

880. Plant Virology
Fall of odd-numbered years. 5(2-6)
405 or approval of department.

External and internal symptomatology, transmission, interactions, purifications, assay and serology of plant viruses.

881. Pathogenesis and Disease Resistance
Winter of odd-numbered years. 4(3-2)
405 and 415, or approval of department.

Lectures, readings, and discussions on mechanisms of pathogenicity and infectivity; physiology and biochemistry of disease development; tumorigenesis; metabolic consequences of infection; nature of disease resistance; and parasitism.

883. Plant Disease Control
Fall of even-numbered years. 3(2-3)
405.

Principals and methods in controlling plant diseases. Considerable emphasis is placed on the chemistry of fungicides, and their role in controlling plant diseases. Other factors affecting disease epidemiology are covered.

885. Plant Diseases in the Field
Spring. 4 credits. 405 and approval
of department.

Diagnosis, distribution and sequential developments of plant diseases in the field.

890. Selected Topics in Plant Pathology
Fall, Winter, Spring. 2 to 5 credits.
Approval of department.

Topics will be selected from the following areas: parasitism, plant viruses, ecology, genetics, nematology, fungicidal action, and soil microbiology.

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

Research for thesis at the master's degree level in one of the following fields: anatomy, cytology, ecology, genetics, lichenology, morphology, mycology, pathology, phycology, physiology, and taxonomy.

918. Advanced Genetics
Winter of odd-numbered years. 3(3-0)
Approval of department.

Role of the gene in differentiation and development, with special emphasis upon the genetic mechanisms responsible for the control of phenogenesis.

920. Advanced Plant Taxonomy
Spring of even-numbered years. 4(4-0)
824, ZOL 441.

Consideration of the recent scientific developments affecting plant classification.

930. Advanced Plant Ecology
Winter of odd-numbered years. 3(2-4)
Approval of department.

Fundamental theories and modern research horizons.

951. Advanced Plant Physiology I
(943.) Fall of even-numbered years.
3(3-0) Approval of department.

Selected topics concerning absorption and inorganic nutrition.

952. Plant Physiology and Biochemistry I
(944.) Winter of odd-numbered years.
3(3-0) Approval of department. Interdepartmental with and administered by the Biochemistry Department.

Selected topics concerning photosynthesis and related processes.

953. Advanced Plant Physiology II
(945.) Spring of odd-numbered years.
3(3-0) Approval of department.

Selected topics concerning the chemistry, physiology and mechanism of action of plant growth hormones.

954. Advanced Plant Physiology III
(946.) Fall of odd-numbered years.
3(3-0) Approval of department.

Selected topics from environmental physiology.

955. Plant Physiology and Biochemistry II
(947.) Winter of even-numbered years.
3(3-0) Approval of department. Interdepartmental with and administered by the Biochemistry Department.

Metabolic pathways of unique significance to plants.

956. Advanced Plant Physiology IV
(948.) Spring of even-numbered years.
3(3-0) Approval of department.

Factors influencing vegetative and reproductive physiology.

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

Research for thesis at the doctor's degree level in one of the following fields: anatomy, cytology, ecology, genetics, lichenology, morphology, mycology, paleobotany, pathology, physiology, and taxonomy.

BUILDING CONSTRUCTION

See Packaging

BUSINESS LAW, INSURANCE AND OFFICE ADMINISTRATION BIO

College of Business

201. Shorthand I
Fall, Winter, Spring, Summer. 3(4-0)
234 or 1 term typewriting.

Gregg shorthand theory, dictation and transcription for students with no previous training.

202. Shorthand II
Fall, Winter, Spring, Summer. 3(3-1)
201, 234 or 1 term shorthand and typewriting.

Development of theory and transcription competency, speed building.

234. Typewriting I
Fall, Winter, Spring, Summer. 2(2-2)
Approval of department.

Mastery of keyboard; building speed and accuracy; elementary typewriting problems.

235. Typewriting II
Fall, Winter, Spring. 2(2-2) 234 or
approval of department.

Improvement of speed and accuracy; arrangement of business letters, tabulation and manuscripts; production typewriting.

236. Advanced Typewriting
Fall, Winter, Spring, Summer. 3(3-1)
235 or 1½ to 2 years typewriting.

Instruction in specialized typewriting problems to develop high-level competency.

304. Advanced Shorthand
(204.) Fall, Winter, Spring. 3(3-1)
May re-enroll for a maximum of 6 credits. 202,
235.

Continuation of 202.

308. Secretarial Administration I
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.

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.

350. Principles of Risk and Insurance
(AFA 350, 296.) Fall, Winter, Spring,
Summer. 4(3-0) Juniors or approval of department.

Risk and risk meeting methods with emphasis on the insurance mechanism. Fundamental principles, legal relationships, types of carriers and organization principle types of coverage and industry regulation.

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.

395. Principles of Urban Real Estate Administration
(AFA 395.) Fall, Spring. 5(5-0) AFA
391 or approval of department; EC 201.

Concepts of urbanism, city functions and city growth. Examines physical, locational, legal, social and economic factors. Role of markets, governments and finance. Theories and techniques of valuing urban real estate.

396. Personal Risks and Insurance
(AFA 396.) Fall, Summer. 5(5-0)
350 or Juniors in business administration.

Personal risk analysis and personal insurance. Emphasis on life, health, automobile, fire and liability insurance. Programming personal insurance. Estate analysis and trusts. Social and economic aspects of personal insurance analyzed.

397. Social Insurance Topics
(AFA 397.) Fall. 4(4-0) EC 200.

Systematic study of the legal, actuarial, social and political aspects of social insurance. Federal and State programs will be analyzed. Problems, solutions and potential alternatives to be discussed.

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
 Fall, Winter. 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.

486. Business Risks and Insurance
 (AFA 486.) Winter, 5(5-0) 350 or Seniors in business administration.
 Business insurance as it relates to business risks and decision making. Emphasis on business exposures, coverages and problems of the risk manager.

487. Management of Insurance Enterprise
 (AFA 487.) Spring. 5(5-0) 350 or approval of department.

Organizational requirements and functional operations of insurance enterprise with emphasis on methods of ratemaking, reserves, financial statement and investment requirements, loss adjustment, underwriting, and marketing. Statutory limitations on management freedom.

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.

884. Insurance Companies as Financial Institutions
 (AFA 884.) Winter. 4(4-0)

Analysis of insurance company investment behavior in the capital market. Emphasis on liquidity requirements, interest rates, legal and organizational requirements affecting investment decisions. Micro and macro aspects are investigated.

886. Seminar in Insurance Problems
 (AFA 886.) Spring. 4(4-0)

Analysis of insurance problems affecting the public interest. Special emphasis on problems due to changing economic and social conditions. Insurance regulatory, financial, marketing and social problems are evaluated.

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

CHEMICAL ENGINEERING CHE
College of Engineering

300. Material and Energy Balances
 (201.) Fall. 3(3-0) One year general chemistry, MTH 214.

Chemical engineering calculations. Material and energy balances in physical and chemical non-flow and flow systems. Behavior of ideal and real gas systems. Heats of reaction. Applications to chemical engineering systems.

311. Thermodynamics for Chemical Engineering
 (202.) Winter. 3(3-0) 361.

First and second laws. Energy, enthalpy, entropy, free energy, the mathematics of property relationships. Energy conversion processes. Fugacity, activity, activity coefficient. Solution theories. Multicomponent phase equilibria.

312. Transfer Processes and Separations I
 Winter. 3(3-0) 300, MTH 215.

Thermodynamics of fluid flow. Frictional effects for laminar and turbulent motion of compressible and incompressible fluids. Dimensional analyses and similitude. Treatment of fluid flow as a momentum transfer process.

313. Transfer Processes and Separations II
 Spring. 3(3-0) 312.

Heat transfer in solids and flowing fluids. Heat transfer in condensing and boiling systems. Application to engineering equipment. Condensation, multiple effect evaporation, and radiation.

314. Transfer Processes and Separations III
 Spring. 3(3-0) 311, 313 or concurrently.

Mass transfer in continuous contacting systems. Mass transfer in single-phase systems, transport analogies, interphase transfer and contacting of immiscible phases.

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.

381. Chemical Engineering Analysis
 Fall, Spring. 3(3-0) Students may not receive credit in both 381 and MTH 341. MTH 215. Interdepartmental with the Mathematics Department.

Formulation of ordinary and partial differential equations describing chemical systems. Boundary value problems, numerical methods, matrices, and applications, to chemical engineering 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 300.

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.

415. Transfer Processes and Separations IV
 Fall. 3(3-0) 314.

Mass transfer in stagewise processes. Counter-current processes, fractionation, contacting efficiency, and simultaneous momentum, heat and mass transfer.

423. Chemical Engineering Laboratory
 (422.) Winter. 3(1-6) 415.

Assigned laboratory problems, requiring team effort. Experimental work, involving momentum, heat and mass transfer; separation processes, such as distillation, filtration, and drying; reactor kinetics; automatic process control.

424. Transport Phenomena and Physical Properties Laboratory
 Spring. 3(1-6) 313 or concurrently.

Experiments involving the transport processes and measurement of physical, chemical and thermodynamic properties of various materials. Comparison of theoretical and experimental results.