

826. Laboratory Animal Pathology
Spring. 4(3-3) Graduate status and approval of department.

Macro and microscopic studies on the diseases of laboratory animals with special emphasis on naturally-occurring diseases which might interfere with the interpretation of experimental results.

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

910. Biology of Disease
Fall. 3(2-3) Approval of department. Primarily for students in the biological sciences.
Basic morphologic changes in disease with emphasis on the related physiologic pathology. Laboratory includes relevant problems in post-mortem diagnosis.

921. Pathology of Nutritional and Metabolic Diseases

Summer of even-numbered years. 4(3-2) Approval of department; PTH 404 or ANT 420. ANS 525, BCH 452, HNF 462 recommended. Interdepartmental with the departments of Large Animal Surgery and Medicine and Animal Husbandry and Human Nutrition and Foods. Administered by Human Nutrition and Foods.
Development, physiopathology and morphologic pathology of nutritional and metabolic diseases including carbohydrate, protein, fatty acid, vitamin and mineral deficiencies, their experimental induction and their medical or economic significance.

980. Histopathologic Diagnosis
Fall, Winter, Spring, Summer. 3(0-9) May reenroll for a maximum of 6 credits. PTH 803, PTH 820.

Trimming, histopathologic examination, description, diagnosis and reporting of specimens from biopsy and necropsy.

990. Advanced Correlative Pathology
Fall, Winter, Spring, Summer. 5(0-15) May reenroll for a maximum of 15 credits. Approval of department.

Experience in morphologic and clinical pathology and correlation of these with the clinical aspects of disease.

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

PHARMACOLOGY AND TOXICOLOGY PHM

(Effective July 1, 1978. Formerly Department of Pharmacology)

**College of Human Medicine
College of Osteopathic Medicine
College of Veterinary Medicine**

350. Introductory Human Pharmacology
Spring. 3(3-0) PSL 432 or PSL 241 or concurrently; or approval of department.

General principles; central nervous system, autonomic nervous system, cardiovascular and renal drugs; chemotherapy; and other selected basic topics.

430. Drug Abuse
Fall of odd-numbered years. 4(4-0) Juniors or approval of department. Biology and chemistry recommended.

Actions, mechanism of action, toxicity and uses of drugs of abuse. Sociological and psychological aspects of drug abuse and the legal aspects of the sale and distribution of drugs are considered.

480. Special Problems
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. Approval of department.

Limited amounts of individual work on selected research problems for undergraduate students.

520A. Principles of Pharmacology
Fall. 4(4-0) PSL 500B, PSL 500C.

Drug absorption, distribution, biotransformation, elimination, antagonism; receptor theory and pharmacogenetics; adverse drug reactions, chemical toxicity. Chemotherapy: antimicrobials, antihelminthics, antineoplastics. Pharmacology related to the autonomic nervous system.

520B. Principles of Pharmacology
Winter. 4(4-0) PSL 500A; BCH 501.

Drug absorption, distribution, biotransformation, elimination, antagonism; receptor theory and pharmacogenetics. Chemotherapy: antineoplastic, antiviral and antimicrobial agents. Toxicology and emergency therapies. Pharmacology related to the autonomic nervous system.

521A. Pharmacodynamics
Winter. 5(4-2) PHM 520A or PHM 520B. Primarily for students of Veterinary Medicine.

Pharmacology of drugs that affect the heart, kidney, central nervous system and nonvascular smooth muscle as related to veterinary medicine. Endocrine and autocoid pharmacology.

521B. Pharmacodynamics
Spring. 4(4-0) PHM 520B or PHM 520A.

Pharmacology of the central and peripheral nervous systems. Cardiovascular, renal and gastrointestinal drugs. Endocrine and autoacid pharmacology.

810. Synaptic Transmission
Winter of odd-numbered years. 4(4-0) Approval of department.

Chemical and electrical aspects of nervous impulse transmission at synaptic and neuroeffector junctions and influences of drugs upon these processes. Intrinsic neuronal circuitry; reticular formation; thalamus; neocortex; cerebellum.

811. Advanced Renal and Autocoid Pharmacology
Spring of even-numbered years. 4(4-0) PHM 521A or PHM 521B and approval of department.

Advanced concepts and current topics in renal and autocoid pharmacology.

812. Advanced Principles of Pharmacology and Toxicology
Spring of odd-numbered years. 5(5-0) PHM 521A or PHM 521B, approval of department.

Kinetics of drug absorption, elimination and metabolism; drug receptor interactions, toxicology of metals and pesticides, industrial and inhalation toxicology; developmental toxicology, teratogenesis, mutagenesis and carcinogenesis. New drug development.

813. Cardiac Pharmacology
Winter of even-numbered years. 4(4-0) PHM 520A, PHM 521A or PHM 520B, PHM 521B; PSL 801, PSL 802, PSL 803; and approval of department.

Effects of drugs on normal physiological and biochemical processes in cardiac cells are studied. Emphasis is placed on mechanisms of drug action.

870. Problems
Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

Limited amounts of individual work on selected research problems for first year graduate students in the Department of Pharmacology and Toxicology.

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

Individual work on research problems for the master's degree in pharmacology.

910. Seminar
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits. Approval of department.

Discussion of recent topics on pharmacology by departmental or outside speakers, or reporting of research efforts by graduate students of the Department of Pharmacology and Toxicology.

980. Problems
Fall, Winter, Spring, Summer. 2 to 5 credits. May reenroll for a maximum of 20 credits. Approval of department.

Limited work on selected research problems.

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

Individual work on research problems for the doctoral degree in pharmacology.

PHILOSOPHY PHL

College of Arts and Letters

Each of the courses PHL 101, PHL 102, PHL 103 is an independent gateway to an area of philosophy. Together they provide a comprehensive introduction to philosophical inquiry through contact with philosophical issues.

101. Introduction to Philosophy: Ethics and Value
Fall, Winter, Spring, Summer. 3(3-0) Students may not receive credit for both PHL 101 and PHL 330.

Moral responsibility, praise and blame, good and evil, justice, law and morality, individual liberty and collective authority and contemporary moral issues are typical problems.

102. Introduction to Philosophy: Epistemology and Metaphysics
Fall, Winter, Spring, Summer. 3(3-0)

Skepticism and certainty, existence, matter and mind, God, space and time, knowledge and belief, perception, personal identity, causality, and free-will are typical problems.

**Descriptions – Philosophy
of
Courses**

- 103. Introduction to Philosophy: Logic**
Fall, Winter, Spring, Summer. 3(3-0)
Deductive and inductive reasoning and such topics as rational argumentation, fallacies, definition, meaning, truth and evidence.
- 200H. Honors Work**
Fall, Winter, Spring. 1 to 16 credits.
Approval of department.
- 211. Introduction to the History of Philosophy, Part I**
Fall, Winter, Spring. 3(3-0)
The Greek and Roman period with emphasis on Plato and Aristotle.
- 212. Introduction to the History of Philosophy, Part II**
Winter, Spring. 3(3-0)
The Middle Ages and early modern periods, with emphasis on Aquinas, Descartes, Spinoza and Leibniz.
- 213. Introduction to the History of Philosophy, Part III**
Fall, Spring. 3(3-0)
The eighteenth and nineteenth centuries with emphasis on British empiricism, Kant, and post-Kantian philosophy.
- 294. Special Topics**
Fall, Winter, Spring, Summer. 2(2-0) to 6(6-0) Approval of department.
Intensive study of some particular problem or author in philosophy.
- 311. Indian Philosophy**
Fall, Winter. 3(3-0)
Metaphysical, ethical and social theories developed within major Indian philosophical systems; e.g., philosophical Buddhism, Vedantist transcendentalism, Samkya dualism, and the Realist schools.
- 312. Chinese Philosophy**
Spring. 3(3-0)
Major cosmological and ethical doctrines of such Chinese authors and movements as Confucius, Mo Tzu, Lao Tzu, Taoism, Yin-Yang dualism, Buddhism, responses to Western influences, the new China.
- 315. American Philosophy**
Spring, Summer. 3(3-0) Three credits in philosophy or approval of department.
Examination of such thinkers as Royce, Pierce, James, Dewey, Whitehead and Santayana, illustrating classic American contributions to philosophy.
- 323. Existentialism**
Fall, Winter, Spring. 3(3-0) Three credits in philosophy or approval of department.
An examination of a major existentialist author (or authors), so designed as to place existentialist views in significant relation to the tradition of European thought.
- 330. Elements of Ethics**
Fall, Winter, Spring, Summer. 3(3-0) Juniors. Students may not receive credit for both PHL 101 and PHL 330.
An inquiry into the nature of the right and the good, addressed to such fundamental problems as the objectivity of moral judgments, the criterion of right and wrong, and the grounds of moral responsibility.
- 337. Logic I**
Fall, Winter, Spring. 4(4-0)
Modern symbolic methods in deductive reasoning. The logic of connectives and quantifiers.
- 338. Logic II**
Fall, Winter, Spring. 4(4-0) PHL 337 or approval of department.
The logic of identity, functions, and descriptions. Theory-building: axioms, definitions, theorems.
- 340. Moral Problems in Medicine and the Life Sciences**
Winter, Spring. 4(4-0) Juniors.
Philosophical aspects of euthanasia, allocation of scarce medical resources, experimentation and informed consent, truth-telling and the doctor-patient relationship, genetic counseling, genetic engineering, behavior control, and health care delivery.
- 341. Philosophical Aspects of Feminism**
Fall, Winter, Spring. 3(3-0)
Conceptual issues in feminist theory. Such concepts as oppression, sexism and chauvinism, feminist separatism, rape, respect and self-respect, personhood, power and control and feminism will be analyzed and explored.
- 342. Philosophy of the Counter Culture**
Fall, Spring. 3(3-0)
Students will examine counter cultural critiques of contemporary culture and values; and develop, articulate, defend their own views on such issues, especially as those issues immediately affect their own lives.
- 343. Ethical Issues in the Social Sciences**
Winter. 3(3-0)
Philosophical treatment of ethical issues arising from the social scientists' conflicting obligations to their subjects, science, profession, career, personal values and society.
- 350. Philosophy of Art**
Fall, Winter, Spring. 3(3-0) Three credits in philosophy or 6 credits in art, music, or literature.
Inquiry into the principles of artistic activity made with a view to determining the conditions under which art is produced, the nature of its product, and the sources of its value.
- 351. Contemporary Esthetic Theory**
Winter. 3(3-0) Three credits in philosophy or 6 credits in art, music, or literature.
Critical examination of contemporary theory in esthetics and the philosophy of art, in which the primary categories of reflection upon the arts have gained their currency. Readings from such authors as Tolstoy, Santayana, Croce, Bullough, Freud, Parker, Prall, Greene.
- 355. Philosophy of Religion**
Winter, Spring. 3(3-0) Three credits in philosophy or 6 credits in religious studies or approval of department.
Alternative philosophical approaches to religion as a personal and/or social phenomenon. Contemporary problems of meaning, evidence and obligation in relation to religious beliefs and practices.
- 360. Philosophy of Law**
Fall, Winter, Spring. 3(3-0) Three credits in philosophy or 6 credits in political science or approval of department.
Philosophic examination of such legal concepts as punishment, responsibility, rights and duties, judicial decisions and justice, and such legal theories as natural law, positivism and realism.
- 361. Philosophy of Technology**
Fall, Winter. 4(4-0) Sophomores or approval of college. Interdepartmental with and administered by Lyman Briggs College.
Is our technology desirable? Are its social forms desirable? What alternatives are there? Students will develop and defend their own appraisals of technology.
- 365. Social and Political Philosophy**
Winter, Spring. 3(3-0) Three credits in philosophy or 6 credits in political science, or approval of department.
Philosophical justifications for political authority and individual liberty. Consideration of such theories as natural law, social contract, utilitarianism and historicism.
- 366. The Philosophy of Karl Marx**
Spring. 3(3-0) Three credits in philosophy or approval of department.
Structural and critical analysis of Karl Marx's philosophical thought. Theory of objectification and alienation; its application to the religious, philosophical, political, social, and economic spheres; reform of the Hegelian dialectic.
- 370. Philosophy of Language**
Fall. 3(3-0) Three credits in philosophy or approval of department.
An elucidation of elementary topics in semantics and philosophy of language, including such topics as meaning, denotation and truth.
- 380. The Nature of Science**
Fall, Winter. 3(3-0) One course in the biological, physical or mathematical sciences.
Conflicting views about science. Such topics as: scientific methodology, the objectivity of science, the presuppositions, goals and limits of science.
- 381. Science, Values, and Decision Making**
Winter, Spring. 3(3-0) One course in the biological, physical or mathematical sciences.
Issues concerning science and man. Such topics as: the value neutrality of science, science and ideology, science and decision making, the scientific predictability of human actions.
- 390. Philosophy in Literature**
Spring. 3(3-0) Juniors.
Philosophical problems found in such writers as Aeschylus, Goethe, Dostoevsky, Tolstoy, Mann, Hesse, Camus.
- 400H. Honors Work**
Fall, Winter, Spring. Variable credit.
Approval of department.
Individually selected program of supervised group or individual study dealing with some phase of philosophy.
- 410. Plato**
Fall. 5(4-0) Three credits in philosophy at 300 level or 9 credits in philosophy or approval of department.
The most important Socratic dialogues, including the "Republic" and the dialogues of the early Academy.

411. Aristotle, Part I

Winter. 4(3-0) Three credits in philosophy at the 300 level or higher or 9 credits in philosophy or approval of department.

Introduction to the philosophy of Aristotle. Readings from the texts of Aristotle and lectures on his philosophy with emphasis on his logical, epistemological and metaphysical inquiries.

412. Aristotle, Part II

Spring. 4(3-0) PHL 411, or approval of department.

Continuation of PHL 411, with emphasis on Aristotle's method in relation to his ethics, politics and rhetoric.

413. Continental Rationalism

Fall. 5(4-0) Three credits in philosophy at 300 level or 9 credits in philosophy or approval of department.

The rationalists of the seventeenth century, with emphasis on Descartes, Spinoza and Leibniz.

414. Medieval Philosophy

Winter. 4(3-0) Three credits in philosophy at 300 level or higher, or 9 credits in philosophy, or approval of department.

Significant philosophers and philosophical problems of the Medieval period.

416. British Empiricism

Winter. 5(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department.

The development of the philosophical school of British Empiricism, with emphasis on the writings of Locke, Berkeley, and Hume.

419. Nineteenth Century Philosophy

Fall. 4(3-0) Three credits in philosophy at 300 level or higher or approval of department.

Significant philosophical developments in 19th century thought, with emphasis on post-Kantian idealism.

420. Analytic Philosophy, 1900-1945

Fall. 4(3-0) Three credits in philosophy at the 300 level or higher or 9 credits in philosophy or approval of department.

Issues in the works of such philosophers as Frege, Russell, Morre, Wittgenstein and Carnap. Will provide a background for recent analytic philosophy.

421. Formal Linguistic Analysis

Winter. 4(3-0) PHL 337 or PHL 420 or approval of department.

Issues in the works of such philosophers as Carnap, Quine, Goodman and Bergman.

422. Non-Formal Linguistic Analysis

Spring. 4(3-0) PHL 420.

Issues in the works of such philosophers as Wittgenstein, Ryle, Austin and Strawson.

423. Kant

Spring. 5(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department.

Kant's metaphysical and epistemological system as expressed in the "Critique of Pure Reason."

424. Contemporary Continental Philosophy

Winter. 4(3-0) Three credits of philosophy at the 300 level or higher or approval of department.

Typical areas of study are phenomenology, structuralism, contemporary interpretation of Marx, hermeneutic (Gadamer), critique of instrumental reason (Horkheimer, Adorno, Habermas) ontologies of the person.

427. Hegel

Winter. 4(3-0) Three credits in philosophy at the 300 level or higher or 9 credits in philosophy or approval of department.

Hegel's "Phenomenology of Spirit", "Science of Logic", or "Philosophy of Right." Textual analysis and critical study of epistemological, metaphysical or ethico-political aspects of Hegelian philosophy.

428. Special Topics in Existentialism

Spring. 4(3-0) PHL 323 or approval of department.

An examination of existentialist thought in terms of a single author or topic.

431. Modern Ethical Theories

Fall. 4(3-0) 3 credits in philosophy at the 300 level or higher or approval of department.

Study of some of the important writers and problems in moral philosophy since the seventeenth century.

432. Contemporary Ethical Theories

Winter. 4(3-0) PHL 431 or 9 credits in philosophy or approval of department.

Study of some of the leading contemporary views of the nature of moral language and consciousness.

437. Nonstandard Logics

Winter. 4(4-0) PHL 337 or approval of department.

Such topics as the logic of possibility, of existence, of knowledge and belief, of obligation, of tense; many-valued logics; intuitionist logic.

439. Introduction to Metatheory

Spring. 4(4-0) PHL 337 or approval of department.

Metatheory for quantificational logic and first order theories—including consistency and completeness theorems, independence of axioms. Introduction to model theory and proof theory.

440. Epistemology, Part I

Fall of even-numbered years. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department.

Study of evidence, grounds of assent, conviction, belief, and certainty.

441. Epistemology, Part II

Winter of odd-numbered years. 4(3-0) PHL 440 or approval of department.

Continuation of PHL 440.

445. Metaphysics, Part I

Fall of odd-numbered years. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department.

Fundamental concepts and categories in metaphysics: substance, process, cause, universal, particular, space, time, endurance, eternity, change, and value.

446. Metaphysics, Part II

Winter of even-numbered years. 4(3-0) PHL 445 or approval of department.

Continuation of PHL 445.

447. Philosophy of Mind

Winter. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department.

Examines classical and contemporary treatments of such concepts as "mind", "self", "intentionality", "mental act", and associated problems (the body-mind relation, "thinking" machines, the connection of thought with action, etc.).

450. History of Esthetic Theory

Spring. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in art, music or literature or approval of department.

Poetics of Aristotle, and the tradition which it has generated in critical reflection on theory of poetry, the drama, and fine arts.

460. Moral and Political Issues

Fall, Winter, Spring. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy, or approval of department.

Philosophical aspects of such issues as freedom of speech and action, civil disobedience, violence, war, justice and equality, human rights and punishment.

471. Philosophy of Mathematics

Spring. 4(3-0) PHL 337 or LBC 372 or MTH 471 or approval of department.

An analysis of the nature of mathematical truth. The theses of logicism, formalism, intuitionism, and conventionalism are critically examined.

480. Philosophy of Science, Part I

Winter. 4(3-0) PHL 337 or approval of department.

Topics such as: the logical structure of scientific theories, empirical meaningfulness and testability, deductive and probabilistic explanation, prediction.

481. Philosophy of Science, Part II

Spring. 4(3-0) PHL 337 or approval of department.

Topics such as: discovery vs. validation of theories, probability, induction and confirmation theory.

483. Philosophy of Physical Science

Fall. 4(4-0) Nine credits in physical science or approval of department. Interdepartmental with and administered by Lyman Briggs College.

Philosophical problems of the physical sciences. The topics will be taken from such areas as: quantum mechanics, space-time, classical mechanics, relativity.

484. Philosophy of Biological Sciences

Winter, Spring. 4(4-0) Nine credits in science or approval of department. Interdepartmental with and administered by Lyman Briggs College.

Methodological notions and problems of the biological sciences such as: observation and measurement, classification, teleological and functional explanation, teleological systems, emergentism, vitalism, value neutrality.

**Descriptions – Philosophy
of
Courses**

- 485. Philosophy of the Social Sciences**
Spring. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or 9 credits, other than basics, in social science or approval of department.
Selected problems in the methodology of the behavioral sciences, including such topics as: concept formation and theory construction, explanation and insight, subjectivity and value judgements, emergence and teleology, historicism, reductionism, measurement, and statistical inference.
- 490. Individual Reading**
Fall, Winter, Spring, Summer. 1 to 4 credits. Approval of department.
Supervised reading on a particular author or topic.
- 494. Special Topics**
Fall, Winter, Spring, Summer. 2(2-0) to 6(6-0) Approval of department.
Intensive study of some particular problem or author in philosophy.
- 495. Proseminar**
Winter, Spring. 1 credit. May reenroll for a maximum of 4 credits. Juniors. Fifteen credits in philosophy or approval of instructor.
Each section will examine a particular topic or author. Emphasis on discussion of student papers.
- 825. Seminar in the History of Philosophy**
Fall, Winter, Spring. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
- 830. Seminar in Ethics**
Winter, Spring, Summer. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
- 837. Seminar in Logic**
Fall. 4(3-0) May reenroll for credit. Approval of department.
- 841. Seminar in Epistemology**
Fall, Winter, Spring. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
- 845. Seminar in Metaphysics**
Fall, Winter, Spring. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
- 850. Seminar in Aesthetics**
Fall. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
The nature of aesthetic values, grounds of criticism, function of the arts, etc.
- 860. Seminar in Social Philosophy**
Spring. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
Philosophy of law and of the state.
- 870. Seminar in the Philosophy of Language**
Fall. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.
Concrete bases of language and nature of meaning.
- 880. Seminar in Philosophy of Science**
Fall, Winter. 4(3-0) May reenroll for a maximum of 12 credits. Approval of department.

- 890. Graduate Reading Course**
Fall, Winter, Spring, Summer. 1 to 10 credits. May reenroll for credit. Approval of department.
Supervised reading course for advanced graduate students for more thorough investigation of special fields.
- 899. Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
- 999. Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

PHYSICAL SCIENCE PHS

College of Natural Science

The content of courses 400, 405, 410 and 412, as well as the problems course, 890, may vary from term to term. Brochures giving detailed information about individual courses are available in the Science and Mathematics Teaching Center and the Office of the Assistant Dean for Lifelong Education. These courses are primarily designed for in-service teachers and interested adults and are offered in off-campus locations.

- 203. Foundations of Physical Sciences**
Fall, Winter, Spring, Summer. 4(3-3) Primarily for elementary school teachers.
Integrated descriptive course in the elements of physical science including the interrelations among chemistry, geology, meteorology, astronomy, and physics.
- 400. Physical Science for Teachers**
Fall, Winter, Spring, Summer. 3 or 4 credits. May reenroll for a maximum of 12 credits. Teacher certification with science major or minor.
For in-service teachers stressing process, inquiry, meaning and field experience. Topics will be generated from classroom experiences of participants.
- 405. Topics in Physical Science**
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits if different topic is taken. Approval of department.
Presentation of single topics from the physical sciences by senior faculty and guest lecturers. Topics are selected to facilitate development of strong physical science programs in schools.
- 410. Seminar on Recent Advances in Physical Science**
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits if different topic is taken. Approval of department.
A series of lectures by senior faculty of topics on the history, development, the most recent advances and the possible future and limits of the physical sciences.
- 412. Recent Advances in Earth Science**
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits if different topic is taken. Approval of department.
A series of lectures by senior faculty on the history, development, most recent advances and possible future trends in the earth sciences.

- 430. Planetarium and Classroom Instruction**
Summer. 4(3-2) AST 119 or AST 217 or AST 229.
Practical operation, techniques, and methods of instruction for astronomy and other sciences in the planetarium theater and the classroom.
- 431. Problems in Planetarium Education**
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Approval of department.
Individual study, training, or project under the direction of a faculty member. Often the training will be in the area of actual delivery of planetarium presentations.
- 890. Problems in Physical Science**
Fall, Winter, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 15 credits. Bachelor's degree in a physical science.

**PHYSICAL SYSTEMS IN
AGRICULTURE AND NATURAL
RESOURCES**

See Agricultural Engineering

PHYSICS PHY

College of Natural Science

Introductory physics courses are offered in both the lecture-recitation and the Competency-Based-Instructional (CBI) format. In the latter format the students are carefully guided through each course via written materials with ample consulting time available. Both content and pace of course are flexible to suit student's needs and interests, final grades being based on total amount of material for which student's mastery is certified. The introductory courses may be grouped by the application of two criteria: The interests of the students the courses are designed to serve and the method of instruction employed.

Lecture-Recitation Format

237, 238, 239, three credits each, designed primarily for students with interests in the life and earth sciences. The mathematics prerequisite is credit for or concurrent enrollment in college algebra and trigonometry (MTH 109 or 111).

287, 288, 289, four credits each, designed primarily for students with interest in the physical sciences, mathematics and engineering. The mathematics prerequisite is credit for or concurrent enrollment in calculus III with vectors (MTH 214).

291H, 292H, 293H, four credits each, designed primarily for Physics majors and others with a special interest in Physics. The mathematics prerequisite is credit for or concurrent enrollment in calculus III with vectors (MTH 214), the Honors section recommended.

Competency Based Instructional Format
237B, an alternate way to earn credit in 237. 281, 282, 283, three credits each, designed for students with interest in the natural sciences, including the life and earth sciences. The mathematics prerequisite is calculus I with analytic geometry (MTH 112).