560. 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 MTI 471 or approval of department.
An analysis of the nature of mathematical truth. The theory of logicism, formalism, intuitionism, and conventionalism are critically examined.

490. 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.

491. 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.

493. 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.

494. 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.

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.

827. 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.

895. Master's Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

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

PHYSICAL SCIENCE

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. 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 on topics of 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 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

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 mastery is certified. The introductory courses may be grouped by the application of two introductory series is covered in one term for each course. Prerequisites to nearly all the first courses in the 300-400 level course sequences are stated in terms of the Introductory Physics courses. The course selected for prerequisite is that which requires the least number of credits and the least mathematical background the department considers adequate. The corresponding term of any introductory sequence that requires a mathematically background is covered in one term for each of the stated prerequisite may be substituted for the stated prerequisite.

All 400 level physics courses (except 430 and 431) require 289 or 293H.

100. The Universe as Home for Man
Spring. 4(4-0)

The place of man in the physical universe. Cosmology, complexities on the human scale, microcosms in the human scale, microcosmic physics, universal conditions for life, future for man, space colonization. Approved through Winter 1981.

201. The Science of Sound I. Rock, Bach and Oscillators (N)
Winter. 3(3-0) or 4(4-0) Interdepartmental with the Department of Mechanical Engineering.


202. The Science of Sound II
Spring. 3(3-0) or 4(4-0) PHY 201. Interdepartmental with and administered by the Department of Mechanical Engineering.


203. Science of Light and Color for Nonscientists
Spring. 4(4-0)

Properties of light with applications to mirrors, lenses, eyes, cameras, lasers, holography. Light spectra, color TV, color vision, filters, pigments. Black and white and color photography.

227. Physics for Audiology and Speech Sciences
Fall, Spring. 3(3-0) MTH 108. Not open to students with credit in PHY 237. Interdepartmental with the Department of Audiology and Speech Sciences.

Introductory physics for Audiology and Speech Sciences majors: kinematics, Newton's Law, conservation of energy and momentum, waves and vibrations, sound propagation, resonance, speech production.

237. Introductory Physics
Fall, Winter, Spring. 3(4-0) MTH 109 or MTH 111 or concurrently. Not open to students with credit in PHY 227.

Mechanics, including Newton's Law, momentum, energy, and conservation laws.

237B. Introductory Physics I, CBI
Fall, Winter, Spring. 3 credits. MTH 109 or MTH 111 or concurrently.

Mechanics including Newton's Law, momentum, energy, and conservation laws.

238. Introductory Physics II, CBI
Fall, Winter, Spring. 3 credits. PHY 238 or PHY 239.

Heat, electricity and magnetism.

239. Introductory Physics
Fall, Winter, Spring. 3(4-0) PHY 238.

Wave motion, sound, light, and modern developments.

239B. Introductory Physics III, CBI
Fall, Winter, Spring. 3 credits. PHY 238 or PHY 239.

Wave motion, sound, light and modern developments.

IDC. Energy Consumption and Environmental Quality
For course description, see Interdisciplinary Courses.

257. Introductory Physics Laboratory
Fall, Winter, Summer. 1(0-2) PHY 237 or PHY 238 or concurrently.

Mechanics and heat.

258. Introductory Physics Laboratory
Winter, Spring, Summer. 1(0-2) PHY 258 or PHY 262 or concurrently.

Heat, electricity and magnetism.

259. Introductory Physics Laboratory
Fall, Winter, Summer. 1(0-2) PHY 259 or PHY 263 or concurrently.

Wave motion, sound, light and modern developments.

281. Basic Physics I, CBI
Fall, Winter, Spring. 3 credits. MTH 112.

Static equilibrium, Newton's laws, power, harmonic motion, rotational motion.

282. Basic Physics II, CBI
Fall, Winter, Spring. 3 credits. PHY 281.

Microscopic origin of heat flow and first law of thermodynamics, electric and magnetic forces and sources, direct currents.