

**880. Seminar in the Philosophy of Science**  
Fall, Winter. 4(3-0) May re-enroll for a maximum of 12 credits. Approval of department.

**890. Graduate Reading Course**  
Fall, Winter, Spring, Summer. 1 to 10 credits. May re-enroll 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 re-enroll 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 the classroom experiences of participants.

**405. Topics in Physical Science**  
Fall, Winter, Spring, Summer. 1 to 3 credits. May re-enroll 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 re-enroll 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 re-enroll 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 217 or 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 re-enroll 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 re-enroll for a maximum of 15 credits. Bachelors 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 interest 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).

291, 292, 293, 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).

287A, 288A, 289A, one credit each, to combine with 281, 282, 283 to give a four credit per term introductory series.

291A, 292A, 293A, one credit each, to combine with 281, 287A; 282, 288A; 283, 289A or 287, 288, 289 to give a five credit introductory series.

291B, 292B, 293B (Honors Physics) in which the five credit introductory series is covered in one term for each course.

The courses taught via the two formats may be grouped to give a wide variety of introductory physics courses. The following equivalencies exist:

237, 238, 239 may be taken as 237B, 238, 239.

287, 288, 289 may be taken as 281, 287A; 282, 288A; 283, 289A.

291B, 292B, 293B may be taken as 281, 287A, 291A; 282, 288A, 292A; 283, 289A, 293A; or as 287, 291A; 288, 292A; 289, 293A.

A student may change from one group of introductory courses to another, but may not earn credit for more than one complete sequence.

Credit may not be earned for more than one of the courses 294, 357, or 364.

201, 301, 357, 430, and 431 cannot be used to meet the requirements for a major in Physics.

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 mathematical background equal to or greater than that of the stated prerequisite may be substituted for the stated prerequisite.

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

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

Man-sound relationship. Production, propagation, detection of sounds. Voice, hearing, scales, timbre, musical instruments. Room acoustics. Electronic reproduction and synthesis of music. Demonstrations emphasized.

**202. The Science of Sound II**  
Spring. 3(3-0) or 4(4-0) 201. Interdepartmental with and administered by the Department of Mechanical Engineering.  
Nature, generation, and propagation of sound. Acoustical phenomenon and measurements. Storage and manipulation of sound in numerical form. Music programming.

**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.