

841. Physiology of the Algae
Fall of even-numbered years. 3(3-0)
Approval of department.
Physiology, chemistry, biochemistry, and aspects of the ultra-structure of the various algal divisions. Discussion of use of algae for the study of classical physiological and developmental problems.

846. Seminar in Plant Pathology
Fall, Winter, Spring. 1(1-0) Ap-
proval of department.

850. Agrostology
Fall of even-numbered years. 3(1-4)
One year of botany or approval of department.
Comprehensive treatment of the systematics, evolution, ecology, geography and economic significance of the grass family; including pertinent aspects of genetics, cytology, anatomy and physiology.

855. Effects of Ionizing Radiations on Plants
Spring of odd-numbered years. 3(3-0)
Approval of department.
Nature of ionizing radiations related to their effects upon plant growth and development including aspects of radiation sensitivity, dosimetry, direct and indirect effects, genetic, evolution and environmental implications related to modes of action at the cell, organism, and population levels.

863. Advanced Environmental Physiology
Winter. 3(3-0) 413 or approval of department.
The plant in relation to its environment: energy exchange; coupling between CO₂ assimilation and transpiration; hydraulics in the stationary and nonstationary states; transport of ions, carbohydrates, and hormones; stress physiology.

865. Advanced Growth and Development
Fall. 3(3-0) 415 or approval of department.
Advanced treatment of the physiological processes of growth and development. The mechanism underlying these processes and the roles played by hormones, light, etc., in controlling them will be analysed.

871. Biology of Nematodes
Winter of even-numbered years. 4(2-6)
Approval of department. Interdepartmental with and administered by the Department of Entomology.
Ontogeny, taxonomy, morphology, pathology and ecology of nematodes, with special reference to plant-parasitic and phyto-pathogenic species.

878. Comparative Limnology
Summer. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Zoology Department.
Theoretical concepts and methods of analysis of environmental parameters influencing productivity of freshwaters. Comparative field investigations of lakes, streams, and other aquatic habitats.

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(2-2)
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; Summer of even-numbered years. Given at W. K. Kellogg Biological Station summer term. 3(2-4)
Approval of department.
Fundamental theories and modern research horizons.

952. Plant Physiology and Biochemistry I
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.

955. Plant Physiology and Biochemistry II
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
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 dissertation 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.

341. Survey of Business Law

Fall, Winter, Spring. 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; principal types of coverage and industry regulation.

370. Administrative Office Management

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.

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. Problems, solutions and potential alternatives.

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. Contracts and Sales

Fall, Winter, Spring, Summer. 3(3-0) 440.
Contracts, including concept of freedom of contract and limitations. Sales. Case study method.

442. Agency, Partnerships and Corporations

Winter. 3(3-0) 441.
The law dealing with agency and business organizations. Case study method.

443. Negotiable Instruments, Secured Transactions, Property

Spring. 3(3-0) 441.
The law of negotiable instruments, secured transactions, and property. Case study method.

445. Real Estate Law

Winter. 3(3-0) 341 or 441.
Law of the real estate business. Combined text and case approach.

446. Interstate and International Business Law

Spring. 3(3-0) 440.
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.
Legal aspects of the hospitality industry.

468. Field Studies

Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 8 credits. 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

Fall, 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

Winter, 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.

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.

890. Special Problems

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

**CHEMICAL
ENGINEERING**

CHE

College of Engineering

222. Pollution of the Environment—Causes and Cures

Spring. 3(3-0) Nonmajors; no science or technical background required.
Pollution of air, water and land. Adulteration of foods. Overtaxing waste facilities. Depleting natural resources. Interaction of engineers, industry, government, and the public in creating and combating these problems.

300. Material and Energy Balances

(201.) Fall. 4(3-2) One year general chemistry, MTH 214 or concurrently, CPS 120 or concurrently.
Chemical engineering calculations. Synthesis of chemical process systems. Analysis of chemical process systems by material and energy balances. Behavior of gases. Enthalpy calculations for changes of temperature, phase changes, chemical reactions.

305. Transfer Processes and Separations I

Fall. 4(3-2) MTH 215; CHE 300 or concurrently.
Thermodynamics of fluid flow. Treatment of fluid flow as a momentum transfer process. Laminar and turbulent motion of compressible and incompressible fluids. Heat transfer in solids and flowing fluids.

306. Transfer Processes and Separations II

Winter. 4(3-2) 305.
Heat transfer in condensing and boiling systems. Multiple effect evaporation. Radiant heat transfer. Application to engineering equipment. Mass transfer in single-phase systems, transport analogies interphase transfer and contacting of immiscible phases.