

Descriptions – BIOPHYSICS

of

Courses

827. Basic Neurobiology
(825.) Fall, 4(4-0) Approval of department. Interdepartmental with the Department of Zoology.

Neural structure and function at cellular and intercellular levels. Membrane and synaptic potentials, receptor transduction, and intracellular transport with an introduction to comparative and evolutionary aspects.

834. Membranes: Natural and Artificial

Spring of odd-numbered years. 2 to 3 credits. May reenroll for a maximum of 3 credits. Approval of department.

Emphasis is placed on the biophysical and biochemical characterization of biological membranes and their theoretical and experimental models. Presentation and discussion by students and staff of recent advances in membrane research.

850. Simpler Systems Approaches to Learning and Memory

Winter of odd-numbered years. 4(4-0) BPY 450 or BPY 827.

Simpler invertebrate and vertebrate, nervous systems which have been or could be useful for electrophysiological and molecular approaches to learning and memory.

865. Advanced Neurobiology

Spring, 4(4-0) BPY 827. Interdepartmental with the departments of Anatomy, Physiology, Psychology and Zoology. Administered by the Department of Anatomy.

Basic organization structure and function of neural networks comprising sensory, motor, and autonomic systems including examples from invertebrates and vertebrates. Attendance at neuroscience seminar is required.

880. Special Topics in Biophysics

Fall, Winter, Spring, Summer. Variable credit. May reenroll for a maximum of 15 credits.

Special topics within the five subdivisions of biophysics; structure, organization and function of biological phenomena, sensory perception, and psychophysics and biomechanics.

885. Vertebrate Neural Systems I

Fall of odd-numbered years. 5(3-4) Approval of department: ANT 815 and BPY 827 recommended. Interdepartmental with the departments of Zoology, Physiology, and Psychology. Administered by the Department of Psychology.

Structure and function of major component systems of vertebrate brains, their evolution, ontogeny and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical and physiological studies.

886. Vertebrate Neural Systems II

Winter of even-numbered years. 5(3-4) PSY 885. Interdepartmental with the departments of Psychology, Physiology, and Zoology. Administered by the Department of Zoology.

Continuation of BPY 885. Major component systems of vertebrate brains, their evolution, ontogeny, and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical, and physiological studies.

890. Readings in Biophysics

Fall, Winter, Spring, Summer. 3 to 6 credits. Approval of department.

Reading course in special topics adapted to the individual preparation and needs of the student.

899. Master's Thesis Research

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

990. Biophysics Seminar

Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 3 credits. Approval of department.

999. Doctoral Dissertation Research

Fall, Winter, Spring, Summer. Variable credit. 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, Man and the Environment (N)

Spring, 3(3-0)

Relevance of plants to modern society on issues such as food production, environmental quality, drug use and abuse, and the exploitation of plants in natural areas for commercial purposes.

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(2-4) CEM 131 or CEM 141; CEM 161; BOT 205 or B S 210 or LBC 141. Introductory organic chemistry recommended.

General principles of plant physiology relating plant structure to function. Topics include cell physiology, water relations, effects of light and temperature, respiration, photosynthesis, mineral nutrition, and hormone action.

302. Introductory Morphology

Fall, Winter, 4(2-4) 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) BOT 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 Paleocology

Spring, 3(3-0) One course in geology or botany or biology or approval of department. Interdepartmental with and administered by the Department of Geology.

History of plants through geologic time; their form and evolution; how and where found, identified and reconstructed; their use in determining ancient geographic patterns, paleoenvironments, paleoclimates and community structure. Field trip.

336. Economic Plants

Spring, 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, 3(2-3) BOT 318 and/or BOT 302.

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(0-6) Approval of department; Seniors.

401. Special Problems

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 16 credits. BOT 302, Seniors, approval of department.

Students with special ability may carry on laboratory research or study of published literature on a selected topic.

402. Introductory Mycology

Winter, 4(2-6) B S 212 or LBC 140 or approval of department.

Survey of the fungi including characteristics, habits 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 fungus diseases infecting 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 318 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.

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. 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.

409. Plant Disease Control

(883.) Winter of odd-numbered years. 3(3-0) BOT 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.

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. Administered by Biological Science.

Factors determining distribution and abundance. Interrelationship 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.

413. Environmental Plant Physiology

Fall. 3(3-0) B S 210 or LBC 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

Winter. Summer of odd-numbered years. 5(3-4) CEM 241; B S 210 or LBC 141 or BOT 205; BOT 301 or BOT 413.

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. 5(3-4) BOT 414 or approval of department.

Growth and development in plants. Topics include the chemistry and effects of hormones, tropisms, thermoperiodicity, reproduction, vernalization and photoperiodism, photomorphogenesis, dormancy, and biological clocks.

427. Cell Biology

Winter. Summer of odd-numbered years. 4(4-0) BCH 200 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. Methods in Cytology—Histology

Winter. 4(2-6) BOT 302.

Preparation of plant materials for microscopic analyses. Emphasis on theory and uses of optical microscopy (bright/dark field, phase contrast, fluorescence, cytophotometry, photomicrography, etc.) and electron microscopy (TEM and SEM).

434. Plant Anatomy

Fall. Summer of even-numbered years. 4(2-4) BOT 302.

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

441. Phytogeography

Winter. 3(3-0) BOT 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 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

Spring. 4(2-4) BOT 318; BOT 301 or BOT 414.

Interrelationship of plants and environment. Factors which govern their distribution.

470. Nematode Diseases of Economic Plants

Winter. 4(3-3) B S 212 or BOT 205. 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

Fall of even-numbered years 3(2-2) BOT 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.

499. Senior Seminar

Winter. 1(1-0) May reenroll 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.

803. Special Problems in Physiology

Fall, Winter, Spring, Summer. 1 to 15 credits. Approval of department.

805. Special Problems in Mycology

Fall, Winter, Spring, Summer. 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, Summer. 1 to 15 credits. Approval of department.

809. Special Problems in Ecology

Fall, Winter, Spring, Summer. 1 to 15 credits. Approval of department.

812. Principles of Plant Disease Epidemiology

Winter of even-numbered years. 3(4-0) BOT 402, BOT 405; or approval of department.

Quantitative and qualitative analysis of pathogen, host, and environmental interactions at the individual and population level. Synthesis of these interactions into a quantitative description of the disease process.

813. Special Problems

Fall, Winter, Spring. 1 to 4 credits. May reenroll for a maximum of 16 credits. Approval of department.

816. Industrial Mycology

Winter of odd-numbered years. 3(2-4) BOT 402 or approval of department.

Industrially important fungi, their uses and characteristics. Methods of commercial production, including acids, enzymes, cheeses, mushrooms, and antibiotics. Several field trips will be taken.

820. Ecology of Hydrophytes

Summer of every third year; given in 1977. 3 credits. BOT 400 and BOT 447 or approval of department. Given at W. K. Kellogg Biological Station.

Physiological and ecological relationships of periphyton, macroalgae, and vascular aquatic plants; field and laboratory methods of analysis of growth factors.

823. Plant Taxonomy I

Fall of odd-numbered years. 4(3-3) BOT 318; ZOL 441 recommended.

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) BOT 823.

Second course of a series on classification and relationships of vascular plants.

825. Tropical Biology: An Ecological Approach

Winter, Summer. 12 credits. Approval of department and acceptance by Organization for Tropical Studies. Interdepartmental with the Department of Zoology.

An introduction in the field to the principles of ecology as they operate in the tropics, especially concerning the tropical environment and biota, ecologic relations, communities and evolution in the tropics. Given in Costa Rica by Organization for Tropical Studies.

828. Cytogenetics

Fall. 4(2-4) BOT 427 or ZOL 441 or approval of department.

Detailed discussions of mitosis and meiosis; mechanisms of chromosome movement; fine structure of chromosomes and spindle apparatus; changes of chromosome number and structure and their genetic significance.

Descriptions - BOTANY AND PLANT PATHOLOGY

of

Courses

- 830. Paleobotany**
Fall. 4(3-4) Approval of department.
Interdepartmental with the Department of Geology.
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 of even-numbered years. 4(3-4)
Approval of department. Interdepartmental with and administered by the Department of Geology.
An introduction to the principles and techniques of spore and pollen analysis, both fossil and recent, and utilization of plant micro-fossils 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(2-4)
BOT 434
Principles underlying the differentiation and growth of reproductive plant structures with special emphasis upon their functional and developmental genetic relationships.
- 836. Advanced Mycology: Biology of the Phycomycetes**
Spring of even-numbered years. 3(3-0)
BOT 402 and approval of department.
Selected topics on the biology of phycomycetous fungi.
- 837. Advanced Mycology: Ascomycetes**
Fall of even-numbered years. 4(2-6)
BOT 402.
Morphological features and adaptations of the major groups of ascomycetous fungi and the imperfect fungi. Evolutionary trends and relationships with reference to recent classification schemes.
- 838. Advanced Paleobotany**
Winter. 3(2-4) Approval of department.
Interdepartmental with the Department of Geology.
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. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Department of Zoology.
An experimental-field approach to the study of populations and communities. Selected topics will deal with population growth, composition, predation, community structure and species abundance. This course is intended to complement ZOL 892.
- 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) Approval 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) BOT 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.
- 864. Plant Biochemistry**
Spring. 4(4-0) BCH 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; photorespiration; dark respiration; cell walls; lectins; 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 mechanism underlying these processes and the roles played by hormones, light, etc., in controlling them will be analyzed.
- 871. Biology of Nematodes**
Spring. 4(2-6) ENT 470 or 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 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.
- 880. Plant Virology**
Fall of odd-numbered years. 5(2-6)
BOT 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)
BOT 405 and BOT 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.
- 882. Genetics of Host/Parasite Interactions**
Winter of even-numbered years. 3(3-0)
ZOL 441, BOT 405.
Inheritance of resistance and susceptibility, virulence and avirulence; types of resistance, aggressiveness in parasites; use of genetics in studies of host/parasite interactions, practical application in disease control.
- 885. 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.
- 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. 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, 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)
BOT 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.
- 956. Advanced Plant Physiology IV**
Spring of even-numbered years. 3(3-0)
Approval of department.
Factors influencing vegetative and reproductive physiology.
Approved through Spring 1981.

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

BUILDING CONSTRUCTION

Sec Agricultural Engineering.

BUSINESS LAW AND OFFICE ADMINISTRATION BOA

College of Business

201. Shorthand I
Fall, Winter, Spring. 3(4-0) BOA 234 or 1 term typewriting.
Gregg shorthand theory, dictation and transcription for students with no previous training.

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. 2(2-2) BOA 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. 3(3-1) BOA 235 or 1-1/2 to 2 years typewriting.
Instruction in specialized typewriting problems to develop high-level competency.

304. Shorthand II
Fall, Winter, Spring. 3(3-1) May reenroll for a maximum of 6 credits. BOA 201, BOA 235.
Development of theory and transcription competency, speed building.

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

309. Secretarial Administration II
Fall, Spring. 4(4-2) BOA 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.

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.

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) BOA 440.
Contracts, including concept of freedom of contract and limitations. Sales. Case study method.

442. Agency, Partnerships and Corporations
Winter, Spring. 3(3-0) BOA 441.
The law dealing with agency and business organizations. Case study method.

443. Negotiable Instruments, Secured Transactions, Property
Winter, Spring. 3(3-0) BOA 441.
The law of negotiable instruments, secured transactions, and property. Case study method.

447. Hotel Law
Winter, Spring. 4(4-0) BOA 440.
Legal aspects of the hospitality industry.

468. Field Studies
Fall, Winter, Spring, Summer.
Variable credit. May reenroll for a maximum of 8 credits. Approval of department.
Planned program of observation and work in selected business firms. Analysis and reports.

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.

871. Seminar: Office Administration
Winter, Summer. 3 credits. May reenroll 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.

878A. Seminar in Business Law
(878.) Winter. 4(4-0) BOA 848 or approval of department.
Contracts, sales, secured transactions and consumer legislation viewed from the judicial, legislative and executive vantage points.

878B. Seminar in Business Law
Spring. 4(4-0) BOA 848 or approval of department.
Agency, partnerships and corporations, viewed from legislative, judicial and executive vantage points, as they affect entrepreneurial decision making.

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
Fall, Winter. 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) CHE 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.

307. Transfer Processes and Separations III
Spring. 4(3-2) CHE 306.
Mass transfer in continuous contacting systems and stagewise processes. Counter-current processes, fractionation, contacting, efficiency, and simultaneous momentum, heat, and mass transfer.