305. Secretarial Administration I
Fall, Winter, Spring. 4(4-0) 236.
Sophomores.
Development of proficiency in transcription skills.

306. Secretarial Administration II
Fall, Winter, Spring. 4(4-2) 236.
Sophomores.
Machine dictation-transcription; duplication and copying processes; machine calculations; records management.

326. Business Writing
Fall, Winter, Spring, Summer. 4(4-0) 441.
Juniors.
Study and analysis of business and industrial communication problems; extensive instruction and practice in writing.

326H. Writing in a Business Culture
Fall, Winter, Spring. 4(4-0) Honors College students.
This intensive honors course in business writing ranges from letters to review articles on professional journals. Historical and linguistic study to illuminate business and technological culture.

341. Survey of Business Law
Fall, Winter, Spring, Summer. 4(4-0) 326.
Juniors.
Not open to business administration students.
Historical development of the law; courts, court procedures and civil remedies, torts, crimes; contracts, agency, sales, negotiable instruments, real and personal property, including bailments and liens. Textbook and lecture rather than case approach.

370. Office Administration
Fall, Winter, Spring, Summer. 3(3-0) 441.
Juniors.
Analysis of office function and relationship to business organization; information handling and data processing; office design and layout; responsibilities of office administrators.

400H. Honors Work
Fall, Winter, Spring, Summer. 1 to 15 credits; Approval of department. Independent and informal study in law, office administration or business communications. Approval of the role of the executive secretary.

410. Secretarial Administration III: Seminar
Winter, Spring. 4(4-0) 416.
Seniors or approval of department.
Analysis of the role of the executive secretary.

440. Law and Society
Fall, Winter, Spring, Summer. 3(3-0) 441.
Seniors or approval of department.
Legal reasoning and legal institutions. Court systems and court procedures. Relationships of citizen and businessman to governmental agencies. Torts, crimes.

443. Property, Sales, Negotiable Instruments
Spring. 4(4-0) 441.
Juniors.
Law of real and personal property, including bailments, liens and security transactions, sales, and negotiable instruments. Case study method used.

445. Real Estate Law
Winter. 3(3-0) 441.
Law of real and personal property, including fixtures, easements, land descriptions, titles, deeds, recording requirements, brokers, land contracts, escrows, closing of sales, abstracts, mortgages, mechanics liens, co-ownership, descent and distribution, administration of estates, zoning, taxes, landlord and tenant. Combined test and case approach.

446. Interstate and International Business Law
Spring. 3(3-0) 441, 440 or 441.
Laws of contracts, sales, negotiable instruments, agency, business associations in the interstate and international spheres. Maritime contracts. International commercial arbitration. Area reviewed studies.

447. Hotel Law
Spring. 4(4-0) 440.
Negotiable instruments, warranties, property, torts, civil rights, agency, partnerships, corporations as applied to hotel and restaurant management.

460. Field Studies
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 8 credits. Business majors and approval of department.
Planned program of observation and work in selected business firms. Analysis and reports.

546. The Legal Environment of Business
Winter, Summer. 4(4-0) 446.
Critical examination of the environment in which business operates. Analysis of the component elements of the legal environment of business and the structural framework in which legal functions operate.

549. Legal Environment of International Business
Spring, Summer. 4(4-0) 449.
Commercial and financial transactions in international business, foreign agencies, branches, subsidiaries. Aspects of labor relations, antitrust, taxation, and transportation as related to foreign operations. Analysis and arbitration in the international business community.

571. Seminar: Office Administration
Winter, Summer. 3 credits. May re-enroll for a maximum of 6 credits. Approval of department.
Problems, practices, and policies involved in office administration. Methods of establishing, analyzing, standardizing, and controlling administrative systems and procedures in the office.

578. Seminar in Business Law
Fall, Spring. 4(4-0) May re-enroll for a maximum of 8 credits. Approval of department.
Public policy with regard to contracts, antitrust, security transactions, labor relations of the firm, viewed from the legislative, judicial, and executive vantage points.

800. Special Problems
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

CHEMICAL ENGINEERING CHE
College of Engineering

201. Chemical Engineering Calculations
Fall, Winter. 3(3-0) CEM 153; MTH 214; PHY 257 or concurrently.
Chemical engineering calculations. Organization of calculations. Material balances, energy balances, behavior of gases, equilibrium relations and reaction rates.

202. Thermodynamics for Chemical Engineering
Winter, Spring. 3(3-0) 201, MTH 215 or concurrently.
First and second laws. Internal energy, enthalpy, entropy, free energy, and work functions. Application to batch and flow processes, open and closed systems, reacting and nonreacting systems. Interrelationships of thermodynamic properties for perfect gases and for real substances.

301. Transfer Processes and Separations
Fall, Winter. 4(4-0) 201; 301 or concurrently; MTH 215.

302. Transfer Processes and Separations
Winter, Spring. 4(4-0) 301.

303. Transfer Processes and Separations
Fall, Spring. 4(4-0) 302.

361. Chemical Thermodynamics
Fall, Spring. 3(3-0) One year general chemistry; one year general physics; MTH 215. Interdepartmental and jointly administered with the Chemistry Department.

401. Applied Process Analysis
Spring. 3(3-0) CEM 130 or 141; MTH 113; or approval of department. Students may not earn credit in both 401 and 201.
Techniques of process analysis applied to natural environmental, and physical systems. Material and energy balances; diffusion, heat conduction and viscous flow. For majors in natural sciences and non-chemical engineers.

422. Chemical Engineering Laboratory
Fall, Winter. 4(0-12) 302.
Assigned projects requiring laboratory investigation. Experimental work involving transport phenomena, momentum, heat, and mass transfer; separation processes such as distillation, filtration, and drying; thermodynamics and reactor kinetics.

428. Chemical Reaction Engineering
Fall. 3(3-0) 303; CEM 362, 461.

443. Chemical Engineering of the Solid State
Spring. 4(4-0) CEM 461.
Polymer, crystalline, organic, and inorganic solids. Relation of bond type and steric con-
446. Polymerization
Fall. 3(3-0). One year organic chemistry, elementary physical chemistry. Interdepartmental study and administered by the Chemistry Department.

Formulation and characterization of polymers of high molecular weight will be emphasized.

451. Dynamics and Control of Chemical Engineering Systems
Winter. 3(0-3), 4TH 215.


460. Problems and Reports
Fall, Winter, Spring. 1 to 9 credits.

Senior, approval of department.

Library and laboratory investigations of problems relating to departmental research.

461. Process Selection and Optimization
Winter. 3(3-0) 303.

Application of chemical engineering principles in design calculations. Selection of the optimum design for equipment, functional units, and for the overall process. Influence of design on capital investment, operating cost, product loss, and product quality.

462. Process Design
Spring. 3(1-0) 401.

Integrated design of the complete chemical engineering process. Process engineering, project engineering, instrumentation, and layout.

465. Process Optimization Methods
Fall, Spring. 3(3-0) MTH 215, knowledge of linear algebra. Interdepartmental with Systems Science.

Methods for determining optimum design and operating policies of systems of varying complexity. Includes classical methods, mathematical programming and modern methods.

481. Transport Phenomena
Fall. 3(3-0) 303.

Solution of engineering problems using the general equations of change for transport of momentum, heat, and mass in an arbitrary continuum. Interphase transport.

801. Advanced Chemical Engineering Calculations I
Fall. 3(3-0) 303.

Chemical engineering applications of advanced mathematical methods. Formulation and solution of mathematical equations which describe physical problems. Computer solutions.

802. Advanced Chemical Engineering Calculations II
Winter. 3(3-0) 601.

Continuation of 801.

811. Advanced Chemical Engineering Thermodynamics I
Fall. 3(3-0) 303, 361; CEM 481.

Advanced treatment of the laws of thermodynamics. Conceptual processes. Corresponding state and higher parameters in computing properties of chemical compounds and solutions.

817. Advanced Chemical Reaction Engineering I
Winter. 3(3-0) 428.


821. Theory of Nuclear Reactors
Fall of even-numbered years. 3(3-0). PHY 359, MTH 341; or approval of department.

Theory and design of nuclear research and power reactors. Nuclear transformation, fission, and energy conversion. Derivation of chain reaction design criteria, and calculation of flux-power distribution. Analysis of reactor safety, reliability, and economics.

825. Theory, Applicability and Engineering of Radioisotopes
Winter of even-numbered years. 3(3-0). PHY 499 or CEM 461 or approval of department.

Principles of utilization of radioisotopes in research and production problems for engineering and science majors. Fundamentals and preparation techniques of radioisotopes. Selection, specification, measurement and disposal for typical technical problems.

826. Flow of Heat I
Spring. 3(3-0) 303.

Steady and unsteady state heat transfer. Conduction and convection in flow and non-flow systems.

828. Optimization of Static Nonlinear Systems
Winter, Summer. 3(3-0) 465 or knowledge of linear programming. Interdepartmental with and administered by Systems Science.

Problem formulation and classification, Kuhn Tucker theory in nonlinear programming, gradient and search methods, techniques for quadratic, integer, geometric, and dynamic programming.

831. Distillation, Absorption, and Extraction I
Spring. 3(3-0) 303.


832. Distillation, Absorption and Extraction II
Fall. 3(3-0) 303.

Mass transfer in distillation, absorption, and extraction processes. Continuous and stagewise phase contacting. Column hydrodynamics and plate efficiency.

841. Advanced Transport Phenomena
Winter. 3(3-0) MTH 215, B.S. in engineering or physical science.


847. Physical Chemistry of Macromolecules
Winter of odd-numbered years. 3(3-0) 446 or approval of department. Interdepartmental with the Chemistry Department.

Thermodynamics-Phase equilibria of polymer solutions; configuration and conformation of chain molecules; characterization of polymer molecular weight and distribution; theoretical and experimental results for dilute solution viscosity and diffusivity, polyelectrolytes.

881. Seminar
Fall, Winter, Spring, Summer. 1(0-2).

May re-enroll for a maximum of 3 credits allowed toward M.S. degree and 6 credits toward Ph.D. degree.

Detailed library investigation of one or more specialized aspects of chemical engineering, such as recent theoretical developments in one of the unit operations; presentations of these studies to a seminar group. Participation generally required each term of residence.

885. Selected Topics in Chemical Engineering
Fall, Winter, Spring. 3(3-0) 3 credits.

May re-enroll for a maximum of 9 credits if a different topic is taken.

A newly developing area of chemical engineering selected by the department for offering each term. Information on the specific topic to be covered should be obtained from the department office before registration.

888. Research Survey
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

909. Research
(EGR 889.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

912. Advanced Chemical Engineering Thermodynamics II
Winter of even-numbered years. 3(3-0) Approval of department.


918. Advanced Chemical Reaction Engineering II
Spring of even-numbered years. 3(3-0) Approval of department.

Quantitative treatment of current literature in chemical kinetics and reaction engineering.

927. Flow of Heat II
Fall of even-numbered years. 3(3-0) Approval of department.

Fundamentals of radiant heat transfer. Computer techniques in the design of radiant and convective heat transfer equipment.

942. Transport Properties
Spring of odd-numbered years. 3(3-0) Approval of department.


965. Special Topics in Optimal Process Theory
Spring of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with Systems Science.

Continuation of 828 and special topics from the literature in nonlinear, stochastic, and dynamic programming.

999. Research
(EGR 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.