

**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**

**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.

**410. Seminar on Recent Advances in Physical Science**  
Fall, Winter, Spring, Summer. 3(3-0)  
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. Seminar on Man, His Earth**  
Fall, Winter, Spring, Summer. 3(3-0)  
Approval of department.  
A summary by senior faculty from Astronomy, Anthropology, Botany, Geology, Meteorology, and Zoology of new ideas, methods, and theories employed by current researchers to unravel the mysteries of the origin of the earth, its interior, the forces developing the scenic surface features, and the evolution of life in its historical setting.

**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 divided into four groups:

- 1) 237, 238, 239 (theory) and 257, 258, 259 (laboratory). These are for students who are taking at the same time, or who have taken, first year mathematics through college algebra and trigonometry.
- 2) 281, 282, 283 (theory) for students of the natural sciences who have taken Calculus I (MTH 112).  
Self-paced, under combined management with 291A, 291B, 292A, 292B, and the self-paced sections of 281A, 282A, 283A, 287, 288, 289.  
Students in 281, 282, 283 may take either 257, 258, 259 or 297, 298, 299 laboratory course sequences.
- 3) 281A, 282A, 283A, 287, 288, 289 (theory) for students of the physical sciences, mathematics, engineering and others taking Calculus III (MTH 214). May be taken as 287 or as 281 plus 281A, 288, or as 282 plus 282A, as 289 or 283 plus 283A.  
The self-paced sections are under combined management with 281, 282, 283, and 291A, 291B, 292A, 292B, 293A, 293B.  
Students in 287A, 287B, 288A, 288B, 289A, 289B may take either 297, 298, 299 or 392, 393, 394 laboratory course sequences.
- 4) 291A, 291B, 292A, 292B, 293A, 293B (theory) for physics majors and others with a special interest in physics. Students should be taking Calculus III (MTH 214). Self-paced, under combined management with 281, 282, 283, and self-paced sections of 281A, 282A, 283A, 287, 288, 289.  
291, 292, 293, 294 (theory) for physics majors and others with a special interest in physics. Students should be taking Calculus III (MTH 214). Lecture-recitation format only.  
Students in 292, 293, 294, 291A, 291B, 292A, 292B, 293A, 293B may take either 392, 393, 394, or 297, 298, 299 laboratory course sequences.

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 PHY 294, 357 or 364.

PHY 201, 256, 301, 357 and 430 cannot be used to meet the requirements for a major in physics.

All 400 level physics courses (except 430) require PHY 289 or 293B or equivalent and MTH 215 as prerequisites.

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

Nature, generation, and propagation of sound. Acoustical phenomenon and measurements. Storage and manipulation of sound in numerical form. Music programming.

**237. Introductory Physics**  
Fall, Winter. 3(4-0) MTH 102 or 109 or 111 or concurrently.  
Mechanics and heat.

**238. Introductory Physics**  
Winter, Spring. 3(4-0) 237.  
Heat, electricity and magnetism.

**239. Introductory Physics**  
Fall, Spring. 3(4-0) 238.  
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) 237 or 281, or concurrently.  
Mechanics and heat.

**258. Introductory Physics Laboratory**  
Winter, Spring, Summer. 1(0-2) 238 or 282 or concurrently.  
Heat, electricity and magnetism.

**259. Introductory Physics Laboratory**  
Fall, Spring, Summer. 1(0-2) 239 or 283 or concurrently.  
Wave motion, sound, light and modern developments.

**281. Basic Physics I**  
Fall, Winter, Spring. 3 credits—Self-paced only. MTH 112.  
Static equilibrium, Newton's laws, power, harmonic motion, rotational motion.

**281A. Physics IA**  
Fall, Winter, Spring. 1 credit—Self-paced only. MTH 113; PHY 281 or concurrently.  
Extensions of 281, plus; frames of reference, special relativity, rocket equation, forced oscillations, resonances, fluid motion, numerical (computer) solutions, moments of inertia, gyroscopic motion.

**282. Basic Physics II**  
Fall, Winter, Spring. 3 credits—Self-paced only. 281, or 281A, or 287, or 291A, or 291B, or 291.  
Microscopic origin of heat flow and first law of thermodynamics, electric and magnetic forces and sources, direct currents.

**282A. Physics IIA**  
Fall, Winter, Spring. 1 credit—Self-paced only. 281, or 281A, or 287, or 291, or 291B; MTH 214 or approval of department.  
Extensions of 282, plus: entropy, transport phenomena, general relativity, electrons, atoms, molecules, solids, Maxwell's equations, electromagnetic fields, energy, alternating currents, and other electricity and magnetism applications, numerical (computer) solutions.