives. Topics include Chinese drama, Japanese drama, Indian drama, Arabic drama and African drama.

Lit 461

Contemporary Ethnic and Minority Drama in America 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Students pursue areas of special interest in American dramatic literature not addressed in other electives. Topics include Hispanic, Asian-American, Native American, African-American, Jewish and other minority drama written and produced in the United States since 1900.

Lit 462

The Russian Novel and Short Story 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. Russian fiction of the 19th and 20th centuries. The material studied will be approached as artistic visions of the human condition, and as documents of Russian social and intellectual history.

Lit 464

Modern Satire 3-0-3

Prerequisites: Eng. 111, Hum 112, Hum 231. Social and political satire of the 20th century. Readings in a variety of satirical styles by such authors as Joseph Heller, Hunter Thompson, Evelyn Waugh and Nathaniel West.

Lit 465

Modern American Non-Fiction 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Literary quality non-fiction from the 1920's to the present. Selections emphasize magazine journalism and "the non-fiction novel," including such authors as Truman Capote, Ernest Hemingway, H.L. Mencken and Tom Wolfe.

Lit 466

The Psychological Novel 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. A study of selected novels exploring the dynamics of the human psyche. The fictional works examined are supplemented by readings of psychoanalytic texts, used partly as a basis for discussion of the literature, partly as an analytic complement to the intuitive insights offered by the fiction.

l it 467

Literary Utopias and Anti-Utopias 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Utopian thought from classical antiquity to the present; the utopian literary tradition, with emphasis on representative works of fiction from the 19th and 20th centuries; landmarks of dystopian or anti-utopian literature.

Lit 469

Historical Literature 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Many novels and plays have been based on actual incidents and historical personalities. This course examines a number of such works. The original historical material will be compared with the literary work it inspired, providing insights into the nature of the creative process and the contrasting purposes of the historian and the creative writer.

Lit 475

The Plays of William Shakespeare 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Selected histories, comedies, and tragedies, with special attention to how the plays work in performance. Varieties of interpretation illustrated through analysis of texts and of film and stage productions.

1 it 480

The Philosophy of Language: Patterns 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Examination of formation, tradition, and change in some typical patterns drawn from English, including American English, with the most noted speculations upon the ways of the human mind that these patterns reflect. Consideration of the relations between language and religion, science, and literature.

Lit 484

Literature and Film 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Examines the types of prose narrative, includ-ing journalistic accounts, novels, short stories, and audio-visual media, such as film and videotape, with emphasis on the different forms and modes used for presenting significant ideas and cultural attitudes.

Lit 490

Science Fiction 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Selected readings in modern and nearmodern science fiction short stories, novels, and criticism. Discussions will focus on both the special nature of science fiction as a literary genre and its function as prophetic extrapolation and social criticism. Whenever possible, discussion will be supplemented by required viewing of appropriate science fiction films.

Lit 492

Spy Fiction, Intelligence and the Cold War 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. Spying and intelligence as depicted in recent history and in popular fiction. Interdisciplinary reading from novelists with hands-on experience in the trade, such as Graham Greene and John le Carré, and by or about modern practitioners such as Whittaker Chambers, Kim Philby and James Jesus Angleton.

Management

Offered by the School of Industrial Management

Dean: Alok Chakrabarti

Assistant Dean: Barbara Tedesco Sponsored Chair: Alok Chakrabarti Distinguished Professors: Chakrabarti, Helfoott

Professors: Hawk, Mills, Rotter, Schachter, Stochaj, Turoff

Associate Professors: Bonitsis, Goldberg, Kahng, Malindretos, Simms

Assistant Professors: T. Chang, Cordero, Datta-Gupta, Lemel, Somers, Spasovic Special Lecturers: Albright, Bagley,

Bocchino, Pulhamus, Slowinski, Worrell Adjunct Professor: Himelstein

Visiting Professor: Bagchi

Research Assistant Professor: Anyanwu Director of Graduate Programs: Malcolm Worrell

Director of Undergraduate Programs: Aaron Pulhamus

Mgmt 190

Industrial Organization and Management 3-0-3

Not available to engineering or technology students. Introduction to business enterprise, including organization structure, basis of authority and responsibility, financial systems, marketing, and the interaction of government and business. The interrelationships of the broad economic, political, psychological, and social influences upon business. (formerly OS 171)

Mgmt 216 Business Statistics 3-0-3

Prerequisite: Math 105. Introduction to business data analysis for application in management decision-making processes. Productivity measures, employment trends, national income data, and consumer price changes. Methods for collection of business and economic data, presentation of data and computer applications, index numbers, historical analysis trend projections, survey sampling, and planning for business research. (formerly IM 305)

Mgmt 290

Legal Environment of Business 3-0-3

The basic principles of common and statutory law applicable to business and professional relationships, emphasizing contracts, negotiable instruments, sales of goods, agency and business organizations. (formerly IE 446)

Mgmt 310

Co-op Work Experience I 3 additive credits. Prerequisites: completion of the sophomore year, approval of the school, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report. (formerly OS 310)

Mgmt 390

Principles of Management 3-0-3

Prerequisite: upper division standing. The broad basic principles of the managerial process that are fundamental to the successful operation of various types of enterprises. Emphasizes the role of management at all levels of responsibility. Organization, motivation and morale; scientific management and human relations; the functions of planning, directing, and controlling. A rational synthesis of research and concepts which together constitute the subject matter of management. (formerly OS 471/ 472)

Mgmt 390H

Honors Principles of Management 3-0-3 Prerequisites: admission to the Honors Program or permission of the instructor.

Mgmt 410

Co-op Work Experience 3 credits Prerequisite: Mgmt 310 or equivalent, approval of the school, and permission of the Division of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminar and completion of requirements that include a report and/or project. (formerly OS 410)

Mgmt 479

Management Issues in Public Policy 3-0-3 Prerequisites: Econ 265 and Econ 266, or SS 201; in addition, one of the following: HRM 308, SS 210, SS 221, SS 231. A survey of key social and political issues within a public policy perspective. Topics covered include policy problems with an emphasis on economics, urban and regional planning, sociology-psychology, natural science or engineering, and political science. (formerly SS 338)

Mgmt 491

International Business 3-0-3

A basic understanding of the activities in international business providing a framework for understanding them from the perspective of a company manager. Subject matter covers the following topics: international trade, multinational enterprises, foreign exchange, foreign direct investment, international financial institutions, barriers to international frade, accounting of taxation, industrial relations, multinational enterprise and world order.

Mgmt 492

Business Policy 3-0-3

Prerequisite: senior standing. A capstone course in the area of business administration focusing on the integration of concepts taught in various functional courses such as marketing, finance, operations management, acounting, organizational behavior. Issues related to corporate responsibilities and ethical behavior are also incorporated in this course. Emphasis on application of concepts to real life situation is achieved through case discussion and projects.

Mgmt 493 Hospital Administration 3-0-3

Prerequisite: upper division standing. The course is designed to acquaint students with hospital administration related to the regional area from which the modern hospital's patients are drawn; the federal, state, municipal and other rules, regulations, and requirements that affect hospital administration. The problems involved in fund raising; sources of external financial aid, grants, research funding; relationships between the modern hospital and American Hospital Association, American Medical Association, hospital and medical insurance companies, as well as accrediting and regulatory agencies, hospital management, hospital administration, and sections of modern hospital administration. The role of the computer in the modern hospital both in terms of the business and control function and in relationship to patient care. Hospital project required. (formerly IM 401)

Mgmt 494

Hospital Unit Processes 3-0-3

Prerequisite: upper division standing. Unit processes in a hospital, provision of patient care, planning for hospital services, functional plans for hospital construction. Functional hospital organizations, medical and surgical services, nursing services, laboratory services, pharmacy services, medical records, dietary services, outpatient services, hospital visitations. Hospital project required. (formerly IE 475)

Mgmt 495

Hospitals and Health Care Facilities Liability 3-0-3

Prerequisite: Mgmt 290. A course encompassing case law and statutory law to provide an understanding of the liabilities that may be incurred in managing a modern hospital or health care facility. (formerly IE 476)

Mgmt 496

Introduction to Transportation 3-0-3

Prerequisite: upper division standing. Introduction to transportation systems and the transportation industry. Survey of the various modes of transportation, organizational structure and operation of private and public carriers. The role of government in the regulation of the U.S. transportation industry. Management of traffic and physical distribution operations. Cost and service comparisons of competing modes of transportation. Organized labor and associated costs. (formerly OS 395)

Mgmt 498

Contemporary Management Issues 3-0-3 Prerequisite: Mgmt 390 or HRM 303. The impact of government regulation on management. The social responsibility of organizations. Ethics in public and private organizations. The impact of rapidly changing technology on management practices. Managing human resources in the future. (formerly OS 455)

98

Mamt 499

Employee-Management Communications 3-0-3

Prerequisite: HRM 305, or a 300 or 400 level management course. The establishment and maintenance of effective channels of both formal and informal oral and written communication among and between management and workers, including attention to the technical essentials of impressive presentation of ideas. Techniques for handling supervisory conferences and reports. The preparation, use and revision of handbooks and various directives, instructions, and manuals of information. (formerly OS 473)

Mgmt 580

Managerial Science

Introduction to the methodology of operations research and system analyses to managerial problems. Concepts of objective functions and constraints, theories of values, optimization and simulation modeling with emphasis on models of production systems, decision analysis, inventory systems, project planning and transportation systems. Topics will be discussed from the deterministic as well as stochastic viewpoints. A student who satisfactorily completes OM 375 must obtain the approval of the graduate advisor before registering for this course.

Management Engineering

Offered by the Department of Mechanical and Industrial Engineering. See Industrial Engineering course list for faculty.

EM 501

Industrial Management 3-0-3

Prerequisite: senior standing. Not open to industrial engineering students. Operational aspects of the management techniques: organization, product design and development, distribution logistics, marketing, plant location and layout, materials handling, production planning and control, inventory control, quality control, work analysis, and incentive plans.

FM 502

Engineering Cost Analysis 3-0-3

Prerequisite: senior standing. Not open to industrial engineering students. Financial, engineering economic, and cost-control aspects of industrial management; the accounting cycle; cost accounting procedure; and cost-model techniques of making cost comparisons through engineering economic studies.

EM 503

Methods and Applications of Industrial **Statistics and Probability 3-0-3**

Prerequisite: senior standing. Not open to industrial engineering students. An analytical approach to basic engineering probability and statistics, with applications drawn from both manufacturing and process industries. Emphasis is placed upon the utility of statistical inference derived from engineering data.

Manufacturing Engineering

Offered by the Interdisciplinary Committee on Manufacturing Engineering

Director of Manufacturing Engineering: Raj Sodhi

MnE 310

Co-op Work Experience | 3 additive credits Prerequisite: completion of sophomore year, approval of program director, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report.

MnE 320

Manufacturing System Dynamics and Control 3-0-3

Prerequisites: Math 222; EE 305 or equivalent. Corequisite: MnE 360 or equivalent. A course covering the principles of automatic controls and system dynamics, with an emphasis on mechanical systems considering hydraulic, pneumatic, thermal and displacement aspects. Topics include first and second order linear systems and the application of the systems in manufacturing processes and equipments.

MnE 351

Materials for Manufacturing 2-2-3

Prerequisites: Chem 116, Phys 231. A combined lecture and laboratory course designed to study the engineering materials used in manufacturing processes, and for manufactured products. This embraces an unusually broad scope of engineering materials including thermoplastics, steels, aluminum, copper, zinc. ceramics, magnesium, thermosets, alloys, glues, composites and blends. The effects of processing history and thermal history are treated. Laboratory exercises are used to reinforce the lecture course, and to provide the student with a practical understanding of material behavior. Material specification, tests and applications are emphasized throughout.

MnE 360

Manufacturing Instrumentation 2-2-3

Prerequisite: EE 305 or equivalent. Corequisite: MnE 320 or equivalent. A combined lecture and laboratory course designed to study the instrumentation used in manufacturing processes. This includes sensors-pressure, velocity, time, and temperature, transducers, and read-out devices. Also included are recording devices and signal analysis techniques. The USA of microprocessors for data collection and data reduction, and for providing actuation signals.

MnE 371

Manufacturing Processes for Metals 2-2-3 Corequisite: MnE 351 or equivalent. A combined lecture and laboratory course on the processing of metals into shaped articles. Topics include: the fundamentals of metal removal technology, and the type of machinery required to perform the operation; the use of computer control systems, programming languages and the process of converting from part design (CAD) to metal removal (CAM); the process of forming from a melt, or sintering from a powder; and the integration of a manufacturing cell, including the shaping process, automated materials handling, and assembly and inspection.

MnE 372

Manufacturing Processes for Plastics 2-2-3

Prerequisites: MnE 351, or equivalent; MnE 371. A combined lecture and laboratory course on the operation, selection and sequencing of plastics fabrication equipment. Each process is evaluated in terms of its production capability and control system characteristics. Topics include the integration of the individual processes into a computerintegrated manufacturing system; the relationship between part properties and processing conditions; post-processing operations such as assembly, machining and decorating; the relationship between plastic part design and tool design for efficient manufacture; and the integration of manufacturing processes (metal, plastics, ceramic) to produce a product.

MnE 401

Design for Manufacturability 2-2-3

Prerequisites: MnE 371, MnE 372, MnE 351 or equivalent. Corequisite: MnE 481. A combined lecture and design project course addressing the problem solving methodology in the design, analysis and synthesis required for the design of a product for manufacturability. The relationship of design, manufacturing, inspection, and materials handling is integrated through the engineering projects. Emphasis is on creative thinking and the use of a computer as a design and simulation tool. CAD/CAM is extensively employed. Team projects on design are also encouraged for more comprehensive design tasks.

MnE 410

Co-op Work Experience II 3 credits

Prerequisite: MnE 310, approval of program director and permission of the Division of Cooperative Education and Internships. Provides for co-op/internship major-related work experience. Mandatory participation in seminars and completion of requirements that include a report and/or project.

MnE 481

Manufacturing Systems Integration 2-2-3 Prerequisite: MnE 320 or equivalent. Corequisite: IE 453. A course covering the integration of the elemental manufacturing systems into cohesive plant-wide systems. Topics include large-scale systems analysis, flexible manufacturing systems, controls of integrated manufacturing systems, commercial integrated manufacturing systems, and factory of the future concepts.

MnE 491 Manufacturing Engineering Project A 2-2-3

Prerequisite: senior standing, and approval of program director. The project is the culmination of the learning experience of the manufacturing engineering student, and allows the student to utilize the prior lecture and laboratory courses, together with additional instruction, to solve industrial problems in manufacturing engineering. Suitable projects are arranged between the faculty advisor and the industrial firm. The projects usually involve library research, design, cost analysis, test planning and preparation of an engineering report.

MnE 492

Manufacturing Engineering Project B 2-2-3

Prerequisites: MnE 491 with C or better, approval of program director. The project is the culmination of the learning experience of the manufacturing engineering student, and allows the student to utilize the prior lecture and laboratory courses, together with additional instruction, to solve industrial problems in manufacturing engineering. Suitable projects are arranged between the faculty advisor and the industrial firm. The projects usually involve library research, design, cost analysis, test planning and preparation of an engineering report.

Marketing

Offered by the School of Industrial Management. See Management course list for faculty.

Mrkt 330

Principles of Marketing 3-0-3

The basic principles and techniques of marketing and its socio-economic role and responsibilities. The fundamental marketing course that is the prerequisite for all other marketing process. The factors relating to the marketing process within the organization and its environments. The nature and significance of organizational buyer behavior, competition, government regulation, consumerism, and social responsibility. The methods of decision making in the areas of marketing research, product development, pricing, distribution, advertising, promotion, and selling. Marketing of products and services to consumers and organizational buyers in the domestic and international markets.

Mrkt 331

Consumer and Buyer Behavior 3-0-3 Prerequisites: Math 105 and Mrkt 330. Psychological, social, and economic influences on consumer behavior. The application of consumer behavioral innovation to marketing decisions: research and measurement techniques, individual influences, en-

vironmental influences, and consumer information processing and decision making. A field research project will be undertaken. (formerly SS 314)

Mrkt 332

Advertising Theory and Technique 3-0-3 Prerequisite: Mrkt 330. Advertising and other sales promotional methods from the perspective of communicating with the market. Special emphasis is placed on the development of creativity in the students. Topics include advertising's place in the marketing mix, media selection, advertising research, and production and sales promotional strategies. (formerly OS 281)

Mrkt 336

Marketing Communications: Promotion, Persuasion and Public Relations 3-0-3

Prerequisite: Mrkt 331. The communication activities of marketing in relation to promotion and advertising. The effects of source, message, and media factors on audience response to communication campaigns. (formerly SS 316)

Mrkt 337

Marketing Distribution Channels 3-0-3

Prerequisite: Mrkt 330. Basic marketing and distribution problems with special reference to operational problems solvable by the mathematical methods of management science. Among the problems treated are decision making in marketing planning, market research, statistical treatment of opinion "polls," product strategy, industrial marketing, and distribution systems. (formerly 1E 457)

Mrkt 338

Product Development and Management 3-0-3

Prerequisite: Mrkt 330. Products are the cornerstones of the marketing effort in both the industrial and service sectors. Methods for analyzing the market needs for products and their development to meet such needs. The process of identifying new product opportunities, screening new product concepts, testing products, test marketing products, positioning products in the market, and developing the marketing strategy and implementation plan. The responsibilities of product management and the position of product manager. Multidisciplinary decision making. Students are required to investigate and report on the new product development process in a real organization.

Mrkt 339

Selling and Sales Management 3-0-3

Prerequisite: Mrkt 330. Sales activities, emphasizing the industrial-user market. The selection, training, development, motivation, compensation, and evaluation of sales personnel. Modern techniques of sales forecasting, budgeting and allocation of resources. (formerly OS 342)

Mrkt 430

Marketing Research 3-0-3

Prerequisites: Mgmt 216 and Mrkt 330. A research and managerial perspective in developing and applying research techniques and procedures. Research from problem formulation to design, data collection, analysis, and managerial report writing. (formerly OS 421)

Mrkt 431

Strategic Marketing Management 3-0-3

Prerequisite: Mrkt 330. An overview of marketing and the various issues management must resolve. Evaluation and choice of competitive marketing strategies, the interrelationship of marketing and other business functions, analysis of marketing opportunities, and development of strategic and operating marketing plans. Marketing management and strategies in the industrial-user market. (formerly OS 422)

Mrkt 433

Services Marketing 3-0-3

Prerequisite: Mrkt 330. The processes by which the needs of the buyers are identified, the relevant services designed, priced, promoted, and delivered. Special emphasis will be given to marketing professional and technical services, as well as financial and health-care services.

Mrkt 434

Industrial Marketing 3-0-3

Prerequisite: Mgmt 216. The relationship between production and distribution. Sales forecasting, product development, packaging, pricing, customer relations, warehousing, advertising, and promotion. (formerly IM 441)

Mrkt 435

International Marketing 3-0-3

Prerequisite: Mrkt 330. The multinational enterprise in world markets. Emphasis on the special skills required to adapt standard marketing practices to foreign environments. Foreign market opportunities and marketing strategies are examined. Students prepare a marketing plan for a foreign country. (formerly OS 423)

Mrkt 530

Principles of Marketing

This courses examines the factors relating to the marketing process within the organization and its environments. The nature and significance of consumer and organization buying behaviors, competition, government regulations, consumerism, and social responsibility are analyzed. The methods of decision making in the areas of marketing research, product development, pricing, distribution, advertising, promotion, and selling are explored. Various strategies are also discussed. A student who satisfactorily completes Mrkt 330 must obtain the approval of the graduate advisor before registering for this course.

Materials Science

Offered by the Department of Physics. See Physics course list for faculty.

MtSc 311

Properties of Materials 3-0-3

Prerequisite: Two semesters of college physics or equivalent. This course is intended for bachelor of engineering technology students and is an introduction to the principal metallic and nonmetallic engineering materials, including their physical properties, response to heat treatment, and corrosion resistance.

MtSc 318

Engineering Materials 3-2-4

Prerequisites: Physics III; Chem 116. This course introduces the student to such engineering materials as metals, viscoelastic materials, ceramics, polymers, and semiconductors. The approach is interdisciplinary with stress upon the structure of materials. Various mechanical and thermal treatments are discussed and related to the stability of the resultant properties. The laboratory sessions implement and emphasize the effects of these mechanical and thermal treatments on the materials.

MtSc 319

Engineering Materials 3-0-3 Prerequisites: Physics III; Chem 116. This course is identical to MtSc 318, with the laboratory omitted.

MtSc 450

Electron Microscopy 2-2-3

Prerequisites: Physics III; Chem 116. This course combines the lecture and laboratory introducing the field of electron in microscopy. Topics include magnetic electron lenses, electron optical systems, selected area diffraction, sample preparation, thin foil techniques, and photography.

MtSc 451

X-Ray Diffraction 2-2-3

Prerequisites: Physics III; Chem 116. This course combines the lecture and laboratory in introducing the methods of X-ray diffraction. Topics include directions and intensities of diffracted beams, diffractometer methods, Laue methods, power photographs, reciprocal lattice constructions, and the rotating crystal method.

MtSc 452

Materials Science | 3-0-3

Prerequisites: Physics III; Chem 116; ME 435 or Phys 335. This course emphasizes the structure and properties of materials and the relationships between them. The primary topics include the thermodynamics of solids, fracture mechanisms, diffusion, elasticity, plasticity, fatigue strength, viscosity, and creep.

MtSc 453

Materials Science II 3-4-5

Prerequisites: MtSc 452. This course emphasizes the electronic properties of materials in conjunction with an introduction to ceramics. Topics include semiconductors, thermoelectricity, magnetism, conductivity, dielectric, optical properties, and an introduction to the properties and behavior of ceramics.

Mathematics

Offered by the Department of Mathematics

Acting Chairperson: John Tavantzis Sponsored Chair: Gregory Kriegsmann (applied mathematics)

Distinguished Professors: Goldberg, Kriegsmann

Professors: Ahluwalia, Andrushkiw, Blackmore, Levy, Milojevic, Perez, Stickler,

Tavantzis, Voronka Associate Professors: Bhattacharjee, Chase, Cohen, Dios, Garfield, Huang, Kappraff, Katzen, Lieb, Plastock, Porter, Sran, Zames Assistant Professors: Affouf, Berliner, Bukiet, Luke, Palacios, Papageorgiou, Perera, Squeff, Vanaja

Director of Undergraduate Studies: Rose Ann Dios

Math 098

Developmental Mathematics 3 additive credits

Placement in this course is determined by performance on standardized entrance examinations. Topics include number line, algebraic expressions, linear equations, word problems, exponents and scientific notation, operations with polynomials.

Note: This course may not be used to satisfy degree requirements in any program.

Math 103

College Algebra 4-0-4 Prerequisite: Math 098 with a grade of C or better. Placement in this course is determined by performance on standardized entrance examinations. Topics include operations with polynomials, rational and square root expressions, solving linear and exponential and quadratic equations, logarithmic functions.

Math 104

Analytic Geometry and Trigonometry 4-0-4

Prerequisite: Math 103 with a grade of C or better. Placement in this course is determined by performance on standardized entrance examinations. Topics include rectangular coordinate systems, circle, parabola, ellipse, hyperbola, radian measure, right triangle, trigonometric identities and equations, laws of sines and cosines.

Math 105

Elementary Probability and Statistics 3-0-3 Prerequisite: Math 103 and Math 104, or Math 107, or equivalent. Placement in this course is determined by performance on standardized entrance examinations. Considers notions of probability. Topics include the binomial and normal distributions, expected value, and variance. The notions of sampling, hypothesis testing, and confidence intervals are applied to elementary situations.

*Math 107

Precalculus 4-0-4

Placement in this course is determined by performance on standardized entrance examinations. Topics include college algebra, trigonometry, analytic geometry, maximumminimum problems that can be solved without calculus. Exponential increase and decay is given substantive consideration.

*In some cases Math 107 is taken for additive credit.

Math 108 Calculus A 3-0-3

Prerequisite: Math 107 or equivalent. Introduction to differentiation techniques and applications to curve-sketching, related rates, and maxima/minima problems. This course is designed as a telecourse for use by the Mind Extension University.

Math 109

Calculus B 3-0-3

Prerequisite: Math 108 or equivalent. Introduction to integration techniques and applications to area, volume, curvelength, surface area, and centroids. Also includes the study of transcendental functions. This course is designed as a telecourse for use by the Mind Extension University.

Math 110 Calculus C 3-0-3

Prerequisite: Math 109 or equivalent. Topics include methods of integration, hyperbolic functions, polar coordinates, infinite series, and Taylor series. This course is designed as

a telecourse for use by the Mind Extension University.

Math 111

Calculus I 4-0-4

Prerequisite: Math 104 with a grade of C or better or Math 107 with a grade of C or better or equivalent. Placement in this course is determined by performance on standardized entrance exams. Considers the theory and techniques of differentiation and integration with applications of both processes to engineering and science.

Math 111H

Honors Mathematics | 4-0-4

The first semester of an eight-semester program in Honors Mathematics. Topics include rates of change, continuity, theory of differentiation and integration, as well as applications to engineering and science problems. Admission to this course is by invitation, based on standardized entrance exams.

Math 112 Calculus II 4-0-4

Prerequisite: Math 111. Topics considered include the differentiation and integration of inverse trigonometric exponential, and logarithmic functions, further methods of integration, infinite series, Taylor series, and applications of the definite integral to physical problems.

Math 112H

Honors Mathematics II 4-0-4 Prerequisite: Math 111H or Math 111 and departmental approval. The second semester of an eight-semester program in Honors Mathematics. Topics include methods of integration, infinite series, introduction to vector analysis and parametric equations.

Math 113

Finite Mathematics and Calculus 4-0-4 Prerequisite: Math 103 and Math 104, or equivalents. Placement in this course is determined by performance on standardized entrance examinations. Consists of three self-

contained modules covered in the following order: linear equations, introduction to probability and statistics, introduction to differential and integral calculus. Focus is on application throughout the course. In preparation for the calculus module, students review algebra fundamentals.

Math 116

Mathematics of Design 3-0-3

Prerequisite: Math 103 and Math 104 or equivalents; Math 111 or Math 113 or Math 138. Mathematical tools for design are presented and incorporated into a set of design projects. Areas of study include: theory of graphs, tilings of the plane, lattices, vectors, transformations, symmetry, study of polyhedra, and the theory of proportion in art and architecture.

Math 117

Intensive Calculus L 4-3-6

Prerequisite: Math 104 with a grade of C or better or Math 107 with a grade of C or better; permission of the math department and dean of freshman studies. Placement in this course is determined by performance on standardized entrance examinations. Considers the theory and techniques of differentiation and integration with applications of both processes to engineering and science. Students participate in workshops which focus upon a wide range of applications and team projects.

Math 118

Intensive Calculus II 4-3-6

Prerequisite: Math 111 or Math 117; permission of the math department and dean of freshman studies. Topics considered include the differentiation and integration of inverse trigonometric, exponential, and logarithmic functions; further methods of integration; hyperbolic functions and polar coordinates; infinite series; Taylor series; and applications of the definite integral to physical problems. Students participate in workshops which focus upon a wide range of applications and team projects.

Math 121 Calculus I for Management 4-0-4

Prerequisite: Math 104 with a grade of C or better or Math 107 with a grade of C or better. Placement in this course is determined by performance on standardized entrance examinations. Considers the theory and techniques of differentiation and integration with applications of both processes to business and management.

Math 122

Calculus II for Management 4-0-4

Prerequisite: Math 111. Topics considered include the differentiation and integration of inverse trigonometric, exponential, and logarithmic functions; further methods of integration; hyperbolic functions and polar coordinates; infinite series; Taylor series; and applications of the definite integral to management problems. Also treats matrix methods and linear programming.

Math 138

General Calculus I 3-0-3

Prerequisite: Math 103 and Math 104, or departmental approval. An introduction to differential and integral calculus of a single variable.

Math 141

Introduction to Actuarial Science 3-0-3 Prerequisite: High school algebra (two years); CIS 101 or CIS 113. This course is designed to serve as an introduction to the mathematics of life insurance. Topics covered include elementary concepts of probability, compound interest, annuities, certain life annuities, life insurance, net premiums, gross premiums net level reserves.

Math 211

Calculus III A 3-0-3

Prerequisite: Calculus II. A continuation of Math 112. Main topics considered are partial differentiation and multiple integrals.

Math 213

Calculus III B 4-0-4

Prerequisite: Calculus II. A continuation of Math 112 focusing on multivariable calculus. Main topics considered are partial differentiation, multiple integrals, line integrals, Green's and Stokes' Theorems.

Math 213H

Honors Mathematics III 4-0-4

Prerequisite: Calculus II and departmental approval. The third semester of an eightsemester program in Honors Mathematics. A rigorous introduction to the calculus of several variables and a brief introduction to statistics. A number of applications are studied in depth.

Math 222

Differential Equations 4-0-4

Prerequisite: Calculus III; knowledge of a programming language. Methods for solving ordinary differential equations are studied, together with physical and geometrical applications, Laplace transforms, numerical and series solutions are included.

Math 222H

Honors Mathematics IV 4-0-4

Prerequisite: Math 213H or departmental approval plus Math 211 or Math 213. The fourth semester of an eight-semester program in Honors Mathematics. It is a first course in ordinary differential equations in which mathematical depth is of primary concern.

Math 225

Survey of Probability and Statistics 1-0-1 Prerequisite: Calculus II. Topics include basic ideas of data analysis, least squares, elementary probability, random variables, special distributions and sampling. Note: This course satisfies the General University Requirement (GUR) in probability and statistics. Any higher level mathematics course in probability and statistics also will satisfy the GUR in probability and statistics. Credit will not be granted for both Math 225 and any such upper level course.

Math 226

Discrete Analysis 4-0-4

Prerequisite: Calculus II. An introduction to discrete mathematics. Topics include elementary set theory, logic, combinatorics, relations, graphs and trees, algebraic systems.

Math 238

General Calculus II 3-0-3 Prerequisite: Math 138. A continuation of

Math 138. Topics include applications of integral calculus and an introduction to ordinary differential equations.

Math 244

Introduction to Probability 3-0-3

Prerequisite: Calculus III; CIS 101 or CIS 113. Topics include basic probability theory in discrete and continuous sample space; conditional probability and independence; Bayes theorem and event trees; random variables and their distributions; joint distribution and notion of dependence; expected values and variance; useful parametric families of distributions including binomial, geometric, hypergeometric, negative binomial, exponential, gamma, normal and their applications; simple case of central limit theorem and its uses. Appropriate computer implementation used to stress and reinforce the ideas of randomness and uncertainty.

Math 305

Statistics for Technology 3-0-3

Prerequisite: Math 309 or equivalent. An introduction to the modern concepts of statistics needed by engineering technologists. Topics include descriptive statistics, statistical inference, regression, correlation, analysis of variance, and nonparametric methods. Applications to technology are stressed. This course is not intended for engineering students.

Math 309 Mathematical Analysis for Technology 3-0-3

Prerequisites: Calculus I and II (AAS level) or equivalent. A continuation of Calculus II. Emphasis on applications such as related rates, maximum and minimum, area, moments, centroids, volumes, approximate methods, partial derivatives, multiple integrals and series.

Math 310

Co-op Work Experience | 3 credits

Prerequisites: completion of the sophomore year, approval of the department, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report.

Math 322

Differential Equations for Technology 3-0-3

Prerequisite: Math 309. An applied science study using differential equations as the vehicle for comprehension of the unknown. After an introduction to first order differential equations and their applications to motion, cooling and electromechanical systems, higher order differential equations and their solutions are treated. The methods of undetermined coefficients, variation of parameters, and many series and numerical methods will be studied. Laplace transforms, matrix methods, and eigenvalue problems are included.

Math 331

Introduction to Partial Differential Equations 3-0-3

Prerequisite: Math 222 or equivalent. Partial differential equations of science and engineering. Topics include initial and boundary value problems for parabolic, hyperbolic, and elliptic second order equations. Stress on separation of variables, special functions, transform methods, and numerical techniques.

Math 332

Introduction to Functions of a Complex Variable 3-0-3

Prerequisite: Math 222 or equivalent. A first course in functions of a complex variable: Cauchy Riemann equations, Cauchy-Goursat theorem, integration, series, residues, poles, geometrical aspects. Emphasis on techniques.

Math 332H

Honors Mathematics V 3-0-3

Prerequisite: Math 222H or Math 222 and departmental approval. The fifth semester of an eight-semester program in Honors Mathematics. A course in complex variables with special emphasis on the evaluation of real integrals. Additional topics include conformal mapping, Riemann surfaces, special functions, and some applications to potential theory.

Math 333

Probability and Statistics 3-0-3

Prerequisite: Calculus III. A course in modern probability, statistics, and statistical inference. Specific topics include discrete and continuous distributions of random variables, probability models in science, and statistical inference.

Math 334

Mathematics for Management Science 3-0-3

Prerequisite: Math 244 or Math 333. Considers mathematical methods found especially in contemporary fields such as operations research and reliability engineering. Topics include linear programming, graph theory, finite mathematics, differential equations, matrices, and determinants.

Math 335

Vector Analysis 3-0-3

Prerequisite: Calculus III. Algebra and calculus of vectors. Topics include the theorems of Gauss, Green and Stokes, and curvilinear coordinates.

Math 336

Applied Abstract Algebra 3-0-3

Prerequisite: Math 112 or Math 113. Classical algebra from a modern and constructive viewpoint. Emphasis placed on the development of algorithmic and computational skills. Topics include rings, fields, and groups and their applications to science and engineering.

Math 337

Linear Algebra 3-0-3

Prerequisite: Calculus II. Matrices, determinants, systems of linear equations, vector spaces, linear transformations, and related topics.

Math 339H

Honors Mathematics VI 3-0-3

Prerequisite: Math 332H or departmental approval. The sixth semester in an eightsemester program in Honors Mathematics. A rapid survey of classical vector analysis followed by an introduction to linear and multi-linear algebra. Topics include the classical vector integral theorems of Green, Stokes, and Gauss; the theory of linear operators on finite dimensional vector spaces with the associated matrix theory; and modern tensor analysis.

Math 340

Applied Numerical Methods and Optimization 3-0-3

Prerequisites: Calculus III; CIS 101 or CIS 113 or equivalent. An introductory course in numerical methods with emphasis on mathematical models. Designed for computer implementation and covers the following topics: solution of linear and nonlinear systems of equations, eigenvalue problems, interpolation and approximation, techniques of optimization, Monte Carlo Methods, and applications to ordinary differential equations and integration.

Math 341

Statistical Methods | 3-0-3 Prerequisite: Math 244 or Math 333 or equivalent. Additional concepts and tools of probability and statistics useful for modeling and statistical inference are developed. Topics include moments; moment generating functions and their variants; probability generating functions; notions of convergence: sums of independent random variables and central limit theorem; weak law of large numbers; covariance, correlation and regression, bivariate normal family; order statistics; random sampling and sampling distribution of a statistic; sampling from normal distribution and related sampling distributions; the idea and framework of statistical inference.

Math 342

Statistical Methods II 3-0-3

Prerequisite: Math 341. A continuation of Math 341, covering the theory and applications of classical statistical inference. Topics include point and interval estimation; criteria of good estimates, notion of sufficiency; maximum likelihood estimators and their large sample properties; statistical hypotheses and tests, including most powerful and uniformly most powerful tests and likelihood ratio tests; classical tests of parametric hypotheses about means and variances of normal populations; tests for proportion; chi-square tests of homogeneity, independence, goodness-of-fit; sign test and Wilcoxon test.

Math' 344

Regression Analysis 3-0-3

Prerequisite: Math 333 or Math 341. Topics include simple linear regression and multiple regression methods and techniques; analysis of variance. Appropriate software implementation described and utilized.

Math 346

Mathematics of Finance 3-0-3 Prerequisites: Calculus I, Math 141. The main topics include: basic problems in interest, annuities certain, amortization and sinking funds, bonds and related securities.

Math 410

Co-op Work Experience II 3 credits Prerequisites: Math 310 or its equivalent, ap-

proval of the department, and permission of the Division of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project.

Math 441

Actuarial Mathematics | 3-0-3

Prerequisite: Math 346 or equivalent. Main topics include the economics of insurance, individual risk models for a short term, survival distributions and life tables, life insurance per year, life annuities, and net premiums.

Math 442

Actuarial Mathematics II 3-0-3

Prerequisite: Math 441. Main topics include net premium reserves, insurance models including expenses, nonforfeiture benefits, and dividends.

Math 443

Statistical Methods III 3-0-3

Prerequisite: Math 342. A continuation of Math 342, covering further techniques and refinements of the tools of statistical inference. Topics include complete sufficient statistics and uniformly minimum variance estimators; general linear hypotheses and related topics; nonparametric inference, including rank and order statistics, permutation methods, u-statistics, Pitman efficiency, introduction to sequential tests and Bayesian analysis.

Math 444

Applied Sampling Methods 3-0-3 Prerequisite: Math 333 or equivalent. An introduction to two specific application areas of statistics: sample surveys and statistical quality control. Topics include sampling from a finite population; different sampling techniques used in sample surveys, including stratification, cluster sampling, and systematic sampling; control charts and acceptance sampling plans.

Math 445

Introduction to Experimental Design 3-0-3

Prerequisite: Math 333 or equivalent. Basic concepts and principles of designs are covered. Topics include randomized blocks, Latin squares, factorial designs.

Math 446

Topics in Applied Statistics 3-0-3 Prerequisite: Math 342 or equivalent. An introduction to applied time series analysis and one other select topic. Introduction to use of statistical methods of analyzing and forecasting data over time; appropriate software used. Choice of selected special topic at the discretion of instructor and class interest.

Math 448H

Honors Mathematics VII 3-0-3

Prerequisite: Math 339H or departmental approval. The seventh semester of an eightsemester program in Honors Mathematics. An advanced undergraduate treatment of mathematical topics chosen by the instructor. Possible areas of concentration include: topology, variational methods, functional analysis, asymptotic analysis and differential geometry.

Math 449H

Honors Mathematics VIII 3-0-3 Prerequisite: Math 448H or departmental approval. The eighth semester of an eight-

semester program in Honors Mathematics. A continuation of Math 448H.

Math 491

Independent Study in Mathematics 3-0-3 Prerequisites: senior standing and departmental approval. Each student will work under the direct supervision of a member of the Department of Mathematics. The work will consist primarily of a project applying the mathematical skills the student has acquired to an engineering and science oriented project.

Math 493

Seminar in Actuarial Science 3-0-3

Prerequisite: Math 141. A series of lectures by practicing actuaries on topics of technical and/or current practices. Subjects announced at the time of registration. Student progress evaluated through projects and term papers. A comprehensive report summarizing some aspect of special interest to the student is required.

Math 495

Topics in Applied Mathematics 3-0-3

Prerequisites: Math 331, Math 332, Math 340. or department approval. A survey of selected areas of applied mathematics. Case histories of problems in applied mathematics from an industrial background.

Math 545

Advanced Calculus | 3-0-3

Prerequisite: undergraduate differential and integral calculus. This course deals with the topics of advanced calculus such as the number system, functions, continuity, differentiability, the Riemann integral, sequences, series, and uniform convergence.

Math 546

Advanced Calculus II 3-0-3

Prerequisite: Math 545 or equivalent. This course is a continuation of Math 545 and considers such topics as partial differentiation, transformations, implicit function theorem, multiple integrals, and line and surface integrals.

Math 551

Engineering Mathematics 3-0-3

Prerequisite: undergraduate differential equations. Mathematical methods useful in the analysis of problems arising in applied mathematics and engineering. Topics are selected from: Fourier series, general orthogonal systems, Laplace and Fourier transforms, boundary-value problems, generalized functions, linear algebra and systems of ordinary differential equations.

Math 560

Methods of Applied Mathematics | 3-0-3 Prerequisites: Math 331, Math 337, Math 545. An introduction to relevant techniques in applied mathematics. Includes basic problems in linear algebra, ordinary and partial differential equations.

Math 561

Methods of Applied Mathematics II 3-0-3 Prerequisite: Math 560. A continuation of Math 560.

Math 573

Intermediate Differential Equations 3-0-3

Prerequisite: undergraduate differential equations. Advanced topics in ordinary differential equations with applications to engineering problems. The qualitative behavior of solutions is stressed. Topics include phaseplane analysis, stability, dynamical systems, and an introduction to chaos.

Math 577

Introduction to Stochastic Processes 3-0-3

Prerequisite: Math 244 or Math 333 or Math 341 and some programming experience. In-troduction to Markov chains, Poisson processes and renewal theory. Birth and death processes. Applications stressed. Computational solutions of illustrative problems are included.

Math 590

BS/MS Co-op Honors Work Experience I 3 additive credits

Prerequisite: standing and acceptance in the combined BS/MS program and permission from the Department of Mathematics and Division of Cooperative Education and Internships. Cooperative education/internship providing on-the-job reinforcement of academic programs in mathematics. Work assignments and projects are developed by the co-op division in consultation with the mathematics department and evaluated by mathematics faculty co-op advisors.

Math 591

BS/MS Co-op Honors Work Experience II 3 additive credits

Prerequisite: Math 590 and permisson from the Department of Mathematics and the Division of Cooperative Education. Continuation of Math 590.

Math 592

Graduate Work Experience III 3 additive credits

Prerequisite: Math 591, graduate standing and permission from Department of Mathematics and Division of Cooperative Education and Internships. Continuation of Math 591.

Required Courses Offered at Rutgers-Newark

Math 640:237

Discrete Structures and Combinatorics 3-0-3

Prerequisite: Math 111. Sets, relations, functions, graphs, trees, formal expressions, mathematical induction, and some algebraic structures; applications to probability and computer science and enumerative problems in combinatorial analysis.

Math 640:441

Introductory Topology 3-0-3

Prerequisite: permission of the advisor. General topological spaces and continuous mappings, linear point set theory and plane point set theory, separation, connectedness and compactness, localization, topological products and Tychonoff's Theorem, metric spaces and isometrics.

Mechanical Engineering

Offered by the Department of Mechanical and Industrial Engineering

Chairperson: Bernard Koplik Associate Chairpersons: John Droughton, Harry Herman (graduate) Sponsored Chair: Ming Leu (manufacturing/ productivity)

productivity) Professors: Allentuch, Caudill, R. Chen, Cochin, Droughton, Fenster, Geskin, Herman, Hrycak, Kirchner, Koplik, Leu, Linden, O'Brien, Wilson, Yu Associate Professors: Cerkanowicz,

Dubrovsky, Fischer, Florio, Harnoy, Ketzner, Levy, Martin, Schmerzler, Sodhi Assistant Professors: Dave, Gaal, Ji, Mayott,

Rosato Research Professors: Bales, Shiminovich,

Ugural Special Lecturer: Surjanhata

Director of Engineering Graphics: Geraldine Milano

ME 202

Elements of Mechanical Engineering 1-2-2 Prerequisites: CIS 101, EG 101. A course that introduces the microprocessor as a tool for problem solving of mechanical engineering applications. Topics include statistical analysis of engineering data, sorting routines, curve fitting, roots of non-linear equations, and numerical integration. An introduction to CAD/CAM in mechanical engineering is included.

ME 215

Engineering Materials and Processes 2-2-3 Prerequisite: Chem 116. A combined lecture and laboratory course relating to the study of engineering materials. The processes of formation from liquid and particle state, plastic forming, molding deformation, and metal removal are studied. The effects of heat treatment on material properties are discussed. Laboratory exercises involve basic machine tools and include computer-controlled equipment.

ME 231

Kinematics of Machinery 3-1-3

Prerequisites: CIS 101, Mech 235. The kinematic analysis of mechanisms such as cam and follower, gear trains, planetary gear systems, and linkage synthesis for generating specific types of motion. Graphical, analytical and digital computer methods are used.

ME 304

Fluid Mechanics 3-1-3

Prerequisites: Mech 236, ME 311. Introduction to the basic principles of conservation of mass, momentum, and energy as they apply to engineering systems which utilize fluids. Some of the topics studied are: dimensional analysis, theoretical and empirical analysis of one-dimensional compressible and incompressible flow, empirical analysis of external and internal flows, and elementary boundary layer theory.

ME 305

Introduction to System Dynamics 3-0-3

Prerequisites: Math 222, ME 314. Principles of dynamic system modeling and response with emphasis on mechanical, electrical, and fluid systems. Application of computer simulation techniques is employed.

ME 310

Co-op Work Experience I 3 additive credits Prerequisites: completion of sophomore year, approval of department, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated by the Co-op Division and approved by the department. Mandatory participation in seminars and completion of a report.

ME 311

Thermodynamics | 3-0-3

Prerequisites: Math 211, Phys 111. A course in thermodynamic fundamentals. Topics studied are the first and second laws of thermodynamics, physical properties of pure substances, entropy, ideal and real gases, and gaseous mixtures.

ME 312

Thermodynamics II 3-0-3

Prerequisite: ME 311. A continuation of ME 311 including studies of irreversibility and combustion. Thermodynamic principles are applied to the analysis of power generation, refrigeration, and air-conditioning systems. Also studied are the introduction to solar energy thermal processes, nuclear power plants, and direct energy conversion.

ME 314

Dynamic Analysis of Machines 3-0-3

Prerequisites: ME 231, Mech 236. Utilizes the principles of dynamics for analyzing high speed mechanical devices. Topics covered are inertial forces, vibration analysis, balancing, and the use of energy methods.

ME 315

Stress Analysis 3-0-3

Prerequisites: Math 222, Mech 232, ME 215. An intermediate level stress course which deals with problems related to mechanical design. Representative topics covered include two-dimensional elasticity, transformation of stress and strain, plane stress problems, axisymmetric members, buckling criteria and failure theories.

ME 316

Machine Design 3-0-3

Prerequisites: ME 231, ME 315. The various aspects of the design process as well as the design of machine elements are discussed. Mini-projects are used to introduce the student to the design procedures used in engineering practice.

ME 339

Fundamentals of Mechanical Design 3-0-3 Prerequisite: Mech 232. A course in mechanical design for industrial engineering students. Among the topics treated are kinematics of mechanisms, machine components, and a brief introduction to mechanical vibrations. The topics are integrated to provide the student with the ability to deal with design problems from the viewpoint of the non-specialist.

ME 343

Mechanical Laboratory | 2-2-3

Prerequisites Math 225, Mech 236. Corequisite: ME 304. A laboratory and lecture course in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, temperature, mass flow, and displacement are covered. Particular attention is paid to the applicability and sensitivity of instruments studied.

ME 403

Mechanical Systems Design I 2-2-3

Prerequisites: ME 304, ME 305, ME 316. Corequisite: ME 407. Lectures and projects covering problem solving methodology in the design, analysis, and synthesis of mechanical and thermal systems. The student's background in all subject areas is utilized together with engineering principles and topics covered in the classroom to serve as a foundation for broad engineering projects. Emphasis is placed on creative thinking and the engineering design process in projects involving the optimal conversion of resources.

ME 405

Mechanical Laboratory II 1-2-2

Prerequisite: ME 343. Corequisite: ME 407. A laboratory course for mechanical engineering students. Emphasizes the use of fundamental principles and instrumentation systems for the analysis and evaluation of mechanical components within a system.

ME 406

Mechanical Laboratory III 1-2-2

Prerequisite: ME 405. Corequisite: ME 407. An advanced laboratory course for mechanical engineering students. Covers the testing and evaluation of complete mechanical systems.

ME 407

Heat Transfer 3-0-3

Prerequisites: Math 222, ME 304, ME 311. A study of the three fundamental modes of heat transfer: conduction, convection, and radiation. A physical interpretation of the many quantities and processes in heat transfer is considered using numerical methods in the solution of problems. The theory is applied to the analysis and design of heat exchangers and other applications. Where appropriate, computer simulation is used.

ME 408

Mechanical Systems Design II 1-2-2

Prerequisite: ME 403. A continuation of ME 403 from a more integrated viewpoint. Concepts in optimization and computer simulation are considered in the design and synthesis of mechanical and thermal systems. The projects are more comprehensive, emphasizing creative design, and requiring design decisions of a more sophisticated nature.

ME 410

Co-op Work Experience II 3 credits

Prerequisites: ME 310, approval of the department, and permission of the Division of Cooperative Education and Internships. Fulltime work experience of approximately one semester's duration. Provides major related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project.

ME 425

Finite Element Method in Mechanical Engineering 3-0-3

Prerequisites: CIS 101, Math 222, and Mech 232. A course that introduces students to the central ideas underlying the finite element method in mechanical engineering and its computer implementation. The fundamental concepts such as interpolation functions for one- and two-dimensional elements, bar element method, Galerkin's method, discretization of a model, methods of assembling global matrices, and the final solution techniques for obtaining nodal values are in-troduced. Specific applications to mechanical engineering problems in trusses, beams, torsion, heat transfer, fluid flow, plane stress and plane strain are included.

ME 432

Principles of Air Conditioning and **Refrigeration 3-0-3**

Prerequisites: ME 304, ME 312; Corequisite: ME 407. A course in the fundamentals of air conditioning and refrigeration. Topics covered are psychometrics, cooling and heat load calculations, air distribution systems, duct design, vapor compression and absorption systems and the principles of cooling towers.

ME 433

Vibration Analysis 3-0-3

Prerequisites: Mech 236, Math 222. An introduction to the fundamental theory of mechanical vibrations. After studying undamped and damped systems with single and multiple degrees of freedom, consideration is given to such topics as transient vibration, vibrations of continuous media, and analog and numerical methods.

ME 435

Thermodynamics 3-0-3

Prerequisites: Math 211, Phys 111. Intended for non-mechanical engineering students of all disciplines. Topics include the basic laws of thermodynamics, properties of fluids and solids, analysis of open and closed systems, gas and vapor power cycles, refrigeration and air conditioning, and an introduction to heat transfer. Cannot be taken for credit by mechanical engineering students.

ME 437

Structural Analysis 3-0-3

Prerequisite: Mech 232. A course intended to acquaint mechanical engineering students with the fundamentals of structural analysis. Consideration is given to such topics as stresses and deflections of beams as well as the design of beams, columns, trusses, and structural connections of steel, reinforced concrete, and timber structures.

ME 438

Introduction to Physical Metallurgy 3-0-3

Prerequisites: Chem 116, Phys 230, ME 215. A course introducing the student to the study of metallic microstructures, solid solutions and the mechanical properties of metals and alloys. Physical understanding of diffusion processes is emphasized in covering the relationship between the nature of metals and different heat treating processes.

ME 439

Principles of Tribology 3-0-3

Prerequisites: Chem 116, Phys 230, Mech 232. An introduction to the principles of wear resistance of machine parts and tribology. Physical understanding of different mechanisms of wear and friction and methods of increasing durability are covered.

ME 451

Introduction to Aerodynamics 3-0-3

Prerequisites: ME 304, ME 311. A first course in aerodynamics which introduces the student to the basic principles and properties of fluid flow around immersed bodies. Topics include the kinematics and dynamics of fluid fields, the thin airfoil, finite wing theory, and one-dimensional compressible flow.

ME 452

Dynamics of Space Flight 3-0-3

Prerequisites: Mech 236, Math 222. An introductory course to the mechanics of space flight. After a brief introduction to the physics of the solar system, the dynamics of space flight is developed from the Newtonian viewpoint. In addition, the performance and propulsion methods of rocketry are considered.

ME 453

Energy Conversion 3-0-3

Prerequisites: ME 311, EE 405. An elective course for engineering students dealing with the theory, analysis, and design of modern static and dynamic energy conversion devices. The applications include thermoelectronics, magnetohydrodynamics, electrohydrodynamics, fuel cells, reciprocating and rotary energy converters.

ME 454

Compressible Flow 3-0-3

Prerequisites: ME 304, ME 312, Math 222. Equations of one-dimensional compressible flow. Topics covered are flows with variable areas, friction, mass addition, heat addition, normal shocks, and combination of these effects. Special topics in two-dimensional flows such as oblique shocks are also included.

ME 455

Automatic Controls 3-0-3

Prerequisite: ME 305. An introductory course covering the principles of automatic controls. Emphasis is placed on systems, considering their mechanical, hydraulic, pneumatic, thermal, and displacement aspects. First and second order linear systems are studied. Various system analysis techniques such as Nyquist and Bode diagrams are introduced. These techniques are applied in system design.

ME 456

Fluid Machinery 3-0-3

Prerequisites: ME 304, ME 311. An introduction to the underlying principles of rotating fluid machinery. Analytical, graphical, and dimensional analysis methods are used in analyzing axial and centrifugal machines. Airfoil, cascade, and channel flow theories are introduced.

ME 457

Electro-Mechanical Systems 3-0-3

Prerequisites: ME 305, EE 405. An introduc-tion to electro-mechanical systems from both an analytical and a descriptive viewpoint. The analysis and design of practical devices such as accelerometers, valves, missiles, microphones, vibrometers, and electro-static speakers are presented.

ME 458

Aerospace Structures 3-0-3

Prerequisite: ME 315. Analysis of determinate and indeterminate thin-walled structures including shells, plates, trusses, frames and columns as applied to monocoque structures. Topics included are unsymmetric bending, shear in thin-walled sections, shear center, torsion in thin-walled sections, energy and stability. Problem solutions requiring computer programs are introduced whenever appropriate. Design considerations include stability, stress analysis, and optimization on the basis of strength to weight ratio.

ME 468

Noise Pollution and Abatement 3-0-3 Prerequisite: Math 222. Consideration of sources and characteristics of noise pollution; physiological effects of noise; hearing conservation; study of fundamentals of noise propagation; techniques of noise measurement; product design for abatement of industrial noise and transportation noise; and noise control legislation.

ME 470

Engineering Properties of Plastics 3-0-3 Prerequisites: ME 215, Mech 232. A study of the physical properties of the various commerical thermosetting and thermoplastic resins. An introduction to linear viscoelastic theory and its relationship to measurable mechanical properties of plastics. Other engineering properties such as flammability, chemical resistance, and electrical properties are discussed.

ME 471

Introduction to Polymer Processing Techniques 3-0-3

Prerequisites: ME 304, ME 407. A study of the various plastics processing techniques. Included in these processes are extrusion, injection molding, blow molding, compression molding, thermoforming, rotational molding, casting, etc. The relationship between product design and choice of process will be presented.

ME 480

Introduction to Solar Energy 3-0-3

Prerequisite: ME 312. An elective course dealing with the use of solar energy for distillation, pool heating, domestic water heating, and space heating and cooling. The thermal processes by which solar radiation is absorbed by a surface, converted into heat, distributed, and stored are studied. Calculation procedures for determining the heat loss of buildings and the development of computer models and simulation techniques are also covered.

ME 490

Mechanical Engineering Project A 3-0-3

Prerequisite: senior standing and approval of the chairperson of the department. A mechanical engineering projects course in which the student works on one or more individually selected projects. The projects usually involve library research, design, cost analysis, planning of testing, and preparation of an engineering report.

ME 491

Mechanical Engineering Project B 3-0-3

Prerequisite: ME 490 and approval of the chairperson of the department. A mechanical engineering projects course in which the student works on one or more selected projects. The projects usually involve library research, design, cost analysis, planning of testing, and preparation of an engineering report.

*ME 635

Computer-Aided Design 3-0-3

Prerequisite: course or demonstrated competence in computer programming. The course deals with the adaption of the digital computer to the solution of engineering design problems. Topics treated include design morphology, simulation, and modeling, algorithms, problem-oriented languages, use of available software, computer graphics, automated design and the application of these concepts to specific engineering design problems.

*ME 639

Combustion Engine Emissions and Their Control 3-0-3

Prerequisites: undergraduate thermodynamics, fluid mechanics and heat transfer. This course studies the role gasoline and diesel engines play in air pollution. The relationship between fundamental engine design, combustion, and emission formulation is traced for the homogeneous combustion process of the gasoline engine and the heterogeneous combustion process of the diesel engine. A discussion of present and future emission control techniques is included. Experiments and/or demonstrations on fuel characteristics, engine performance, and exhaust emissions are performed.

*ME 670

Introduction to Biomechanical Engineering 3-0-3

Prerequisites: undergraduate thermodynamics, statics, and dynamics. This is an introductory *~*course in biomechanical engineering designed to interpret the functioning of physiological systems in terms of mechanical engineering systems. Topics include fluid flow, structure and motion, transport and material aspects, and energy balances of the body as well as the overall interaction of the body with the environment.

*ME 671

Biomechanics of Human Structure and Motion 3-0-3

Prerequisites: undergraduate statics, kinematics, and dynamics. Principles of engineering mechanics and material science are applied to the study of the behavior of human structural and kinematic systems and to the design of prosthetic devices. Topics include anatomy; human force systems; human motion; bioengineering materials; design of implants, supports, braces, and replacement limbs.

*ME 679

Polymer Processing Techniques 3-0-3

Prerequisites: undergraduate courses in fluid dynamics and heat transfer. A course dealing with the processing of plastics. Included are the fundamentals of the various processing techniques such as extrusion, injection molding, compression molding, thermoforming, casting, foaming, etc.

Mechanics

Offered by the Department of Civil and Environmental Engineering. See Civil Engineering course list for faculty.

Mech 230

Statics and Dynamics 4-0-4

Prerequisites: Phys 111, Math 112. The students must have a working knowledge of college level algebra, trigonometry, and elements of calculus in addition to mechanics (physics). Primary objectives include the following: an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces, the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles.

Mech 230H

Honors Statics and Dynamics 4-0-4

Prerequisites: Phys 111, Math 112, and approval of the advisor. An honors course for the student with adequate preparation in freshman physics and math courses. Primary objectives include an understanding of statics and dynamics as given in the regular Mech 230 course, virtual work, LaGranges equations, and moments of inertia. Ability to solve gyroscopic and other three-dimensional problems that require an understanding of vector analysis.

Mech 232

Mechanics of Materials 3-1-3

Prerequisites: Mech 230, Math 211, or equivalents. The entering student must have a working knowledge of statics with emphasis on force equilibrium and free body diagrams. Primary objectives include: an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple practical mechanical problems, and of the mechanical behavior of materials under various load conditions. Classroom studies are supplemented by laboratory experiments.

Mech 235

Statics 3-0-3 Prerequisites: Phys 111, Math 112. The student must have a working knowledge of college level algebra, trigonometry, and elements of calculus in addition to mechanics (physics). Primary objectives include: an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces.

Mech 235H

Honors Statics 3-0-3 Prerequisites: Phys 111, Math 112, and approval of the advisor. An honors version of Mech 235.

Mech 236

Dynamics 2-0-2

Prerequisites: Mech 235. Primary objectives include the following: an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles.

^{*}These courses are offered as graduate courses but may be taken as undergraduate electives with approval of the chairperson or associate chairperson of the mechanical and industrial engineering department.

Mech 330 Mechanics of Rigid and Deformable Bodies 4-0-4

Corequisites: Phys 111 and Math 112. A course for chemical engineering majors in which the equilibrium of rigid bodies, including simple machines and trusses, is studied emphasizing two-dimensional problems using scaler methods. Mechanics of deformable bodies includes the topics of pressure vessels, torsion of shafts, stresses in beams and column action. The kinematics of particles and the relation between forces and the motion of particles are studied.

Nuclear Science

Offered by the Department of Physics. See Physics course list for faculty.

NuSc 461

Nuclear Reactor Physics 3-0-3

Prerequisites: Physics III; Math 222. The basic concepts of nuclear reactor practice are introduced and developed in ways that suit their ultimate applications to the design of a reactor. Topics include nuclear instability and radioactive decay, nuclear interactions, nuclear fission, neutron slowing down, and reactor criticality.

NuSc 462

Nuclear Reactor Theory 3-0-3

Prerequisite: NuSc 461. Selected topics in the analysis, design, and construction of nuclear reactors including neutron diffusion; one, two, and multi-energy-group as well as Fermi age calculations; reactor kinetics; poisoning; reactor control; temperatúre effects; and numerical calculations.

NuSc 463

Neutron Transport Theory 3-0-3

Prerequisites: Physics III; Math 222. A geometric approach to problems dealing with the ways in which neutrons distribute themselves in various regions of space is presented for situations that have exact analytic solutions. The mathematical laws which describe these neutron distributions are developed. Solutions of the mathematical equations, both exact and those using various numerical approximations, are compared to provide an understanding of how neutrons are distributed in various regions of a nuclear reactor and a radiation shield.

NuSc 464

Nuclear Reactor Laboratory 2-2-3

Prerequisite: NuSc 461. The course is largely a laboratory and consists of basic experiments in nuclear instrumentation and experiments with a sub-critical reactor. The experiments performed are of such a nature as to assist the nuclear scientist in the general areas of reactor analysis and design. Computer and numerical techniques are emphasized.

Operations Management

Offered by the School of Industrial Management. See Management course list for faculty.

OM 375

Management Science 3-0-3 Prerequisite: Mgmt 216. Introduction to statistical and mathematical techniques used in management decision making. Students will develop the concepts of management science and use its techniques with unrestricted focus. Operations management applications will be made in factory settings, health-care and other service industries, education and government agencies. (formerly IM 329)

OM 377

Introduction to Manufacturing Management 3-0-3

Prerequisites: Mgmt 216 and OM 375. A comprehensive technical survey of important management topics in manufacturing technology and related systems. Evaluation methods in manufacturing automation strategies, flow line production, industrial robots, material handling, group technology, flexible manufacturing systems, automated-inspection, process control, and computer integrated manufacturing (CIM) systems. An introduction to modern manufacturing systems with an emphasis on economics as well as technical issues related to manufacturing technology. Course includes practical laboratory sessions with plant visits and videotape presentations.

OM 378

Purchasing and Materials Management 3-0-3

Prerequisite: Mgmt 390. The functions necessary to the effective and efficient procurement of resources necessary for the operation of the enterprise: purchasing system procedures, quality assurance, specification preparation, contracts and traffic. Materials management emphasized. (formerly IM 351)

OM 379 Operating Control 3-0-3

Prerequisite: Mgmt 390. The modern techniques of control based on systems concepts. The areas covered relate to control of production, quality, materials, costs, and facilities. Special attention is given to use of the computer in operations control. (formerly IM 330)

OM 380

Introduction to Operations Research I 3-0-3

Prerequisite: OM 375. An introduction to the methodology of operations research and system analyses as they apply to managerial problems. Concepts of objective functions and constraints, theories of values, and optimization. Elementary mathematical models of linear production systems, linear program-

ming, single-stage inventory systems, projects and transportation planning. Topics will be discussed from the deterministic point of view. The course provides introductory decision-making skills for the analyses of operations research and related problems. It provides the foundation needed for all subsequent courses in management science.

OM 381

Introduction to Operations Research II 3-0-3

Prerequisite: OM 380. A continuation of OM 380, introducing uncertainty, risk, and the probabilistic approach. Elementary mathematical models of reliability, replacement analysis, inventory, quality control systems; waiting line models arrival and exponential service; game theory and statistical decision making. The course provides advanced decision-making skills for the analyses of operations research and related problems. Emphasis is on probabilities models.

OM 475

Production Planning and Control I 3-0-3 Prerequisites: CIS 101, IE 221, junior or senior standing. The components and functioning of in-production, planning, and control systems. Material, equipment, and manpower requirements for optimizing continuous and intermittent manufacturing operations. The use of a computer to simulate such

OM 476

Quality Control 3-0-3

models. (cross-listed IE 459)

Prerequisite: MNET 315. The management of industrial quality control, development and treatment of the operational and statistical principles of acceptance sampling and process control, and problems in control chart operations. (cross-listed MNET 420)

OM 477

Work Measurement Techniques 3-0-3

(Not to be taken by manufacturing technology students). Work measurement and methods appraisal techniques for industrial and clerical operations. Charting, micro-motion study, stop watch analysis, element analysis, rating and leveling, practice studies of hand and machine operations, work sampling, predetermined times. (cross-listed MNET 419)

OM 480

Production Processes/Production Planning and Control 2-2-3

Introduction to design and control of manufacturing processes. Theory and practice of manufacturing techniques, measurement and quality control, automated processes and tape controlled machines. Selection of the best and most economical processes to meet design specifications. In addition to lecture and discussion, the student observes equipment in operations in the laboratory and in plant visits. (cross-listed IE 224)

OM 481

Production Simulation Seminar 3-0-3

Prerequisites: Acct 317; HRM 303; Econ 265 and Econ 266, or SS 201. An exercise in production analysis and control utilizing a digital computer as a simulated enterprise in the ongoing process of production. Decisions under uncertain conditions in production facilities and equipment, inventory management, capacity utilization, production quotas and control, manpower requirements, and financial needs. (formerly IM 448)

OM 482

Quantitative Methods in Forecasting 3-0-3 Prerequisites: IE 439, IE 331. An analytical approach to forecasting based on time series techniques, with application to marketing, inventory control, and management. Techniques include regression, auto-regression, and moving average processes and exponential smoothing. Applications and computational efficiency are stressed. (formerly IE 467)

OM 483

Operations Management Forecasting 3-0-3 Prerequisite: Econ 265 and Econ 266, or SS 201. Concepts and techniques of successful management of production and services enterprises. Strategic planning, market iden-tification, sales forecasting, resources planning, facilities design, capacity requirements planning, production scheduling, work methods analysis, quality assurance, energy and safety management and value analysis. Computer simulation and other management science techniques. (formerly IE 490)

OM 484

Production Planning and Control II 3-0-3 Prerequisite: IE 459. Further exploration of basic management functions as applied to production and operations analysis and control, including topics underlying optimization of arrangement of physical facilities (plant layout, site selection and materials handling), and topics germane to the planning, schedul-ing and control of production timing. Decision-making skills with emphasis on computer modeling for the analysis of advanced production and operations problems in manufacturing as well as service systems.

Philosophy

Offered by the Department of Humanities. See Humanities course list for faculty.

Phil 431

Problems in Philosophy 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. An examination of problems of a social, ethical, esthetic, religious, and scientific nature and a study of the related principles and methods of philosophy. Readings will be chosen from a wide range of periods and schools from the Greeks to the present, with some application of philosophical analysis to individual and societal problems.

Phil 433

Moral Philosophy 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. A critical discussion of the history and fundamental elements of ethical thought. The course will examine topics such as the basic ethical theories, the nature of right and wrong, the significance of moral choice, the structure of the moral life, and the place of reason in ethics. Readings from both classical and modern philosophers.

Phil 434

Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. A philosophical examination of the nature of engineering practice and applied technology. The course considers such questions as: How do the societal functions of engineers and the practical application of technologies relate to basic moral and intellectual values? What moral obligations are implied by the uses of technology? What are the ethical duties of engineers in the practice of their careers? How are technological practice and engineering related to questions about knowledge and reality?

Phil 450

Representative Philosophies 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. The ideas of a few great thinkers, from a variety of historical periods. The purpose is to show the student at first hand how these philosophers accelerated intellectual progress and how their work may contribute to the solution of modern problems.

Phil 455

The Philosophy of Science 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. An investigation into the foundations and implications of modern science, with special emphasis on the influence of philosophy on scientific thought, and on philosophic questions.

Physical Education

Offered by the Division of Physical Education and Athletics

Director: J. Malcolm Simon Coordinator: Duane Felczak Professor: Simon Specialists: DeNure, Felczak, Kostecky, Milavsky, Perez, Zabriskie

PE 101

Introduction to Lifetime Sports I 0-1-1 This class, offered only in the fall semester, will introduce a variety of the individual, dual, and team sports available at NJIT.

PE 102

Lifetime Sports II 0-1-1 A continuation of PE 101; students may participate in a variety of activities or develop an area(s) of concentration.

PE 103

Swim Instruction 0-1-1 Students develop aquatic skills, including various swimming strokes and rescue techniques, according to skill level. Limited to 10 students.

PE 104

Survival Swimming 0-1-1 This course is designed for the average, weak or non-swimmer and will emphasize

survival swimming, basic rescue and water safety techniques, and swimming instruction.

PE 105

Lifesaving/Lifeguard Training 0-1-1 An American Red Cross certification course. The purchase of textbooks will be required. Laboratory hours to be established at first lecture.

PE 106

Water Safety Instructor 0-1-1

Prerequisite: Valid Advanced Lifesaving certificate. An American Red Cross certification course. The purchase of textbooks will be required. Laboratory hours to be established at first lecture. Upon successful completion of this course, an individual will be able to teach swimming at all levels as well as emergency water safety.

PE 108

Sports for Women 0-1-1

A course designed specifically for women interested in learning and competing in individual, dual and team sports.

PE 110 Skiing 0-1-1

A course of instruction and practical experience in recreational skiing designed for the novice and intermediate skier. The course will include lectures on safety, equipment and clothing, first aid and injuries, tuning and repair; six sessions at Hidden Valley, and possibly one weekend trip to Vermont. Students will be responsible for costs of lift tickets and any equipment rentals. Transpor-tation may be provided.

PE 111

Introduction to Bowling and Archery 0-1-1 A course designed to teach the rules, techniques and scoring of each sport. Archery equipment will be provided. For bowling, students must pay a \$1 per class alley fee.

PE 113

Volleyball 0-1-1 Students learn current techniques and skills while playing triples (3 on 3) and leading up to competitive team (6 on 6) volleyball.

PE 114

Advanced Volleyball

Prerequisite: PE 113 or approval of the instructor. Advanced methods and techniques of spikes, serves, blocks, sets, team transi-tion, strategy, tournament play, statistics and videotape analysis.

PE 115

Strength Training and Conditioning 0-1-1 Covers strength and conditioning techniques and programs, goal setting, and record keeping.

PE 118

Walking 0-1-1 An approach to cardiovascular fitness and weight reduction. Walking tours may be offered.

Emphasis on preparation for touring and recreational biking. May include some short tours. Students must have their own bikes.

PE 120

Introduction to Racquet Sports 0-1-1 An introduction to the racquet sports of badminton, paddleball, tennis and racquetball. The course will include rules of play, service, strokes and playing strategy for singles and doubles.

PE 121

Badminton 0-1-1 The course will include the rules, skills, strokes and strategies of badminton, and will provide an opportunity for competition.

PE 122

Paddleball 0-1-1

A course covering rules, skill building, strategies, and tournament play.

PE 123

Tennis for Beginners 0-1-1 This course will introduce students to the rules and basic techniques and strategies of tennis.

PE 124

Intermediate Tennis 0-1-1

This class will emphasize correcting problem strokes, strategies, drills and tournament play.

PE 125

Golf 0-1-1 Designed for the beginner or intermediate golfer. Areas to be covered are grip, stance, swing, strokes and use of clubs, progressing towards actual course play. Students will have to provide their own clubs and pay green fees.

PE 127

Sailing and Windsurfing 0-1-1

Learn the basics of small boat sailing and windsurfing. Course will include principles of sailing, rules of the road and boat maintenance with practical experience at Spruce Run Reservoir. Transportation may be provided.

PE 128 Hydrofitness 0-1-1

A water fitness course designed to tone major muscle groups, and strengthen the cardiovascular system. Course includes exercises for all parts of the body, recipes for staying in shape, and the aerobic way to a strong heart.

PE 129

Individualized Fitness 0-1-1

Specific training to meet the individual student's interest. Areas include techniques of strength training, goal setting and record keeping.

PE 132

Aerobics 0-1-1

Course is designed for cardiovascular conditioning, weight loss, and muscle toning.

PE 133

Swim for Health 0-1-1

A course designed for those who want to use swimming to improve their health and fitness. Swim for Health is a concentrated program which teaches students the techniques and methods used in the development of individualized "training programs."

PE 134

Beginning Fencing 0-1-1 Introduces fencing as both a lifetime and intercollegiate sport. Basic equipment is provided.

PE 135

Beginning Swimming 0-1-1

A course designed for the non-swimmer. Includes survival techniques and basic rescue.

PE 136

Beginning Karate 0-1-1 An introductory course in shotokan karate. Includes basic self-defense. Gi (martial arts uniform) optional.

PE 137

Intermediate Karate 0-1-1

A continuation of PE 136. Includes an introduction to katas, Japanese terms and complex self-defense. Gi (martial arts uniform) required.

PE 140

Weights in Motion for Women 0-1-1

A course designed as a low-impact aerobic program utilizing handweights to increase flexibility, coordination, muscle tone and cardiovascular endurance.

PE 141

Introduction to Dance 0-1-1 An introduction to several styles of dance, including ballet, modern, jazz, tap, folk, ethnic, and social.

PE 142

Introduction to Racquetball 0-1-1 An introduction to rules, skill development, strategies and tournament play.

PE 143

Introduction to Wallyball 0-1-1 An introduction to rules, skill development, strategies and tournament play.

Physics

Offered by the Department of Physics

Acting Chairperson: Leon J. Buteau, Jr. Sponsored Chairperson: William Carr (microelectronics) Professors: Buteau, Carr, Fink, Gautreau, Goode, Levy, Savin Associate Professors: Chin, Farber, Natapoff, Ravindra, Reiziss, Russo, Stevenson, Towfik Assistant Professors: Giordano, Jermakian, Reisman

Phys 100

Introductory Physics 3-2-4

This course is designed for students who have not had high school physics and for those who wish to review the subject. It may be taken in the summer preceding the freshman year or in the first semester of the freshman year. It consists of a survey of introductory physics with special emphasis on those portions of the subject matter which are most useful to engineering students. Does not fulfill NJIT General University Requirements.

Phys 102

General Physics 3-0-3

Prerequisite: satisfactory completion of two high school mathematics courses and two high school science courses. This course is intended for students in architecture. It is an elementary course in statics and dynamics. Subjects discussed are kinematics, Newton's laws of motion, energy, momentum, conservation principles, and mechanical properties of matter. Lab must be taken concurrently.

Phys 102A

General Physics Laboratory 0-2-1

Prerequisite: same as Phys 102. This course is the laboratory component of Phys 102 and must be taken concurrently.

Phys 103

General Physics 3-0-3

Prerequisite: Phys 102. This course is intended for students in architecture. Topics discussed are heat, thermodynamics, sound, wave motion, illumination, geometric and physical optics, and color. Lab must be taken concurrently.

Phys 103A

General Physics Laboratory 0-2-1 Prerequisite: same as Phys 103. This course is the laboratory component of Phys 103 and must be taken concurrently.

*Phys 105

Physics A 3-0-3

Placement in this course is determined by performance on standardized entrance examinations. This course constitutes a study of elementary mechanics. Emphasis is on the fundamental laws of mechanics and conservation laws. Topics include scalar and vector quantities, rectilinear motion, equilibrium and Newton's laws of motion, friction, work and energy, impulse and momentum. Lab must be taken concurrently.

*Phys 105A

Physics A Laboratory 0-2-1

Placement in this course is determined by performance on standardized entrance examinations. This course is the laboratory component of Phys 105 and must be taken concurrently.

Phys 106

Physics B 3-0-3

Prerequisite: Phys 105; Corequisite: Math 111. This course is an extension of Physics 105 in the area of mechanics and an introduction to electricity and magnetism. Topics discussed will include circular motion, moment of inertia and radius of gyration, angular motion, dc circuits, electric fields, and magnetic fields. Lab must be taken concurrently.

*In some cases, Phys 105 and Phys 105A are taken for additive credit.

Phys 106A

Physics B Laboratory 0-2-1 Prerequisite: same as Phys 106. This course is the laboratory component of Phys 106 and must be taken concurrently.

Phys 107

Physics C 3-0-3

Prerequisite: Phys 106. This course is a continuation of Physics 106 and includes relationships between electric and magnetic phenomena, magnetic properties of matter, and simple ac circuits. Lab must be taken concurrently.

Phys 107A Physics C Laboratory 0-2-1

Prerequisite: same as Phys 107. This course is the laboratory component of Phys 107 and must be taken concurrently.

Phys 111

Physics 1 3-0-3

Corequisite: Math 111. This course deals with the study of elementary mechanics. Emphasis is placed on the fundamental concepts and laws of mechanics especially the conservation laws. Topics discussed are: scalar and vector quantities of mechanics; rectilinear and circular motion; equilibrium and Newton's laws of motion; work, energy, momentum; the conservation laws. Lab must be taken concurrently. See Phys 111A.

Phys 111H

Honors Physics 13-0-3

Corequisite: Math 111. Admission to this course is by invitation, based on class standing and standardized entrance exams. This is the first semester of a three semester program in Honors Physics. This course covers the material taken up in Phys 111, but topics are treated more comprehensively and in greater depth. More extensive use of mathematics is made in Phys 111H. Lab must be taken concurrently. See Phys 111A.

Phys 111A

Physics | Laboratory 0-2-1

Prerequisite: same as Phys 111. This course is the laboratory component of Phys 111 and Phys 111H. Lab must be taken concurrently with Phys 111 or Phys 111H.

Phys 121

Physics II 3-0-3

Prerequisites: Phys 111 or Phys 111H; Math 111. This course deals with an introduction to electricity and magnetism. Topics discussed include simple dc circuits, the electric field, the magnetic field, relationships between electric and magnetic fields, magnetic properties of matter, and simple ac circuits. Lab must be taken concurrently. See Phys 121A.

Phys 121H

Honors Physics II 3-0-3

Prerequisites: Phys 111 or Phys 111H; Math 111. This is the second semester of a threesemester program in Honors Physics. The course covers the material given in Phys 121. Greater use is made of vector analysis. In addition, an introduction to Maxwell's equations for the electromagnetic field and their application to physical problems is given. Lab must be taken concurrently. See Phys 121A.

Phys 121A

Physics II Laboratory 0-2-1

Prerequisite: same as Phys 121. This course is the laboratory component of Phys 121 and Phys 121H. Lab must be taken concurrently with Phys 121 or Phys 121H.

Phys 202

Introductory Astronomy and Cosmology 3-0-3

A non-mathematical presentation of contemporary views of the origin, evolution, and structure of the solar system, stars, galaxies and the universe. Special topics include neutron stars, black holes, gravitationally strange objects, and the "big bang."

Phys 204

Concepts in Physics 3-0-3

This course is intended for B.S. in Management students. BSET students may take this course with permission of advisor. A survey course in physics emphasizing fundamentals in mechanics, heat, sound, light, electricity, and modern physics. Special emphasis given to the nature of scientific analysis and the physics underlying modern technologies. Lab must be taken concurrently.

Phys 204A

Concepts in Physics Laboratory 0-2-1 This course is the laboratory component of Phys 204 and must be taken concurrently.

Phys 230

Physics III 4-0-31/2

Prerequisites: Phys 121, Math 111. This course is intended for students in civil engineering and mechanical engineering only. Elements of simple harmonic motion, wave motion, geometric and physical optics are treated. Modern theories of matter and radiation are discussed. The equivalence of mass and energy is also discussed. Lab must be taken concurrently.

Phys 230A

Physics III Laboratory 0-1-1/2

Prerequisite: same as Phys 230. This course is the laboratory component of Phys 230 and must be taken concurrently. Lab consists of one two-hour session every other week.

Phys 231

Physics III 4-0-4

Prerequisites: Phys 121 or Phys 121H; Math 111. Elements of simple harmonic motion, wave motion, geometric and physical optics are considered. The wave and particle duality of nature is emphasized and made plausible by an examination of the important experiments and theories which lead to the modern concepts of matter and radiation. The conservation laws are broadened to include the law of equivalence of mass and energy. Experiments complement lectures and recitations. Lab must be taken concurrently. See Phys 231A.

Phys 231H

Honors Physics III 4-0-4

Prerequisites: Phys 121 or Phys 121H; Math 111. This is the third semester of a threesemester program in Honors Physics. This course covers the material given in Phys 231. Physical optics is treated in greater detail. Modern physics includes a greater number

of topics, with special emphasis on the waveparticle duality in nature. Lab must be taken concurrently. See Phys 231A.

Phys 231A

Physics III Laboratory 0-2-1

Prerequisite: same as Phys 231. This course is the laboratory component of Phys 231 and Phys 231H. Lab must be taken concurrently with Phys 231 or Phys 231H.

Phys 233

Physics III 3-0-3

Prerequisite: Phys 121. This course is intended for students in chemical engineering only. Topics include elements of simple harmonic motion, wave motion, interference and diffraction, quantum mechanics, semiconductor models, carrier distribution, Fermi functions, and selected topics.

Phys 310

Introduction to Atomic and Nuclear Physics 3-0-3

Prerequisites: Physics III; Math 222. Selected topics in atomic physics including the Pauli Exclusion Principle and the Atomic Shell Model will be discussed. In nuclear physics, the two-body problem, nuclear models, and alpha, beta, and gamma radiation will be studied. Accelerators and nuclear detectors will also be studied.

Phys 311

Co-op Work Experience I 3 credits

Prerequisite: acceptance into the co-op program. Students gain major-related ex-perience and reinforcement of the academic program. Work assignments are facilitated and approved by the Division of Cooperative Education and Internships. There is a mandatory participation in seminars and a mandatory final report/project.

Phys 320

Astronomy 3-0-3

Prerequisites: Phys 103 or Phys 121 or Phys 121H. A quantitative introduction to the astronomy of the solar system, the stars, the galaxy, and galaxies in general with an emphasis on the physical principles involved.

Phys 335

Introductory Thermodynamics 3-0-3

Prerequisite: Physics III. Introductory thermodynamics, kinetic theory, statistical physics. Topics include equations of state, the three laws of thermodynamics, reversible and irreversible processes.

Phys 390

Selected Topics of Current Interest in Physics 1-0-1

Prerequisite: Physics III. This is a seminar course covering topics that are currently in the forefront of physics. The lecture series offers exposure to such topics as nuclear physics, solid state physics, plasma physics, the special and general theories of relativity, and the history and philosophy of science.

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Phys 411

Co-op Work Experience II 3 credits Prerequisites: Phys 311 and acceptance into the co-op program. Provides for co-op work assignments which must be approved by the Division of Cooperative Education and Interrepting. There is a mandatory participation

ternships. There is a mandatory participation in seminars and a mandatory final report/ project.

Phys 430

Classical Mechanics | 3-0-3

Prerequisites: Phys 230 or Phys 231 or Phys 231H; Math 222. Newtonian mechanics of particles and systems. Lagrange's and Hamilton's approaches. Continuous systems.

Phys 431

Classical Mechanics II 3-0-3

Prerequisite: Phys 430. Continuation of Physics 430. Theory of small oscillations and mechanical waves. Rigid bodies. Topics include: stability, linearization methods, forced vibrators and perturbation theory, fluids and mechanics of continuous media.

Phys 432

Electromagnetism 1 3-0-3

Prerequisites: Physics III; Math 222. Electrostatics and magnetostatics, Maxwell's equations with applications, and electrodynamics.

Phys 433

Electromagnetism II 3-0-3

Prerequisite: Phys 432. Continuation of Phys 432. Maxwell's equations with applications and electrodynamics.

Phys 441

Modern Physics 3-0-3

Prerequisites: Physics III; Math 222. After a brief review of classical physics and kinetic theory, the course considers nuclear and atomic structure. Key experiments illustrating the wave-particle duality are discussed and elements of wave mechanics are introduced, followed by applications of two-state quantum systems. The motion of an electron in periodic lattice is then discussed, leading to a consideration of the band theory of solids. The electrical, thermal and magnetic properties of solids follow. The course ends with a semi-quantitative description of plasmas and superfluid systems.

Phys 442

Introduction to Quantum Mechanics 3-0-3 Prerequisites: Physics III; Math 222. Waveparticle duality, the Schrodinger and Heisenberg formulations of quantum mechanics. The hydrogen atom, perturbation theory, and concepts of degeneracy, composite states and general properties of eigenfunctions.

Phys 443

Modern Optics 3-0-3

Prerequisites: Physics III; Math 222. Electromagnetic theory of light, interference, diffraction, polarization, absorption, double refraction, scattering, dispersion, aberration, and an introduction to quantum optics. Other topics include holography, lasers, information retrieval, spatial filtering, and character recognition.

Phys 446

Solid State Physics 3-0-3

Corequisite: Phys 441 or Phys 442. An introduction to modern concepts of the solid state. Topics include crystal structure and diffraction, crystal binding and elastic properties, thermal properties, dielectric phenomena, band theory of solids and Fermi surfaces, electrical conductors, semiconductors, magnetism, and superconductivity.

Phys 448

Semiconductor Physics 3-0-3

Prerequisite: Physics III. The physics of semiconductors is examined and applied to problems of interest to the engineer. The course includes the following topics: the band theory of solids, conduction in solids, hole and electron statistics, and P-N junction theory with emphasis placed upon low-level and high-level injection. Metal semiconductor contacts and P-N-P transistor theory are also discussed.

Phys 449 Advanced Physics Laboratory 0-6-3

Prerequisites: senior standing and permission of the department. Students will draw on previous studies to examine experimentally the interaction of photons and particles. These interactions will be examined by optical and spectroscopic methods involving nonmonochromatic as well as laser light, by electrical and electronic devices, using vacuum, thin film, and Hall measurement techniques, by nuclear irradiations involving a subcritical reactor and the necessary associated measuring methods. Independent study, library research, and data reduction involving advanced error analysis form an integral part of the course.

Phys 450

Advanced Physics Laboratory 0-4-2

Prerequisites: advanced standing and permission of the instructor. Introduction to electrical measurements; instrumentation; theoretical and applied electronics, solid state electronic devices, digital circuitry; computer design; experiments in modern physics.

Phys 452

Atomic and Nuclear Physics 3-0-3

Prerequisites: Physics III; Math 222. Topics include atomic spectra, atomic structure, and nuclear physics.

Phys 456

Introduction to Solid State Physics 3-0-3 Prerequisites: Physics III; Math 222. Treats

the same topics as Phys 446 while introducing the necessary modern physics. Designed for students choosing a minor in applied physics. Students majoring in applied physics are ineligible.

Phys 461

Mathematical Methods of Theoretical Physics 3-0-3

Prerequisites: Phys 430, Phys 432, Phys 433. Topics include vector and tensor analysis, matrix methods, complex variables, Sturm-Liouville theory, special functions, Fourier series and integrals, integral equations, and numerical solutions of differential equations. Phys 481

Applied Solid State Physics: Microelectronics I 3-0-3

Prerequisite: Phys 446 or Phys 456. Topics include physics of bipolar and field effect devices and Phonon and optical spectra, unipolar devices, thermal and high field properties of semiconductor devices. (Not to be taken if EE 463 has been taken).

Phys 482 Applied Solid State Physics:

Microelectronics II 3-0-3

Prerequisite: Phys 446 or Phys 456. Topics include large-scale integrated circuits, device characteristics, charge-coupled devices, LED and semiconductor lasers, photodetectors and electrical and optical properties of materials. (Not to be taken if EE 463 has been taken).

Phys 483

Applied Solid State Physics: Computer Electronics 0-6-3

Prerequisite: Phys 446 or Phys 456. Introduction to digital concepts; binary circuits and microprocessor architecture. Applications of discrete solid-state devices and integrated circuits are explored both in theory and practice. The laboratory also serves as an introduction to hardware and software components of a typical microcomputer.

Phys 485

Computer Modeling of Applied Physics Problems 3-0-3

Prerequisites: Physics III; Math 222. General computer programming modeling methods and techniques. Numerical solutions to integro-differential equations. Eigenvalues problems. Application of computer-aided-design and other packages.

*Phys 605

Classical, Modern, and Solid State Physics 13-0-3

Prerequisites: Physics III; Math 222 or the equivalent. Classical mechanics, statistical mechanics and thermodynamics, quantum mechanics, and solid state physics. Classical and modern physics presented as back-ground to course in solid state physics. Topics to include Bloch theorem and methods of calculating electronic band structure, Fermi surfaces, conduction and optical properties of solids and topics of special interest.

*Phys 606

Classical, Modern, and Solid State Physics II 3-0-3

Prerequisite: Phys 605. Continuation of Phys 605.

*These courses are offered as graduate courses but may be taken as electives with approval of the department.

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Required Courses offered at Rutgers-Newark

Phys 750:307

Computer Electronics 4 credits Prerequisites: Phys 446 or Phys 456. Introduction to digital concepts; binary circuits and microprocessor architecture; applications of discrete solid-state devices and integrated circuits. The laboratory serves as an introduction to hardware and software components of a typical microcomputer.

Phys 750:461

Computational Methods in Applied Physics 3 credits

Prerequisites: Physics III; Math 222. General computer progamming modeling methods and techniques; numerical solutions to integro-differential equations; eigenvalue problems; applications of computer-aided design and other packages.

Science, Technology and Society

Offered by the Department of Social Science and Policy Studies. See Social Science course list for faculty.

Acting Director: Eric Katz Associate Director: John O'Connor

STS 257

Technology and Society I 3-0-3 Prerequisites: Eng 111, Hum 112. Examines the nature, functioning, and evolution of manufacturing, communications and other technologies in a social-ecological world.

The first semester uses case studies and visits to engineering laboratories and other plant sites to focus on scientific and technological forces that are reshaping our domestic economy.

STS 258

Technology and Society II 3-0-3

Prerequisites: Eng 111, Hum 112. Examines the nature, functioning, and evolution of manufacturing, communications, and other technologies in a global environment. The second semester uses case studies and engineering site visits to focus on scientific and technological forces that are transforming our global political economy.

STS 301

Independent Study 1 credit

The prerequisites for independent study courses in the STS program are junior standing in the program and written approval of the program director. The courses consist of self-paced study on an individual or small group basis in a specific area integral to a student's STS concentration but not available on a regular course basis.

STS 302

Independent Study 2 credits

STS 303 Independent Study 3 credits

STS 304

Writing about Science, Technology and Society 3-0-3

Prerequisite: Eng 111. In this course, students develop their abilities to write lucidly and speak forcefully about the interrelationship of science, technology, and society. Students learn to articulate a sense of purpose so that they can choose the appropriate methods for reporting issues in a technological society. The goal of the course is the effective development and transfer of technical knowledge in a complex world.

STS 308

Technology and Global Development: Introduction to STS 3-0-3

Prerequisites: Eng 111, Hum 112. This course introduces students to the important public issues that technology brings to the modern world, such as energy development and environmental pollution. It emphasizes the close connections between science and technology, social institutions, and cultural values. The course also analyzes today's "global village," the changing relations between East and West and the Third World, and worldwide development and environmental issues.

STS 308H

Honors Technology and Global Development 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 308.

STS 310

Technology and Human Values 3-0-3

Prerequisites: Eng 111, Hum 112. The course examines the interactions between science, technology and human values. Specifically, it explores psychological, moral, and philosophical consequences of, and humanistic responses to, technological change. Readings—essays, fiction, and research articles—treat such topics as the philosophical foundations of modern science, scientism, technicism; the impact of technology on images of man found in modern literature; and the moral implications of various kinds of recent technology.

STS 310H

Honors Technology and Human Values 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 310.

STS 311

Co-op Work Experience | 3 credits

Prerequisites: completion of the sophomore year, approval of the department, and permission of the Division of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op Division. Mandatory participation in seminars and completion of a report.

STS 316

Mass Communications, Technology and Culture 3-0-3

Prerequisites: Eng 111, Hum 112. This course uses the tools of the humanities and social sciences to study the interplay between technology and mass culture. Focus is upon motion pictures, electronic music, and television as both technologies and as forms of art. Special attention is also devoted to the portrayal of science and technology in the media.

STS 316H

Honors Mass Communications, Technology and Culture 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 316

STS 321-325

Special Topics in Science, Technology and Society 3-0-3

An in-depth examination of a current STS issue. A new topic is addressed each time the course is offered.

STS 330

The Professional Engineer: History and Context 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. An examination of the origins of modern engineering and the context in which engineering has developed. The course includes an analysis of the contemporary bureaucratic culture—its structure and the values which drive it. The student will be expected to confront both the constraints and opportunities presented by the professional world of engineering.

STS 330H

Honors the Professional Engineer: History and Confect 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 330.

STS 350

Computers and Society 3-0-3

Prerequisites: completion of a 100-level GUR course in CIS. Examines the historical evolution of computer and information systems and explores their implications in the home, business, government and science. Impacts on the individual, the organization, and society are considered. Topics include automation and job impact; applications in electronic funds transfer, government, education, medicine and others; professional ethics, and legal issues. Co-listed as CIS 350.

STS 395

Theories of Science, Technology, and Society 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231, SS 200 or equivalent. Theory-building in science, technology and society. The course considers competing intellectual traditions in creating a theory of STS. The course covers such themes as the relationship between science, technology and the state; social epistemology; laboratory science studies; feminist perspectives on science and technology; ecological foundations for science and technology, and the globalization of science and technology.

STS 395H

Honors Theories of Science, Technology, and Society 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 395.

STS 401

Independent Study 1 credit The prerequisites for independent study courses in the STS program are junior standing in the program and written approval of the program director. The courses consist of self-paced study on an individual or small group basis in a specific area integral to a student's STS concentration but not available on a regular course basis.

STS 402

Independent Study 2 credits

STS 403

Independent Study 3 credits

STS 411

Co-op Work Experience II 3 credits Prerequisites: STS 311 or its equivalent, approval of the department, and permission of the Division of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project.

STS 412

Technology and Policy in Contemporary America 3-0-3

Prerequisites: Eng 111, Hum 112. A study of technology and politics in recent America. Focuses on the role of the federal government in shaping technology, especially through funding technological innovations and applications. Topics will include the origins of technology policy in World War II, the influence of the Cold War, the science and technology policy advisory system, and political and cultural influences on technology policy.

STS 412H

Honors Technology and Policy in **Contemporary America 3-0-3**

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 412.

STS 413

Environmental History and Policy 3-0-3 Prerequisites: Hum 231, SS 201. This course covers the rise of the modern environmental debate, and examines its current priorities and values, politics and economics, and impacts on industry and society. Students review the role of regulatory agencies, private industry, public interest groups, and the media. Current major issues in New Jersey are considered, as well as environmental debate on a national and global level.

STS 413H

Honors Environmental History and Policy 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 413.

STS 414

Environmental Economics 3-0-3

Prerequisites: SS 201 or equivalent or instructor's permission. A detailed overview of the relationship between political economy and the environment. This course draws on diverse case studies including global warming, harvesting of minerals on the ocean's floors, destruction of old growth forests, and contamination of the nation's water, air and soils. The course explores economic remedies to the fast-changing relationship between society and nature.

STS 414H

Honors Environmental Economics 3-0-3 Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 414.

STS 444

Communications Policy 3-0-3 Prerequisites: Eng 111, Hum 112, SS 200 or equivalent. Study of communication environments and developing communications technologies as central elements of evolving political and social systems. Analysis of philosophical, military, economic and technical premises for communications policy and the process of regulation.

STS 444H

Honors Communications Policy 3-0-3 Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 444.

STS 460

Ethics and the Environment 3-0-3 Prerequisites: Eng 111, Hum 112, Hum 231. An examination of contemporary en-vironmental problems from the perspective of ethics or moral philosophy. An analysis of the ethical presuppositions and value principles underlying environmental policy. The study of ethical theories and their application to the environmental crisis.

STS 460H

Honors Ethics and the Environment 3-0-3 Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 460.

STS 471

City and Country in the Americas 3-0-3

Prerequisites: Eng 111, Hum 112, Hum 231. This course focuses on the technological choices and cultural attitudes which have shaped the cityscapes and landscapes of North and Latin America. Topics of study include an examination of urban and rural land use patterns, the concept of regionalism, attitudes toward nature and the wild, and the ideas of home and place. Students will be expected to link these topics in a project exploring the impact of settlement in cases drawn throughout the Americas.

STS 471H Honors City and Country in the Americas 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to STS 471.

STS 490 Project and Seminar I 3 credits

Prerequisite: senior standing in the STS program. Each student undertakes a comprehensive study of an issue in science technology and human affairs. The solution will require application of knowledge and skills acquired in course work, self-study, and library research as well as consultation with persons in the academic community, in-dustry, and government. The completed study will be submitted as a detailed written report. The seminar meets weekly. Speakers from education, government, and industry will address themselves in topics of current interest to STS students.

STS 491

Project and Seminar II 3 credits A continuation of STS 490.

Required Courses offered at Rutgers-Newark

Political Science 790:310

Science, Technology, and Public Policy 3-0-3

Study of political issues that involve science and technology, such as arms control, energy resources, environmental pollution, public health, occupational safety, and technology transfer.

STS 880:331, 332

Topics in Science, Technology, and Society 3-0-3

An interdisciplinary approach to issues that face the world; examined from the perspectives of the natural sciences, the social sciences, and the humanities.

Social Science

Offered by the Department of Social Science and Policy Studies

Professors: Bordman, Geithman, O'Connor, Opie

Associate Professors: Elliot, McMahon, Sher Assistant Professors: Black, Katz, Spitz

SS 200

Understanding Technological Society 3-0-3

problem-centered and task-oriented A course that integrates social science theory and practice into the leading public issues of a technological society. Students learn critical thinking through hands-on assignments. The course emphasizes student understanding of social institutions that directly affect technological development and professional careers.

SS 200H

Honors Understanding Technological Society 3-0-3

Prerequisites: admission to the Honors Program or permission of the instructor. An honors course parallel to SS 200.

114

SS 201

Economics 3-0-3

The nature of a market economy. Microeconomics—demand theory, production possibilities, cost and price, equilibrium analysis, and applications to decision making in the firm. Macroeconomics—national income accounts, consumption, investment, government monetary and fiscal policy, and problems of employment and price levels. Economic analysis leading to an understanding of current developments in the United States economy and international trade and currency problems. Students who have received credit for Econ 265 or Econ 266 may not subsequently receive credit for SS 201.

SS 201H

Honors Economics 3-0-3

Prerequisite: Admission to the Honors Program or permission of the instructor. An honors course parallel to SS 201.

SS 210

General Psychology 3-0-3

Introduction to the study of human behavior. Topics include motivation, perception, learning, cognitive development, personality and emotion, individual difference, and biological basis of behavior, as well as methodology in psychological research.

SS 210H

Honors Psychology 3-0-3

Prerequisite: Admission to the Honors Program or permission of the instructor. An honors course parallel to SS 210. Presents the basic principles and methods of psychology. Topics include experimental logic and design principles, biological basis of behavior, perception, learning, cognitive processes, motivation, personality development, psychopathology, and social processes. As part of the course, research projects are undertaken.

SS 221

Sociology 3-0-3

An examination of modern society and culture, analyzing the forces for stability and change. Topics covered are: the individual and society (socialization, conformity, alienation, class structure); social institutions (religion, law, education, family, state); social process (conflicts and harmony, cohesion and dissolution, power, authority and revolution); urbanization, industrialization and technological change.

SS 231

Political Science 3-0-3

The course analyzes the concept of the state, authority, institutions of control, monarchy, dictatorship, democracy; constitutionalism and liberty; and the relationship between the law, the state, and the individual.

SS 338

Issues in Public Policy 3-0-3

Prerequisites: SS 201, or Econ 265 and Econ 266; in addition, one of the following: SS 210, SS 221, SS 231. A survey of key social and political issues within a public policy perspective. Topics covered include policy problems with an emphasis on economics, urban and regional planning, sociology-psychology, natural science or engineering, and problems with a political science emphasis.

SS 431

Municipal Government in Contemporary Society: Theory and Practice 3-0-3

Prerequisite: junior standing. This course is designed to provide the municipal engineer or planner with a foundation for planning and operational efficiency based upon the concepts and problems of local government. Attention is focused on such topics as fiscal management, intergovernmental relations, and planning and operation of public works.

SS 451

International Relations 3-0-3

Prerequisite: SS 201, or Econ 265 and Econ 266, or SS 231. Analysis of the factors affecting relations among nations. Emphasis on the growing interdependence of the world system. Examination of international agencies, such as the United Nations, the World Bank, and the International Monetary Fund. International political and economic conflict. Patterns of power, and the roles of diplomacy, war, and international terror. Attempts to ameliorate conflicts among nations.

SS 452

Social, Political and Economic Implications of Race and Ethnicity 3-0-3

Prerequisite: SS 210 or SS 221 or SS 231. An examination of cultural and psychological patterns of behavior as a manifestation of how minorities in the United States function within a multi-cultural, multi-ethnic society. Some consideration will be given to divergent value systems, ethical codes, patterns of racism and prejudice, and the social and psychological implications of being bilingual and bicultural. Emphasis will be placed upon the Black and Hispanic experiences.

SS 506

Technology Assessment 3-0-3

Prerequisite: SS 201, or Econ 265 and Econ 266; a course in calculus or statistics. A framework for assessing the impact of technology on society, taking into account both present and future interactions of economic, social, and environmental factors. The approach to existing problems will be multidisciplinary, and analytical techniques for evaluation and forecasting will be utilized and demonstrated (i.e., benefit-cost analysis, cross-impact matrices).

SS 511

Economics of Energy 3-0-3

Prerequisite: SS 201, or Econ 265 and Econ 266. The demand for energy, its sources and determinants (elasticity measures); trends in patterns of energy use and future prospects; international aspects. The supply of energy; alternative sources (coal, nuclear, geothermal, solar); economic analysis of shifts among sources; industrial and market structures in the energy production sector; significance for supply elasticities and energy prices. The "energy crisis"—analysis and evaluation. The economics of long-range energy decisions-new sources, conservation, and environmental protection; evaluating costs and benefits; decision model for energy technology assessment; the breeder deferment decision; energy economy interactions; energy sector share of GNP; impact of energy cuts on GNP; alternative economic techniques for reducing energy consumption. (Co-listed as Econ 511).

SS 521

Urban Social Structure 3-0-3

Prerequisite: at least one course in social science. An introduction to the city as a social system. The study of the conflict relations among various segments of the urban population; race and religion—their implications; the changing systems of social stratification; urban family structure; and the concept of a "culture of poverty." The impact of social and technological change upon urban society, the physical and environmental characteristics of a city as outputs of social systems as well as constraints upon behavior.

Support Courses

Frsh Sem

Freshman Seminar

Issues related to a successful college life are discussed during this weekly seminar course. Topics include: time management, study skills, interpersonal relationships and career decision making. Freshman Seminar is a graduation requirement for all first-time, full-time freshman students.

Tutr 089

Freshman Tutorial I

Prerequisite: special permission. Developmental in nature, this course is designed to assist students in developing appropriate study skills strategies that will lead to eventual success at NJIT. Particular attention will be paid to problem solving, study skills, abstract and cognitive skills development.

Tutr 090

Freshman Tutorial II

Prerequisite: special permission. Developmental in nature, this course is designed to assist students in developing appropriate study skills strategies that will lead to eventual success at NJIT. Particular attention will be paid to problem solving, study skills, abstract and cognitive skills development.



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AKANSU, ALI N., Assistant Professor of Electrical Engineering (1987). Technical University of Istanbul, B.S.E.E., 1980; Polytechnic Institute of New York, M.S.E.E.; Ph.D., 1987.

ALLENTUCH, ARNOLD, Professor of Mechanical Engineering (1966), and Associate Vice President for Academic Affairs—Research (1980). Worcester Polytechnic Institute, B.S.M.E., 1953; Cornell University, M.S., 1959; Polytechnic Institute of Brooklyn, Ph.D., 1962.

ANDRUSHKIW, ROMAN I., Professor of Mathematics (1964). Stevens Institute of Technology, B.E., 1959; Newark College of Engineering, M.S.E.E., 1964; University of Chicago, M.S., 1967; Stevens Institute of Technology, Ph.D., 1973.

ANSARI, FARHAD, Professor of Civil and Environmental Engineering (1983). University of Illinois, B.S., 1975; University of Colorado, M.S., 1978; University of Illinois, Ph.D., 1983.

ANSARI, NIRWAN, Assistant Professor of Electrical Engineering (1988). New Jersey Institute of Technology, B.S.E.E., 1982; University of Michigan, M.S.E.E., 1983; Purdue University, Ph.D., 1988. ARMENANTE, PIERO, Associate Professor of Chemical Engineering (1984). University of Rome, Laurea in Ingegneria Chimica, 1977; University of Virginia, Ph.D., 1984.

BADENHAUSEN, OTTO P., Assistant Professor of History (1967). Hamilton College, B.A, 1954; Berlin Free University, M.A., 1959. BAGHERI, SIMA, Associate Professor of Civil and Environmental Engineering (1984). Teheran University, B.S., 1965; Illinois State University, M.S., 1968; University of Wisconsin, Ph.D., 1984.

BALES, ERVIN L., Research Professor of Architecture and Research Professor of Mechanical Engineering (1984). University of South Carolina, B.S., 1957; Bradley University, M.S., 1962; University of Illinois, Ph.D., 1967.

BALL, W. H. WARREN, Professor of Electrical Engineering (1968). Technical University of Nova Scotia, B.E., 1944; University of Toronto, M.A.Sc., 1946; Cornell University, Ph.D., 1957.*

BALTRUSH, MICHAEL A., Associate Professor of Computer and Information Science (1975) and Associate Chairperson of the Department (1986). University of Connecticut, B.S.E.E., 1968; Ph.D., 1976.

BALTZIS, BASIL C., Associate Professor of Chemical Engineering (1983). National Technical University of Athens (Greece), Diploma in Ch.E., 1978; University of Illinois, at Urbana-Champaign, M.S.Ch.E., 1980; University of Minnesota, Ph.D., 1983.

BARAT, ROBERT B., Assistant Professor of Chemical Engineering (1990). New Jersey Institute of Technology, B.S., 1980; M.S., 1983; Massachusetts Institute of Technology, Ph.D., (1990).

BARNES, WILLIAM, Associate Professor and Program Coordinator of Computer and Electrical Engineering Technology (1990). Northeastern University, B.S.E.E., 1967; Fairleigh Dickinson University, M.S.E.E., 1982.*

BAR-NESS, YEHESKEL, Distinguished Professor of Electrical Engineering (1985) and Director of the Center for Communication and Signal Processing. Technion, Israel Institute of Technology, B.S., 1958; M.S., 1963; Brown University, Ph.D., 1969.

BART, ERNEST N., Assistant Professor of Chemical Engineering (1968). New York University, B.Ch.E., 1957; M.Ch.E., 1960; Ph.D., 1971.

BENANAV, DAN, Assistant Professor of Computer Science (1989). State University of New York at Albany, B.S., 1980; Rensselaer Polytechnic Institute, M.S., 1982; Ph.D., 1989.

BENGU, GOLGEN, Assistant Professor of Industrial and Management Engineering (1988). Bosphourus University, B.S., 1981; North Carolina A&T State University, M.S., 1985; Clemson University, Ph.D., 1987. BERLINER, ARMAND, Assistant Professor of Mathematics (1963). Rutgers University, B.A., 1963; Newark College of Engineering, M.S., 1965. BLACK, MICHAEL, Assistant Professor of Social Science and Policy Studies (1990). University of Oregon, B.A., 1972; University of California, Santa Barbara, M.A., 1973; University of Oregon, Ph.D., 1981.

BLACKMORE, DENIS, Professor of Mathematics (1971) and Director of Graduate Studies in Mathematics (1989). Polytechnic Institute of New York, B.S., 1965; M.S., 1966; Ph.D., 1971.

BLADIKAS, ATHANASSIOS K., Associate Professor of Industrial and Management Engineering (1988) and Associate Director of the Center for Transportation Studies and Research (1989). The City College, B.S., 1971; Columbia University, M.B.A., 1975; Polytechnic Institute of New York, M.S., 1976; Ph.D., 1983.

BONITSIS, THEOLOGOS H., Associate Professor of the School of Industrial Management (1990). Assistant Professor of Economics and Finance (1984). Bernard M. Baruch College, B.A., 1976; The Graduate School, CUNY, Ph.D., 1984.

BORDMAN, SANFORD, Professor of Economics (1968). City College of New York, B.S., 1949; City University of New York, Ph.D., 1969. BOZZELLI, JOSEPH W., Distinguished Professor of Chemistry (1975). Marietta College, B.S., 1964; University of Dayton, M.S., 1968; Princeton University, Ph.D., 1972.

BRICKEN, WILLIAM B., Associate Professor of Architecture (1985). Harvard University, M. Arch., 1977.

BUKIET, BRUCE G., Assistant Professor of Mathematics (1989). Brown University, Sc.D., 1980; Courant Institute, M.S., 1983; Ph.D., 1986. BUTEAU, LEON J., Jr., Acting Chairperson of Physics (1990). Professor of Materials Science (1959). Newark College of Engineering, B.S.M.E., 1958; Stanford University, M.S., 1959; University of Florida, Ph.D., 1963.*

CAGNATI, VINCENT N., Assistant Professor of Chemistry (1958). Columbia University, B.A., 1949; Stevens Institute of Technology, M.S., 1952.

CARPINELLI, JOHN D., Assistant Professor of Electrical and Computer Engineering (1987). Stevens Institute of Technology, B.E.E.E., 1983; Rensselaer Polytechnic Institute, M.E.E.E., 1984; Ph.D., 1987.

CARR, WILLIAM, N., Professor and Holder of Sponsored Chair in Microelectronics (1986). Carnegie Mellon University, B.S., 1959; M.S., 1959; Ph.D., 1962; Southern Methodist University, M.S., 1966.

CATALANO, JIM, Associate Director of Physical Education and Athletics and Men's Basketball Coach (1987). Jersey City State College, B.A., 1973; William Paterson State College, M.Ed., 1980. CAUDILL, REGGIE J., Professor of Mechanical Engineering and Executive Director of the Center for Manufacturing Systems (1990). University of Alabama, B.S., 1971; M.S., 1973; University of Minnesota,

University of Alabama, B.S., 1971; M.S., 1973; University of Minnesota, Ph.D., 1976. CELIK. ZEYNEP. Associate Professor of Architecture (1991). Istanbul

CELIK, ZEYNEP, Associate Professor of Architecture (1991). Istanbul Technical University, B.Arch., 1975; Rice University, M.Arch., 1978; University of California, Ph.D., 1984.

CERKANOWICZ, ANTHONY E., Associate Professor of Mechanical Engineering (1989). Stevens Institute of Technology, B.S., 1962; M.S., 1964; Ph.D., 1970.

CHAKRABARTI, ALOK K., Distinguished Professor of Management, Holder of Sponsored Chair in Management of Technology, and Dean of the School of Industrial Management (1989). Jadavpur University, B.Ch.E., 1963; Indian Institute of Management, M.B.A., 1966; Northwestern University, Ph.D., 1972.

CHAN, PAUL C., Professor of Civil and Environmental Engineering (1966). Chu Hai College, B.Sc., 1958; Worcester Polytechnic Institute, M.Sc., 1962; Texas A & M University, Ph.D., 1968.*

CHANG, TUNG-LUNG, Assistant Professor of Management (1990). National Chengchi University, Taipei, B.S., 1974; M.B.A., 1979; Ph.D., 1984; George Washington University, Ph.D., 1990.

CHAO, DANIEL Y., Assistant Professor of Computer and Information Science (1990). National Taiwan University, B.S., 1976; University of California, Los Angeles, M.S., 1981; University of California, Berkeley, Ph.D., 1987.

CHAO, XIULI, Assistant Professor of Industrial Engineering (1989). Shandong University, B.S., 1983; Columbia University, Eng.Sc.D., 1989.

CHASE, HAMILTON, Associate Professor of Mathematics (1968). City College of New York, B.E.E., 1947; New York University, M.S., 1950; Case Institute of Technology, Ph.D., 1964.*

CHEN, CHIEN-HUEI, Assistant Professor of Computer and Information Science (1988). National Kaohsiung Institute of Technology, B.E.E., 1980; State University of New York at Stony Brook, M.S.E.E., 1984; Purdue University, Ph.D., 1988.