**Atoms are Everything**

1. What is the theme you propose for your group of courses? In what ways do you think this theme speaks to issues important to our freshman population? To the University's mission?

The theme of this cluster is that there are a few physical principles from which we can understand all the incredibly diverse phenomena that we observe in the Universe. The goal of physics is to uncover these basic principles. The three courses that compose this cluster give an overview of the progress that has been made in finding these ideas in the past few hundred years.

This cluster is primarily intended for physics majors, but may also be useful for chemistry, geology, and biology majors. The current cluster recommended for physics majors, Interdependence of Chemicals, severely disrupts work towards the physics major. Students taking this cluster are required to take a five unit chemistry sequence, several other GE classes, and most take calculus which is a co- or pre-requisite for all physics courses for the major. This means that most students don’t have room in their schedule to add a five unit physics course. The outcome is that physics majors are unable to take physics courses their first year! This is frustrating to students eager to start on their chosen area of study, and additionally means that they can not take any other physics classes their sophomore year since the 1000 series is a prerequisite to all major courses. Hence many students need five years to complete the intensive 105 unit major because of this GE imposed delay. This new cluster will allow physics majors to become immersed in physics there first year and ultimately graduate in a more timely fashion.

2. List the three courses (prefix, number, title, units)

   PHYS 1001 General Physics: Newtonian Mechanics and Oscillations (5)
   PHYS 1002 General Physics: Thermodynamics and Electromagnetism (5)
   PHYS 1003 General Physics: Optics and Modern Physics (5)

3. Explain how the theme will be used to integrate course content in each course.
   (Describe the contribution of each discipline's perspective on the theme that will help create a coherent learning experience for the students.)

These three courses are tightly integrated based on the content. Each course will explore a different area of physics, but later material will build on early ideas. For example, angular momentum will be discussed in PHYS 1001 to explain the motion of ice skaters, planets, and gyroscopes. In PHYS 1003 the same principle of angular momentum will be used to explain many properties of atoms and molecules. In this cluster the same professor will teach all three courses which will lend a practically cohesive nature to the classes.
4. Explain how each course in the proposed learning community will support student learning of each of the lower division general education area learning outcomes and General Education requirements (passed by Academic Senate February 17, 2004). Please use the GE course application forms to address this question. (If the course has already been approved for GE credit, and the current application form was used, please attach a copy. If the course has not yet been approved for GE credit, the use of the application form will permit review for GE credit, even if the cluster application is not selected.
(http://www.csuhayward.edu/ge/subcommittee/ge/learningoutcomes.htm).

Applications for general education credit are attached.

5. Attach course outlines for the three courses. Each course outline should indicate how the theme would be used in the course and any student activities that cross all three courses. (For example, will there be common reading(s) in the three courses? Will there be common assignments, or assignments on which students work the entire year? Will students keep a cluster portfolio? Etc.)

Course syllabi are attached.
Application for General Education Credit  
for Lower Division Physical Science (Area B1)

Course title  General Physics: Newtonian Mechanics and Oscillations
Course number PHYS 1001

1. Students will demonstrate broad science content knowledge in the physical sciences such as the nature and structure of matter, Earth’s place in the Universe, or the conservation of energy and matter.

Students will learn the physical principles that govern most macroscopic objects.

- Position, velocity, and acceleration
- Motion with constant acceleration
- Vectors and two-dimensional motion
- Force and Newton’s Laws
- Static and Dynamics
- Conservation of momentum
- Conservation of energy
- The theory of gravity
- Angular momentum

2. Students will demonstrate the application of quantitative skills (such as statistics, mathematics and the interpretation of numerical graphical data) to physical science problems.

The topics in this class are developed based on the mathematics of calculus. Students will develop advanced numeracy skills with which they will explore a variety of physical systems. Besides calculus students will use algebra and geometry on a weekly basis. Students will be expected to become proficient at reading and interpreting graphical data. Extensive in class examples will be given to develop these skills, and students will have weekly homework. Midterms and a final exam will be formatted such that students must demonstrate mastery of these quantitative skills.

3. Students will demonstrate a general understanding of the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

The nature of science and scientific investigation will be discussed by examining the historical evolution of different physical theories. For example, Newton developed the first theory of gravity in 1687 which successfully described many diverse phenomena in the natural world including the motion of the planets, the tides, and the path a ball takes when thrown through the air. However in 1915 Einstein developed his General Theory of Relativity, which totally altered our view of gravity and successfully explained exotic phenomena such as black holes and gravitational lensing.
Application for General Education Credit  
for Lower Division Physical Science (Area B1)

Course title: General Physics: Thermodynamics and Electromagnetism

Course number: PHYS 1002

1. Students will demonstrate broad science content knowledge in the physical sciences such as the nature and structure of matter, Earth's place in the Universe, or the conservation of energy and matter.

Students will learn the physical principles that govern electricity and magnetism.

- Simple harmonic motion and resonance
- Electric charge and the electric field
- Electrical circuits
- Magnetism and the magnetic field
- Electromagnetic induction
- Electromagnetic waves
- AC circuits
- Theory of Relativity

2. Students will demonstrate the application of quantitative skills (such as statistics, mathematics and the interpretation of numerical graphical data) to physical science problems.

The topics in this class are developed based on the mathematics of calculus. Students will develop advanced numeracy skills with which they will explore a variety of physical systems. Besides calculus students will use algebra and geometry on a weekly basis. Students will be expected to become proficient at reading and interpreting graphical data. Extensive in class examples will be given to develop these skills, and students will have weekly homework. Midterms and a final exam will be formatted such that students must demonstrate mastery of these quantitative skills.

3. Students will demonstrate a general understanding of the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

The nature of science and scientific investigation will be discussed by examining the historical evolution of different physical theories. For example, Newton developed the first theory of gravity in 1687 which successfully described many diverse phenomena in the natural world including the motion of the planets, the tides, and the path a ball takes when thrown through the air. However in 1915 Einstein developed his General Theory of Relativity, which totally altered our view of gravity and successfully explained exotic phenomena such as black holes and gravitational lensing.
Application for General Education Credit
for Lower Division Physical Science (Area B1)

Course title  General Physics: Optics and Modern Physics

Course number  PHYS 1003

1. Students will demonstrate broad science content knowledge in the physical sciences such as the nature and structure of matter, Earth’s place in the Universe, or the conservation of energy and matter.

Students will learn the physical principles that govern most microscopic objects and the theory of light.

- Work, heat, and the First Law of Thermodynamics
- Heat engines, refrigerators, entropy
- Waves
- Interference and diffraction
- Optics
- Hydrogen atom
- Wavefunctions and the Uncertainty Principle
- Periodic table
- Nuclear physics

2. Students will demonstrate the application of quantitative skills (such as statistics, mathematics and the interpretation of numerical graphical data) to physical science problems.

The topics in this class are developed based on the mathematics of calculus. Students will develop advanced numeracy skills with which they will explore a variety of physical systems. Besides calculus students will use algebra and geometry on a weekly basis. Students will be expected to become proficient at reading and interpreting graphical data. Extensive in class examples will be given to develop these skills, and students will have weekly homework. Midterms and a final exam will be formatted such that students must demonstrate mastery of these quantitative skills.

3. Students will demonstrate a general understanding of the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

The nature of science and scientific investigation will be discussed by examining the historical evolution of different physical theories. For example, Newton developed the first theory of gravity in 1687 which successfully described many diverse phenomena in the natural world including the motion of the planets, the tides, and the path a ball takes when thrown through the air. However in 1915 Einstein developed his General Theory of Relativity, which totally altered our view of gravity and successfully explained exotic phenomena such as black holes and gravitational lensing.
Approved by Department Chairs:

Signature

Department Date

Signature

Department Date

Signature

Department Date

Approved by College Dean/Associate Dean from each participating college:

Signature

Date

Signature

Date

Signature

Date

Signatures of three faculty members: Ideally, the person who will teach the courses will participate in the cluster planning. However, recognizing the staffing difficulties departments face, the faculty member who plans the cluster must agree to provide a thorough orientation to the expectations and methods developed for the learning community to the actual instructor. We each agree, if selected, to meet on for six hours during the following three days for an end-of-Spring workshop on interdisciplinary curriculum, pedagogy and course integration

June 8-10.

Signature

Date

Signature

Date

Signature

Date

\(^1\) While Colleges do not approve courses for GE, College approval assures support for departmental participation.