b. Twelve credits of earth science, chemistry, or physics (excluding the two areas selected in item a). The physics courses will include 107, 108, and 314. The geology courses will include Geology 103.
c. A minimum of six credits in biology, including Biology 101.
d. Natural Science 322, 324, 326, 327.
e. All requirements listed under the catalog section Secondary Education.

105 Principles of Physical Science (4)

A survey of topics selected from physics and chemistry designed for the non-science major. Some of the physics topics to be studied include the nature of light and color, electrical phenomena, heat and energy, as well as other topics necessary for understanding much of the phenomena associated with everyday life. Chemistry topics include describing the nature of matter at a macroscopic level and at an atomic level. Social issues with a scientific or technological component are discussed. All topics are developed through laboratory exercises. **Does not apply to any science major.**

Physics (PHY)

Professor Wentworth
Associate Professor Plano Clark

Physics is concerned with basic questions about the structure and behavior of the physical universe: the description and causes of motion, the nature of energy and energy changes in systems, the interactions between particles, the relationship between the macroscopic behavior of a system and its microscopic parts. It is both a foundation for understanding other sciences, such as astronomy, chemistry and biology, and a source of practical knowledge used by the engineering disciplines which promote technological advances.

Physics is often divided into subfields according to the type of system being studied: elementary particle physics, nuclear physics, atomic and molecular physics, and condensed matter physics. However, all of these subfields share common principles understood by all physicists.

Three groups of students are served by the Physics program: students needing a science course for the Doane Plan, science and preprofessional students in disciplines other than physics, and students majoring in physics. There are common goals for all of these students, although the level of achievement will differ between the groups. The common goals are to:

- Develop a student's ability to make observations about the physical world.
- Develop a student's ability to construct and test hypotheses about these observations.
- Give students experience in quantitative problem solving in a physical context.

- Help students become familiar with the fundamental laws of behavior for our universe as understood by contemporary science.

Requirements for the Physics Major:

Complete 1 or 2.

1. Students not seeking secondary education certification in physics must complete the following:
   a. A minimum of 35 credits in physics with a cumulative grade point average of 2.00 or above.
   b. Physics 107, 108, 205 (or 201, 202).
   c. Physics 225 within two semesters of completing item "b" above.
   d. Physics 301 (or 324), 302, 306, 314, 435 (or 4 credits of 471), 496.
   e. Four additional credits in physics at the 300-400 level.
   f. Cognates Chemistry 125, Information Science and Technology 145, Mathematics 235, 236, 237, 238, 329.
2. Students seeking secondary education certification in physics must complete the following:
   a. A minimum of 27 credits in physics with a cumulative grade point average of 2.60 or above.
   b. Physics 107, 108, 205 (or 201, 202).
   c. Physics 225 within two semesters of completing item "b" above.
   d. Physics 301 (or 324), 302, 306, 314, 496.
   e. Cognates Astronomy 103, 103L (or Geology 103), Biology 101, Chemistry 125, Information Science and Technology 145, Mathematics 235, 236, 237, 238, 329, Natural Science 322, 324, 326, 327.
   f. One additional teaching major.
   g. All requirements listed in the catalog under Secondary Education.

Requirements for the Physics Minor:

1. Complete a minimum of 20 credits in physics as follows:
   a. Physics 107, 108 (or 201, 202).
   b. A minimum of at least 12 additional credits in physics at the 300-400 level.
2. Complete the cognates Mathematics 235, 236.

107-108 Introductory Physics (4) (4)

A course designed to meet the needs of the preprofessional student and the science major as well as providing an introduction to physics for all students. Topics covered include mechanics, optics, thermodynamics, sound, electricity and magnetism, electronics, and selected areas of modern physics. Lecture and laboratory. ***Prerequisite: Mathematics 105, 125 (or equivalent).***

201-202 General Physics (4) (4)

A calculus-based introduction to physics. Topics include mechanics, optics, thermodynamics, sound electricity and magnetism, electronics, and selected areas of modern physics. Lecture and laboratory. ***Prerequisite: Physics***

107 or permission; Mathematics 235, 236 (may be taken concurrently). Physics 201 offered spring; Physics 202 offered fall.

205 Calculus Topics in General Physics (2)

A course surveying calculus-related topics selected from the areas of mechanics, wave phenomena, thermodynamics, electricity, and magnetism and optics. An introduction to numerical techniques for the solution of problems will also be given. ***Prerequisites: Physics 107, Math 235. May be taken concurrently with Physics 108 and Math 236. Offered spring term.***

225 Sophomore Exam (0)

A departmentally administered examination covering topics from the entire introductory physics sequence: Physics 107, 108, 205. The examination provides an opportunity for students to review and integrate the knowledge gained in the introductory sequence. It demonstrates long-term mastery of topics. **Generally taken fall semester of the sophomore year. Physics majors must pass the exam with a minimum score of 50% (the examination may be repeated).** ***Prerequisite: Physics 107, 108, 205. (Pass/Fail)***

290, 390, 490 Directed Study (1-3) (1-3) (1-3)

An opportunity for supervised, independent study of a particular topic based on the interest of the student and the availability and approval of the faculty.

301 Analog Electronics (4)

A study of AC and DC circuits and solid state devices. Elements of network analysis appropriate for AC and DC circuits is introduced. Basic building blocks of modern circuits is studied including diodes, transistors, operational amplifiers, and other integrated circuits. Topics are developed through extensive laboratory experience. ***Prerequisite: Physics 107, 108 (or 201, 202). Offered alternate years.***

302 Electricity and Magnetism (4)

A study of the interaction of charged particles with electric and magnetic fields. The topics which are studied include fields due to stationary charges or steady currents, basic dielectric properties of materials, the vector potential, Faraday's law, the motion of charged particles in fields, basic magnetic properties of materials, Maxwell's equations, and an introduction to electromagnetic waves. Completing the course allows the student to describe important definitions and relationships for each topic studied, describe the experimental observations that suggest or support the descriptions, make predictions using classical electromagnetic theory in each of the areas studied, and use analytical and numerical techniques to aid in the solution of problems posed by electromagnetic theory. ***Prerequisite: Physics 107, 108 (or 201, 202); Mathematics 235, 236, 237, 238, or permission. Offered alternate years.***

306 Mechanics (4)

A study of the classical mechanics of a particle, systems of particles, and rigid bodies. The course includes study of particle dynamics, central force problems, Lagranigian and Hamiltonian formulations of mechanics, and the description of rigid body motion. Experimental work in selected areas is performed. Completing the course allows the student to describe important defi-

nitions and relationships in each area studied, discuss the importance of classical mechanics to contemporary physics and engineering, work problems in each of the areas studied, and design and carry out experiments testing descriptions and relationships in selected areas. ***Prerequisite: Physics 107, 108 (or 201, 202); Mathematics 235, 236, 237, 238, or permission. Offered alternate years.***

308 Heat and Thermodynamics (4)

A study of temperature, heat and work, the laws of thermodynamics, entropy, the Carnot cycle, and introduction to statistical mechanics. Experimental work in selected areas is performed. Completing the course allows the student to describe important definitions and relationships for each of the topics covered, discuss experimental evidence for each relationship or law, design and carry out experiments in selected areas, and do calculations involving theoretical relationships studied. ***Prerequisite: Physics 107, 108 (or 201, 202); Mathematics 235, 236, 237, 238, or permission. Offered alternate years.***

312 Optics (4)

A survey of geometric and physical optics. The course includes study of the nature of light, production and measurement of light, lenses, mirrors, lens systems, aberration theory, interference phenomena, optical interferometry, and diffraction phenomena. Experimental work in selected areas is performed. Completing the course allows the student to design simple optical systems, recognize limitations due to aberrations, analyze a variety of interference and diffraction phenomena using appropriate analytical and numerical techniques, and design and perform experiments in selected areas. ***Prerequisite: Physics 107, 108 (or 201, 202); Mathematics 235, 236, 237, 238, or permission. Offered alternate years.***

314 Modern Physics (4)

An introduction to fundamental principles of physics used in describing molecules, atoms and nuclei. The course includes study of special relativity, introductory quantum mechanics, and applications of these theories. Experimental work in selected areas is performed. Completing the course allows the student to describe important definitions and relationships in each of the areas studied, understand historically important experiments which suggested each of the major theories, and perform calculations which apply the major theories discussed. ***Prerequisite: Physics 107, 108 (or 201, 202); Mathematics 235, 236. Offered alternate years.***

318 Statics (4)

Statics is a study of forces and movements of forces on rigid bodies in equilibrium, and is a fundamental course for all engineering students. The course includes a detailed examination of the forces and moments acting on various structures from both an experimental and theoretical standpoint. Computer-modeling packages will be used to provide students with a working knowledge of important tools for problem solving and drafting software to help visualize the projects. Both analytical and numerical solutions will be developed and used to enhance the students' problem-solving skills. Upon successful completion of the course, students will have produced a free-body diagram of an object, analyzed free-body diagrams and solved force problems

using vector algebra, determined the loads (forces) on elements of a structure (e.g., a bridge) and how those loads are transmitted to other elements of the structure, demonstrated facility in numerical problem solving, and demonstrated the ability to gather and analyze data in selected areas of the topics covered. ***Prerequisite: Physics 107 or 201. Offered alternate fall terms.***

324 Digital Electronics (4)

An introduction to digital logic devices, microcontrollers (programming and operation), analog-to-digital and digital-to-analog converters, and basic input/output methods. Emphasis is given to controlling a process using these devices. Completing the course allows the student to identify and develop digital solutions to selected real world data acquisition and control problems. ***Prerequisite: Physics 107, 108. (Cross-referenced with Information Science and Technology 324.)***

435 Mathematical Methods for Physics (4)

A course designed to integrate mathematics into a coherent foundation for problem solving for upper-level physics and engineering courses. Topics include Laplace and Fourier transformations, Fourier series, vector operators, ordinary and partial differential equations, and orthogonal functions. Emphasis is given to the solution (analytical and numerical) of problems from both physics and engineering. Completion of the course allows the student to define important aspects of each mathematical topic, to describe the relevance of each topic to physics and engineering problems, and to work both formal and physics/engineering problems involving each topic. ***Prerequisite: Physics 107, 108; Mathematics 235, 236, 237, 238. (Cross-referenced with Mathematics 435.)***

496 Senior Seminar (1)

The senior seminar presents an opportunity to integrate knowledge from all previous course work by working on a research project in collaboration with a faculty member. The chosen project is designed to promote understanding of basic research methods by their application. Students are responsible for the design of all aspects of the project including computer modeling, data analysis, and a formal write-up of their results. Communication is extremely important so students present their work locally and are encouraged to present papers at local and national conferences whenever possible. ***Prerequisite: Permission of the instructor. Offered fall term.***

Political Science (PSI)

Assistant Professor Hill
Adjunct Professor McPartland

Political science studies the use of authority and influence within legal, political, human and governmental contexts. It is designed to 1) prepare students to become effective citizens who contribute to and participate in democratic processes, 2) provide the knowledge and develop the intellectual skills which allow students to successfully enter and complete law school and