922. Thermal Biophysics
Spring of odd-numbered years. 3(3-0)
Approval of department.

990. Biophysics Seminar
Fall, Winter, Spring, Summer. 1 credit. May re-enroll for a maximum of 3 credits. Approval of department.

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

BOTANY AND PLANT PATHOLOGY BOT
College of Agriculture and Natural Resources
College of Natural Science

IDC. Resource Ecology and Man
For course description, see Interdisciplinary Courses.

201. Plants and Man
(304) Winter. Spring. 3(3-0)
The relevance of plants to modern society with emphasis on those plants which supply drugs, food, fuel and oxygen, and those which have historical or esthetic importance.

205. Plant Biology
Winter. 3(3-0) High school chemistry and high school algebra.
An introduction to plant science for students seeking a general knowledge of the principles of plant biology as well as for prospective plant science majors.

301. Introductory Plant Physiology
Fall, Spring. 4(3-4) CEM 131 or 141; 161; B S 211 and introductory organic chemistry recommended.
General principles of plant physiology relating plant function to structure.

302. Introductory Morphology
Fall, Winter. 4(3-4) B S 212 or approval of department.
Structures and life cycles of representative plant groups showing progressive evolutionary developments.

318. Introductory Plant Systematics
Spring. 4(2-3) 302 or B S 212 or approval of department.
Plant diversity with emphasis on identification, classification, nomenclature, and evolutionary relationships of vascular plants.

335. Fossil Plants, Their History and Paleoecology
Spring. 3(3-0) One course in geology or botany or biology or approval of department. Interdepartmental with and administered by the Geology Department.
History of plants through geologic time, their form and evolution; how and where found, identified and reconstructed; their use in determining ancient geographic patterns, paleo-environments, paleoclimates and community structure. Field trips.

336. Economic Plants
Fall. 3(3-0)
Histories, characteristics, and origins of plants used in industrial processes, drug manufacture, and agriculture. Nontechical to broaden student's cultural interest in plants.

400. Aquatic Plants
Spring. 3(1-4) One year of botany or zoology or approval of department.
Aquatic plants, their classification, ecology and economic importance. Relationships to problems in fisheries, in wildlife management, and to role in limnology. Experience for student in plant ecology, aquatic biology, and water sanitation.

400H. Honors Work
Fall, Winter, Spring. 3(0-9) Approval of department. Seniors.

401. Special Problems
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 18 credits. 302, approval of department.
Students with special ability may carry on laboratory research or study of published literature on a selected topic.

402. Introductory Mycology
Fall, Winter. 4(2-6) B S 212 or approval of department.
Survey of the fungi, a background course for students taking plant pathology or other courses in mycology.

405. Introductory Plant Pathology
Fall. 4(2-4) 302 or B S 212 or approval of department. Students may not receive credit in both 405 and 407.
General principles of plant pathology including detailed study of selected diseases as examples of important groups.

406. Medical Mycology
Fall, Spring. 4(3-2) 402 or approval of department. Interdepartmental with the Department of Microbiology and Public Health.
Characteristics, habits, and laboratory identification of fungus diseases infecting human. Emphasis on laboratory techniques and morphological characteristics of the various mycooses.

407. Diseases of Forest and Shade Trees
Spring. 4(2-3) 301; 302; 315 or FOR 304. Students may not receive credit in both 405 and 407.
Diseases which affect trees in forests, parks, suburbs and nurseries, and methods of control.

408. Freshwater Ecology
Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with Biological Science and the Department of Zoology and administered by Biological Science.
The ecology of freshwater ecosystems, their biotic structure, and the functional interrelationships of environmental variables regulating population dynamics, productivity and community structure. Extensive field investigations.

410. Terrestrial Ecology
Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with Biological Science and the Department of Zoology and administered by Biological Science.
Factors determining distribution and abundance. Interrelationships of plants, animals, and environment. Extensive field investigations of several types of terrestrial communities in light of current theory.

411. Systematic Botany
Summer. 4(2-6) B S 212 or approval of department.
Taxonomy, identification, and evolutionary relationships of vascular plants, illustrated by the local flora; extensive field studies.

414. Plant Physiology: Metabolism
Winter. Summer of odd-numbered years. 4(3-4) 302; 1 year chemistry including organic.
Comprehensive study of metabolic activities of plants. Emphasis on mineral nutrition of plants and processes of photosynthesis, protein synthesis, and respiration.

415. Plant Physiology: Growth
Spring. Summer of even-numbered years. 4(3-4) 414.
Comprehensive study of growth processes of plants, with emphasis on germination, dormancy, hormone, and physiological phenomena associated with phases of development.

427. Cell Biology
(837.) Winter. Summer of odd-numbered years. 4(4-6) BCH 202 and one year of general botany or general zoology.
Cell organization and distribution of standard inclusions. Structure and function of the nucleus and other cytoplasmic organelles.

431. Histological Techniques
Winter. 4(2-6) 302.
Preparation of plant materials for microscopic study. Special emphasis on the many variations in microtechnique, including paraffin and geloid embedding, freezing microtomy and ultrathin sectioning for electron microscopy.

434. Plant Anatomy
Fall. Summer of even-numbered years. 4(2-4) 303.
Principles underlying the differentiation and growth of vegetative plant structures with special emphasis upon their functional and developmental genetic relationships.

441. Phycology
Winter. 5(3-0) 302.
Distribution of plants over the earth, with special reference to North America. Geological history and environmental factors which influence distribution.

447. Fresh Water Algae
Spring. 4(2-4) One year botany or zoology. Primarily for students in Fisheries Biology, Wildlife Management and Sanitary Engineering.
Identification of fresh water algae, especially those forms associated with fish food problems, water contamination and limnology. Methods for making analyses of samples for biological survey work on lakes and streams. Economic aspects and life histories of the algae.

450. Ecology
Spring. 4(2-4) 318; 301 or 414
Interrelationship of plants and environment. Factors which govern their distribution.

455. Experimental Ecology
Spring. 5(2-9) Approval of department. Interdepartmental with and administered by the Zoology Department.
Dynamics, regulation and production of biological populations, structure composition and stability of biotic communities; biogeochronological and energetic characteristics of ecosystems.

470. Nematode Diseases of Economic Plants
Winter of odd-numbered years. 4(2-4)
Interdepartmental with and administered by the Department of Entomology.
Major nematode diseases of economically important plants, with emphasis on diagnostic symptoms, nematode biology and principles of control.
480. Insects in Relation to Plant Diseases
Winter of even-numbered years. 4(2-4)
302. Interdepartmental with and administered by the Department of Entomology. Relationships of insects, mites and nematodes to important plant diseases incited by bacteria, fungi, viruses and toxins. Mode of transmission and means of control. Transmission techniques and important plant-pathogen-insect relationships.

409. Senior Seminar
Winter. 1(0-0) May re-enroll for a maximum of 3 credits. B 5 212 and 1 course in botany or approval of department. Reports by students, faculty, and guest lecturers, with emphasis on current developments in research.

800. Special Problems in Taxonomy
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

801. Special Problems in Anatomy and Morphology
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

802. Special Problems in Pathology
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

803. Special Problems in Physiology
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

805. Special Problems in Mycology
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

806. Special Problems in Cytology and Genetics
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

807. Special Problems in Algae
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

809. Special Problems in Ecology
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

812. Ecology and Epidemiology of Plant Pathogens
First course of a series on classification and relationships of vascular plants. Family characteristics, patterns, geographic distribution, and evolutionary trends are stressed. Contributions from classical taxonomy, cytotaxonomy and experimental taxonomy are discussed.

824. Plant Taxonomy II
Winter of even-numbered years. 4(3-3)

825. Tropical Biology: An Ecological Approach
Winter, Summer. 12 credits. Approval of department and acceptance by Organization for Tropical Studies. Interdepartmental with the Zoology Department.

826. Advanced Tropical Botany
Winter, 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 graminaceous flora, etc.

827. Cytogenetics
(919.) Fall. 2(2-4) 437 or ZOL 441 or approval of department.

828. Advanced Botany
(919.) Fall. 2(2-4) 437 or ZOL 441 or approval of department.

829. Paleobotany
Fall of even-numbered years. 3(3-2)

836. Advanced Mycology: Current Biological Advances
Spring of even-numbered years. 4(4-0)

837. Advanced Mycology: Morphology and Taxonomy
Spring. 4(3-3) 406.

838. Advanced Paleobotany
Winter. 3(3-4) Approval of department. Interdepartmental with and administered by the Department of Zoology.

841. Physiology of the Algae
Spring of even-numbered years. 4(3-3)

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.

850. Biology of Nematodes
Winter of even-numbered years. 4(2-4)

855. Effects of Ionizing Radiations on Plants
Spring of odd-numbered years. 3(3-2)

859. Agrostology
Fall of even-numbered years. 3(3-4)

865. Effects of Ionizing Radiations on Plants
Spring of even-numbered years. 3(4-0)

871. Biology of Nematodes
Winter of even-numbered years. 4(2-4)

872. Morphogenesis of Reproductive Structures
Spring of even-numbered years. 4(3-3)

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

385. Morphogenesis of Reproductive Structures
Spring of even-numbered years. 4(3-3)

386. Advanced Mycology: Current Biological Advances
Spring of even-numbered years. 4(4-0)

387. Advanced Mycology: Morphology and Taxonomy
Spring. 4(3-3) 406.

388. Advanced Paleobotany
Winter. 3(3-4) Approval of department. Interdepartmental with and administered by the Department of Zoology.

389. Population Ecology
Summer. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Zoology Department.

390. Agrostology
Fall of even-numbered years. 3(3-4)

391. Physiology of the Algae
Spring of even-numbered years. 4(3-3)

392. Industrial Mycology
Fall of odd-numbered years. 3(2-4)

393. Industrial Mycology
Fall of even-numbered years. 3(2-4)

394. Industrial Mycology
Fall of odd-numbered years. 3(2-4)

395. Industrial Mycology
Fall of even-numbered years. 3(2-4)
878. Comparative Limnology
Summer. 6 credits. Approval of department. Given in 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. 3(2-0) 405 or 415, 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; tumorogenesis; metabolic consequences of infection; nature of disease resistance; and parasites.

882. Plant Disease Control
Fall of even-numbered years. 3(2-3) 405. Principal 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, 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 phenogens.

920. Advanced Plant Taxonomy
Spring of even-numbered years. 4(4-0) 924, ZOL 414. 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.

931. Advanced Plant Physiology
Fall of even-numbered years. 3(3-0) Approval of department. Selected topics concerning absorption and inorganic nutrition.

932. Plant Physiology and Biochemistry I
Fall 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.

933. Advanced Plant Physiology II
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.

934. Advanced Plant Physiology III
Fall of odd-numbered years. 3(3-0) Approval of department. Selected topics from environmental physiology.

955. Plant Physiology and Biochemistry II
Winter of even-numbered years. 3(3-0) Approval of 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, pathology, physiology, and taxonomy.

BUILDING CONSTRUCTION

See Packaging

BUSINESS LAW, INSURANCE AND OFFICE ADMINISTRATION

College of Business

201. Shorthand I
Fall, Winter, Spring. 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. 3(3-1) 201, 234 or 1 term shorthand and typing. Development of shorthand and transcription competency, speed building.

234. Typewriting I
Fall, Winter, Spring. 2(2-2) Approval of department. Mastery of keyboard; building speed and accuracy; elementary typewriting problems.

235. Typewriting II
Fall, Winter, Spring. 3(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
Fall, Winter, Spring. 3(3-1) May re-enroll for a maximum of 6 credits. 202. Continuation of 202.

308. Secretarial Administration I
Winter, Spring. 4(4-0) 236, 304. Sophomore. Development of proficiency in transcription skills.

309. Secretarial Administration II
Fall, Winter, Spring. 4(4-2) 236, 308, 304. Sophomore. Machine dictation-transcription; duplication and copying processes; machine calculations; records management.

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

341. Survey of Business Law
Fall, Winter, Spring. 4(4-0) Junior. 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) Junior 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 covers and industry regulation.

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

385. Principles of Urban Real Estate Administration
(AFA 385.) Fall, Spring, 5(5-0) AFA 361 or approval of department; EC 201. Concepts of urbanism, city functions and city growth. Examinations physical, location, 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) 380 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.