Name of Proposer:
Jessica Kintner

Name of Department/Program of Proposer:
Physics and Astronomy Department

Name of Department/Program housing the course:
Physics and Astronomy Department

Name of Chair/Program Director:
Jessica Kintner

Type the course acronym, course number and course title:

PHYS 040/041, Revolutions in Science and Revolutions in Science Laboratory. Concurrent enrollment in both courses is required

How often is this course taught:
yearly

Course prerequisites:
None

Unit value of the course:
1.25

Normal class size:
15

Number of sections expected in Fall 2012:
0

Number of sections expected in Spring 2012:
1

Is the course designed for and/or appropriate for first-year students:
This course is quite appropriate for first-year students since it has no prerequisites.

Choose the working groups and learning goals:
Scientific Understanding

Teaching: how the course will guide students to achieving the learning outcomes.

Physics 40 is designed for students who have not taken a college-level science course. I would like to provide a bit of background on the course.

First a description of the course, from the catalog: Physics 40

> is intended to introduce the methods and ideas of science. Students gain an appreciation for the scientific "way of knowing" by learning how phenomena in nature are observed and catalogued, and how general principles are deduced from observations. Concurrent enrollment in Physics 41

is required.

From our original course proposal:

> The specific content of the course will vary with the instructor. Physics 40 is meant to be a course which fosters an appreciation of scientific thought and accomplishments. This can be done using many different topics and approaches.

In recent years, we have taught three versions of the course: one each on quantum mechanics, astronomy, and light. The latter two used a historical approach to show how the scientific theory evolved over time. Regardless of the scientific content, which varies by instructor, Physics 40 meets the criteria for the designation of "Scientific Understanding" as I will outline below.

(1) Demonstrate an understanding of scientific concepts, principles, and theories that explain the natural and physical world.

This course will guide students towards achieving the first learning outcome by exploring the particular scientific content determined by the instructor, for example, the science of astronomy, light, or quantum mechanics.

I will attach sample syllabi from two previous incarnations of this course; however, I would like to emphasize that these are samples, and we do not want to be locked into specific content for this course. We hope the department will have the say over whether the content is scientific enough. (In other words, I'm hoping we don't need to seek re-approval for every new department member who teaches the course via a different topic.)

The topics are primarily covered in a lecture format, but classes routinely include discussions, active physical demonstrations, and time for students to apply concepts themselves by doing problems. The laboratory also explores these same topics. As a hands-on experience, laboratory is an opportunity to analyze and model a real system based on physical principles.

(2) Collect, analyze, and interpret empirical data gathered in a laboratory or field setting.

This course has a required laboratory that meets for one 3-hour session every other week. During the course of the laboratory, students will collect, analyze and interpret empirical data gathered in a laboratory, and occasional field, setting. A sample lab schedule is attached.

Students are provided with a written description of each experiment covering the physical concepts, a description of the experimental setup, guidelines on how to collect data, procedures on how to analyze the data, and questions that guide them in interpreting the data in light of the physical principles. Students carry out these activities themselves. The instructor periodically advises on specific procedures or concepts.

(3) Examine social or ethical issues that arise in the process of scientific inquiry or out of scientific or technological developments.

This goal will be met primarily in the lecture section. Readings from texts or original sources, class discussion, and some students writing will include social or ethical issues that arise in the process of scientific inquiry. The entire class is structured around "Revolutions" in scientific thought. Invariably such revolutions bring up social or ethical issues. Examples from previous classes include: What does it mean that at the smallest level, we seem to live in a statistical world rather than a deterministic one, as can be seen from a philosophical interpretation of quantum mechanics. What obligations do we have

to report theories or observations that challenge well-accepted thought, as can be seen from the Galilean revolution in astronomy or in the development of quantum mechanics? What role should scientists take in developing public policy as can be seen, for example, from Albert Einstein's role during WWII? Are there limits to the pursuit of knowledge, in particular if that pursuit can result in destructive technologies?

Learning: how coursework will be used to measure student learning of the outcomes

(1) Demonstrate an understanding of scientific concepts, principles, and theories that explain the natural and physical world.

This learning outcome will be assessed through homework, midterm exam(s), and a comprehensive final exam. Homework and exams involve some problems, short answer, and some essay questions. Problem solving is the primary way students can demonstrate their understanding. Solutions to problems require more than a numerical answer. Acceptable problem solutions start with identifying appropriate physical principles relevant to the situation, identifying the correct physical quantities to calculate or reason through, and presenting a logical mathematical or verbal progression to arrive at a final value or answer.

The laboratory also allows for students to demonstrate their understanding. The laboratory coursework requires students to give written and verbal explanations of the physical principles and any calculations involved in the experiment.

(2) Collect, analyze, and interpret empirical data gathered in a laboratory or field setting.

Students can demonstrate that they have done and understood these tasks in the following ways: (1) submitting a formal lab report or informal notebook entry that documents their efforts using text, diagrams, and/or calculations; (2) taking a quiz that requires analyzing and interpreting a different set of data using the same techniques; and/or (3) giving a verbal explanation or physical demonstration of the physical principles, measurement techniques and data analysis used in the experiment.

(3) Examine social or ethical issues that arise in the process of scientific inquiry or out of scientific or technological developments.

Students can demonstrate that they have examined social or ethical issues arising from the process of scientific inquiry in a variety of ways: (1) class discussion, or small group discussion with a presentation to the class; (2) answers to essay questions on homework, midterms, or the final exam; and/or (3) part or all of a final project/paper for the course.

Chair will oversee submission of student work:
Yes

Chair will oversee instructor participation in Norming and Assessment exercises:
Yes

Once you have completed this form, please send your syllabi to Darcy Tarbell:
Yes

Thank you: