

**826. Advanced Tropical Botany**

Summer. 12 credits. Approval of department and acceptance by Organization for Tropical Studies.

A field course on the adaptation, evolution, and physiological characteristics of tropical plants. The subject will vary from term to term, but will include such topics as the reproductive biology of tropical plants, tropical forest ecology, biology of tropical epiphytes, biology of tropical grasses, biology of tropical ferns, etc.

**827. General Cytology**

Spring and Summer of odd-numbered years. 4(3-2) One year general chemistry and 1 year general botany or general zoology. Designed primarily for biological science students.

Plant and animal materials. Cell morphology and variation, organization and distribution of standard inclusions, structure of the nucleus and the mechanism of mitosis.

**830. Paleobotany**

Fall. 4(3-4) Approval of department. Interdepartmental with the Geology Department.

Survey of fossil plants: their preservation, occurrence, geology, paleogeography, paleoecology, evolutionary history, classification and representative types. One weekend field trip to fossil plant locality.

**831. Palynology**

Spring. 4(3-4) Approval of department. Interdepartmental with and administered by the Geology Department.

An introduction to the principles and techniques of spore and pollen analysis, both fossil and recent, and utilization of plant microfossils for stratigraphic determinations and paleoecologic interpretation of most sedimentary accumulations and rocks. (Includes certain algae, protozoans, similar organisms of uncertain affinity and dissociated fragments of larger organisms.)

**835. Morphogenesis of Reproductive Structures**

Spring of even numbered years. 4(3-4) 434.

Principles underlying the differentiation and growth of reproductive plant structures with special emphasis upon their functional and developmental genetic relationships.

**836. Advanced Mycology: Current Biological Advances**

Winter. 4(4-0) Approval of department.

Recent and current advances in the biology of fungi, with emphasis upon experimental studies of structural and functional differentiation during ontogeny.

**837. Advanced Mycology: Morphology and Taxonomy**

Spring. 4(3-2) 402.

Recent morphological studies, taxonomic methods, and phylogeny. The laboratory will be devoted to special problems related to the student's interests.

**838. Advanced Paleobotany**

Winter. 3(2-4) Approval of department. Interdepartmental with the Geology Department.

Morphology, anatomy, phylogenetic relationships and classification of fossil plants. Microscopic analysis of tissues and organs prepared by thin section, transfers, peels, polished and etched surfaces, and macerations.

**839. Population Ecology**

Summer of odd-numbered years. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Zoology Department.

A synopsis of growth and regulation of plant and animal populations; interrelationships of biotic and environmental factors that control population responses and interactions. Laboratory and field experiments.

**841. Physiology of the Algae**

Spring. 4(3-2) 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.

**845. Current Problems in Plant Metabolism**

Fall, Winter, Spring. 1(1-0) 414.

**846. Seminar in Plant Pathology**

Fall, Winter, Spring. 1(1-0) Approval of department.

**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.

**880. Plant Virology**

Fall. 5(2 6) 405 or approval of department.

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

**881. Parasitism and Pathogenesis**

Winter of odd-numbered years. 4(2-4) 415, 405, or approval of department.

Physiology of parasitism and disease development in plants. Parasitism by plant pathogens is compared with parasitism in other groups.

**883. Plant Disease Control**

Fall. 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.

**919. Cytogenetics**

Fall. 3(3-0) 918.

**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**

Spring of odd-numbered years. 3(2-4) 415, 450, 824.

Fundamental theories and modern research horizons.

**943. Advanced Plant Physiology I**

Fall of even-numbered years. 3(3-0) 414.

Selected topics concerning absorption and inorganic nutrition.

**944. Advanced Plant Physiology II**

Winter of odd-numbered years. 3(3-0) 414.

Selected topics concerning photosynthesis and related processes.

**945. Advanced Plant Physiology III**

Spring of odd-numbered years. 3(3-0) 415.

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

**946. Advanced Plant Physiology IV**

Fall of odd-numbered years. 3(3-0) 414.

Selected topics from environmental physiology.

**947. Advanced Plant Physiology V**

Winter of even-numbered years. 3(3-0) 414.

Metabolic pathways of unique significance to plants.

**948. Advanced Plant Physiology VI**

Spring of even-numbered years. 3(3-0) 415.

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, pathology, phycology, physiology, and taxonomy.

**BUILDING CONSTRUCTION**

See Packaging

**BUSINESS LAW AND OFFICE ADMINISTRATION**

BOA

**College of Business**

**201. Shorthand I**

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

Basic principles, elementary vocabulary, beginning dictation, and transcription for students with no previous training.

**202. Shorthand II**

Fall, Winter, Spring, Summer. 4(4-0)  
201, 234 or 1 term shorthand and typewriting.  
writing.  
Continuation of 201. Vocabulary, dictation, and transcription.

**203. Shorthand III**

Fall, Winter, Spring. 4(4-0) 202,  
235.  
Continuation of 202 with development of speed and accuracy.

**204. Advanced Shorthand**

Fall, Winter, Spring. 4(2-4) 203,  
236.  
Continuation of 203. Speed writing from dictation.

**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.

**308. Secretarial Administration I**

Fall, Winter, Spring. 5(4-2) 204,  
236. Sophomores.  
Development of proficiency in transcription skills.

**309. Secretarial Administration II**

Fall, Winter, Spring. 5(5-0) 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. 5(5-0) Seniors or  
approval of department.  
Analysis of the role of the executive secretary.

**427. Business and Technical Reports**

Fall, Winter, Spring, Summer. 4(4-0)  
Juniors.  
Discussion and illustration of report writing techniques; study of use, form, and structure of different types; practice in preparing the most frequently used. One complete research report required.

**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 Management**

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. 3(3-0) May re-enroll  
for a maximum of 6 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. Vari-  
able credit. Approval of department.

**CHEMICAL ENGINEERING CHE**

**College of Engineering**

**201. Chemical Engineering Calculations**

Fall, Winter. 3(3-0) CEM 153; MTH  
214; PHY 237 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.

**203. Thermodynamics for Chemical Engineering**

Fall, Spring. 3(3-0) 202, MTH 215.  
Partial molar quantities. Chemical potential, fugacity and activity. Phase equilibria in multicomponent systems. Chemical reaction equilibria in homogeneous, heterogeneous, and electrochemical systems. Statistical significance of energy and entropy. Use of quantum theory to calculate thermodynamic properties.

**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.