499. Independent Study
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits. Approval of instructor.
Individual reading and research under the supervision of a member of the Biomedical Engineering Committee.

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

400. Aquatic Plants
Fall. 2(3-0) BOT 318 or BOT 392. Students may not receive credit in both BOT 400 and BOT 423.
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.

401I. Honors Work
Fall, Winter, Spring. 3(0-6) Approval of department; Seniors.

402. Introductory Mycology
Fall. 4(2-6) B S 212 or LBS 140 or approval of department.
Survey of the fungi including characteristics, habitats and diversity. Background course for biology students or those expecting to specialize in microbiology, mycology, plant pathology, or other fields involving fungi.

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

406. Medical Mycology
Fall, Spring. 4(2-6) BOT 402 or approval of department. Interdepartmental with the Department of Microbiology and Public Health.
Characteristics, habits, and laboratory identification of fungi. Emphasis on fungicides affecting humans. Emphasis on laboratory techniques and morphological characteristics of the various mycoses.

407. Diseases of Forest and Shade Trees
Spring. 4(3-2) BOT 301; BOT 302; BOT 316 or FOR 204. Students may not receive credit in both BOT 405 and BOT 407.
Diseases which affect trees in forests, parks, suburbs and nurseries, and methods of control.

409. Plant Disease Control
Winter of odd-numbered years. 3(0-0) BOT 395.
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.

411. Systematic Botany
Summer. 2(3-0) BOT 312, BOT 302 or approval of department. Students may not receive credit in both BOT 411 and BOT 425.
Taxonomy, identification, and evolutionary relationships of vascular plants, illustrated by the local flora; extensive field studies.

413. Environmental Plant Physiology
Winter. 3(0-0) B S 210 or LBS 141 or BOT 205.
Major topics include plant-soil-water relationships, gas exchange, and stress physiology. Minor topics include mineral nutrition and energy budgets.

414. Plant Physiology: Metabolism
Fall. 3(3-0) CEM 241; B S 210 or LBS 141 or BOT 205; BOT 301.
General principles underlying plant metabolic processes. Nutrient requirements, photosynthesis, translocation, respiration, nitrogen metabolism, and structures associated with these processes.

415. Plant Physiology: Growth and Development
Spring. Summer of even-numbered years. 3(0-3) BOT 414 or approval of department.
Growth and development in plants. Topics include the chemistry and effects of hormones, tropisms, thermonperiodicity, reproduction, vernalization and photoperiodism, photomorphogenesis, dormancy, and biological clocks.

421. Field Studies of Freshwater Algae
Summer. 3 credits. Students may not receive credit in both BOT 421 and BOT 447.
One year of botany or zoology or approval of department. Given at W.K. Kellogg Biological Station.

426. Aquatic and Wetland Plants
Summer. 3 credits. Students may not receive credit in both BOT 423 and BOT 400.
BOT 302, B S 212 or approval of department. Given at W.K. Kellogg Biological Station.
Extensive exposure to plants in aquatic environments. Emphasis on systematics, morphology, evolution and community relations. Survey of diverse wetland and aquatic habitats with numerous field trips.

427. Cell Biology
Fall. 4(4-0) BCH 200 and one year of general botany or general zoology.
Organization and structure of the cell, with emphasis on eukaryotes. Structure and function of the nucleus and cytoplasmic organelles. An introduction to molecular biology.

434. Plant Anatomy
Fall, Summer of even-numbered years. 4(4-0) BOT 302.
Principles underlying the differentiation and growth of vegetative plant structures with special emphasis upon their functional and developmental genetic relationships.
441. Geographical Plant Ecology
Winter, 3(3-0) BOT 205 or BOT 302 or B S 212 or approval of department.

447. Fresh Water Algae
Spring, 4(2-4). Given at W. K. Kellogg Biological Station Summer term: 4 credits. B S 212, BOT 302. Students may not receive credit in both BOT 421 and BOT 447.
Identification of fresh water algae, especially those forms concerned 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
Interrelationship of plants and environment. Factors which govern their distribution.

464. Comparative Limnology
Summer, 6 credits. B S 210. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Department of Zoology.
Theoretical concepts and methods of analysis of environmental parameters influencing productivity of freshwaters. Comparative field investigations of lakes, streams, and other aquatic habitats.

470. Nematode Diseases of Economic Plants
Spring of odd-numbered years, 4(3-3) BOT 405. 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.

490. Special Topics in Plant Pathology
Fall, Winter, Spring. 2 to 5 credits. May enroll for a maximum of 6 credits if different topics are taken. Approval of department. Topics may be selected from the following areas: genetics, parasitism, virology, disease control, phytobacteriology, nematology, epidemiology, physiology, soil microbiology, and others.

499. Senior Seminar
Winter. 1(1-0). May enroll for a maximum of 3 credits. B S 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. Summer. 1 to 15 credits. Approval of department.
Fall of odd-numbered years. 4(4-0) BOT 450 or ZOL 389, STT 422, 1 term of calculus.
The dynamics, evolution, regulation, and distribution of plant populations; subject matter interfaces with plant genetics, plant systematics, and plant physiology.

856. Plant Genetics and Molecular Biology
Spring of even-numbered years. 3(3-0) Approval of department and a course in introductory genetics. Interdepartmental with Genetics and the Department of Biochemistry.

858. Plant Diseases in the Field
Spring. 4 credits. BOT 405 and approval of department.
Diagnosis, distribution, and sequential development of plant diseases in the field. Field trips permit observation of diseases in the natural setting.

860. 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.

861. Selected Topics in Botany
Fall, Winter, Spring. 2 to 5 credits. May be repeated for a maximum of 6 credits if different topics are taken. Approval of department.
Topics may be selected from ecology, systematics, evolution, physiology, cytology, mycology, bryology, physiology, lichenology, anatomy, morphology, genetics, and others.

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

864. Plant Biochemistry
Spring. 4(4-0) BCN 401, BOT 301 or approval of department. Interdepartmental with and administered by the Department of Biochemistry.
Metabolism of nitrogen-compounds, carbohydrates, and lipids unique to plants’ cell organelles; photosynthesis; photospiration; dark respiration; cell walls; nitrogen cycle including nitrogen fixation; sulfur cycle.

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

871. Biology of Nematodes
Spring of even-numbered years. 4(2-6) ENT 474, with departmental approval and administered by the Department of Entomology.
Ontogeny, taxonomy, morphology, pathology, and ecology of nematodes, with special reference to plant-parasitic and phytopathogenic species.

880. Biological Oceanography
Spring. 3(3-0) CHE 381 or concurrently or approval of department.
Study of changes of temperature, phase changes, chemical reactions, and modern research in oceanography. Utilization of computer-aided design software.

891. Master’s Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Research in anatomy, bryology, cytology, ecology, genetics, lichenology, morphology, mycology, paleobotany, pathology, physiology, and taxonomy.

900. Doctoral Dissertation Research
Fall, Winter, Spring. Variable credit. Approval of department.
Research in anatomy, bryology, cytology, ecology, genetics, lichenology, morphology, mycology, paleobotany, pathology, physiology, and taxonomy.

BUILDING CONSTRUCTION MANAGEMENT
See Agricultural Engineering.

CHEMICAL ENGINEERING CHE College of Engineering

300. Material and Energy Balances
Fall, Winter. 4(2-2) One year general chemistry, MTH 214 or concurrently, CPS 112 or concurrently.