

- 308. Secretarial Administration I**
Fall, Winter, Spring. 4(4-0) 236,
304. Sophomores.
Development of proficiency in transcription skills.
- 309. 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)
Juniors.
Study and analysis of business and industrial communication problems; extensive instruction and practice in writing.
- 326H. Writing in a Business Culture**
Fall, Winter. 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)
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)
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.
- 416. Secretarial Administration III: Seminar**
Winter, Spring. 4(4-0) Seniors or approval of department.
Analysis of the role of the executive secretary.
- 440. Law and Society**
Fall, Winter, Spring, Summer. 3(3-0)
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.
- 441. Law of Contracts and Business Organizations**
Fall, Winter, Spring, Summer. 5(5-0)
440.
Law of contracts, including the concept of freedom of contract and its importance as the focal point of business transactions. Study of the legal framework within which formal business organizations must operate.
- 443. Property, Sales, Negotiable Instruments**
Spring. 4(4-0) 441.
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 sale, abstracts, mortgages, mechanics liens, co-ownership, descent and distribution, administration of estates, zoning, taxes, landlord and tenant. Combined text and case approach.
- 446. Interstate and International Business Law**
Spring. 3(3-0) 341, 440 or 441.
Laws of contracts, sales, negotiable instruments, agency, business associations in the interstate and international spheres. Maritime contracts. International commercial arbitration. Area directed studies.
- 447. Hotel Law**
Winter, Spring. 4(4-0) 440.
Negotiable instruments, warranties, property, torts, civil rights, agency, partnerships, corporations as applied to hotel and restaurant management.
- 468. 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.
- 848. The Legal Environment of Business**
Winter, Summer. 4(4-0)
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 law functions.
- 849. Legal Environment of International Business**
Spring, Summer. 4(4-0)
Commercial and financial transactions in international business, foreign agencies, branches, subsidiaries. Aspects of labor relations, anti-trust, taxation, and transportation as related to foreign operations. Litigation and arbitration in the international business community.
- 871. 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.
- 878. Seminar in Business Law**
Fall, Spring. 4(4-0) May re-enroll for a maximum of 8 credits. 848 or approval of department.
Public policy with regard to contracts, anti-trust, security transactions, labor relations of the firm, viewed from the legislative, judicial, and executive vantage points.
- 890. 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 287 or concurrently.
Chemical engineering calculations. Organization of calculations. Material balances, energy bal-

- ances, 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; 361 or concurrently; MTH 215.
Thermodynamics of fluid flow. Application to flow equipment. Frictional effects for laminar and turbulent motion of compressible and incompressible fluids. Dimensional analysis and similitude. Continuity and flow equations in tensor notation. Treatment of fluid flow as a momentum transfer process. Analogous treatment of heat flow. Heat transfer in solids and flowing fluids.
- 302. Transfer Processes and Separations**
Winter, Spring. 4(4-0) 301.
Heat transfer in condensing and boiling systems. Application to engineering equipment. Condensers, interchangers, and multiple effect evaporators. Radiation. Mass transfer. Analogies with momentum and heat. Continuous and stagewise contactors.
- 303. Transfer Processes and Separations**
Fall, Spring. 4(4-0) 302.
Simultaneous heat and mass transfer. Humidification. Gas absorption. Distillation, ideal, non-ideal, binary and multicomponent. Extraction. Azeotropic and extractive distillation. Mass transfer with chemical reaction.
- 361. Chemical Thermodynamics**
Fall, Spring. 3(4-0) One year general chemistry; one year general physics; MTH 215. Interdepartmental and jointly administered with the Chemistry Department.
Thermodynamics. Properties of gases. Laws of thermodynamics, properties of ideal and non-ideal solutions, thermodynamics of chemical reactions, activities in non-ionic systems.
- 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) 303.
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.
Quantitative treatment of mechanisms and rates of chemical reactions. Catalysis. Design and analysis of flow and non-flow reactors. Interpretation of laboratory kinetic data.
- 443. Chemical Engineering of the Solid State**
Spring. 4(4-0) CEM 461.
Polymeric, crystalline, organic, and inorganic solids. Relation of bond type and steric con-

figuration to mechanical, electrical, thermal, and optical properties. Influence of macroscopic structure on physical properties. Surface phenomena. Applications.

446. Polymerization

Fall. 3(3-0) One year organic chemistry, elementary physical chemistry. Interdepartmental with and administered by the Chemistry Department.

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

451. Dynamics and Control of Chemical Engineering Systems

Winter. 5(5-0) 303, MTH 215.

Transient behavior of chemical engineering processes. Elements and dynamic response of control loops. Composition measurement and control. Analysis of system stability. Optimizing control.

460. Problems and Reports

Fall, Winter, Spring. 1 to 9 credits. Seniors, 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(1-6) 461.

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, 361.

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) 801.

Continuation of 801.

811. Advanced Chemical Engineering Thermodynamics I

Fall. 3(3-0) 203, 361; CEM 461.

Advanced treatment of the laws of thermodynamics. Cryogenic 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.

Treatment of absorption and catalysis and their application to catalytic reactors. Heat, mo-

mentum, and mass-transfer in fixed-bed and fluidized-bed reactors. Non-catalytic heterogeneous reactions. Homogeneous chain reactions and free radical mechanisms. Computer applications to solution of complex kinetic problems.

821. Theory of Nuclear Reactors

Fall of even-numbered years. 3(3-0) PHY 289; 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 498 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.

Stagewise calculations in distillation, absorption, and extraction processes. Computer techniques. Liquid-gas and liquid-liquid equilibria. Batch, continuous, binary and multi-component calculations.

832. Distillation, Absorption and Extraction II

Fall. 3(3-0) 303.

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

841. Advanced Transport Phenomena

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

Use of equations of change in solving engineering problems. Boundary layer and penetration theories of interphase transport. Potential flow. Theories of turbulence from statistical standpoint.

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.

886. Selected Topics in Chemical Engineering

Fall, Winter, Spring, Summer. 3(3-0)

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. 3 credits.

Literature search, problem analysis, and layout of a complete research program.

893. Special Problems

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

899. Research

(EGR 899.) 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.

Relation of thermodynamics to quantum theory and statistical mechanics. Computation of chemical engineering thermodynamic data from spectral measurements. Irreversible thermodynamics.

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.

Use of molecular theories to calculate transport properties of gases and liquids. Empirical methods of estimating transport coefficients. Rheology of polymer systems.

965. Special Topics in Optimal Process Theory

Spring of odd-numbered years. 3(3-0) SYS 828 or 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.