Department of Physics Assessment Plan

The Goals

We have three mutually-complementary goals in our Physics program:

(1) Education, in the old-fashioned sense: "leading-out" into the world. Our students must learn about the nature of the universe, its constituents and occupants large and small, and the laws under which they operate.

(2) Critical thinking in an interactive learning environment. They must learn to recognize and solve problems especially in the field of Physics. They must learn how physical laws are discovered as well as how they are applied; and they must learn both the power and the limitations of physical law.

(3) Job training. Our students must acquire the technical skills needed to obtain and hold an appropriate place in our technological society.

The central core of science is the concept that theoretical models can be tested by experimental measurements. This "Scientific Method" underlies the Department of Physics Assessment Plan for attainment of our "Goals". The theoretical model of a student-centered learning environment makes predictions regarding the knowledge and skills possessed by our graduates. These "Achievement Standards" can only be validated by well-defined measurements (assessments). The "Achievement Metrics" provide the evidence needed to judge the quality of our student-centered learning environment.

The Achievement Standards

Our Science General Education Students shall:

- Understand how different themes of science make connections within and between the different scientific disciplines. Examples of underlying themes are science as inquiry, scale and structure, energy, balance, evolution and patterns of change.
- Understand and apply the scientific method.
- Use experimental and observational results to evaluate the validity and limitation of theories, and scientific claims.
- Increase understanding of the dynamic and evolving natural world.
- Investigate problems that require knowledge of scientific concepts and reasoning.
- Appreciate issues raised by science for contemporary society and of science in everyday life.
Our Physics Major students shall additionally:

- Know, understand, and use principles of physics.
- Use reasoning and logic to define a problem in terms of principles of physics.
- Design experiments or solve problems using principles of physics, mathematics and instrumentation.
- Analyze and interpret physical data.
- Be able to communicate their knowledge to other scientists, and understand others as they communicate their knowledge.
- Take pride in their understanding of principles of physics and feel a sense of belonging to the community of physicists.

The Achievement Metrics

Internal Metrics

The Department of Physics shall:

- Review our curriculum and course content for consistency with the Achievement Standards.
- Test student achievement in classes with a variety of methods and review their progress: questions by teachers, recitations by students, problem assignments, laboratory reports, quizzes, midterms, term papers and final examinations.
- Conduct exit interviews and require completion of written questionnaires for graduates.
- Review and update annually with tenured faculty.
- Consider the results of Student Evaluation of Faculty and other measures of teaching effectiveness.

External Metrics

The Department of Physics shall:

- Study acceptance rates and success in graduate and credential programs.
- Review nationally-standardized test scores (ETS: GRE or MFT).
- Track the success of our graduates in their careers.
- Communicate with other departments to ensure that our courses meet their students' needs (especially general education and service courses).
- Identify trends in physics education by maintaining contacts with the national community of physics educators.
- Compare our curriculum with that of other universities.
Time Frame

We will implement the standardized test and interview near the end of Spring Quarter 2003. The Department will examine the results during the following Fall quarter.
Assessment Questionnaire for Graduating Seniors

1. How many years have you attended CSUH?

2. Were you a full-time student?

3. Why did you choose CSUH?

4. Was the scheduling of courses convenient?

5. Was the department office friendly and helpful?

6. Please evaluate the Physics curriculum. (Understandable? Useful?)

7. Please evaluate the Physics laboratories. (Understandable? Helpful?)

8. Please evaluate the Physics faculty. (Understandable? Helpful?)

9. Were the required Chemistry courses helpful?

10. Were the required Math courses helpful?

11. Do you know, understand, and use principles of physics?

12. Can you use reasoning and logic to define a problem in terms of principles of physics?

13. Can you design experiments and solve problems using principles of physics, mathematics and instrumentation?
14. Can you analyze and interpret data?

15. Can you communicate your knowledge to other scientists, and understand others as they communicate their knowledge?

16. Do you take pride in your understanding of principles of physics and feel a sense of belonging to the community of physicists?

17. Did you receive adequate career counseling?

Department of Physics Assessment Matrix

We shall list six desired learning objectives numerically for General-Education students, and then we shall list our General Education courses and point out how and where these outcomes are addressed. We shall repeat the process for our Science Major students.

The Learning Outcomes

Our General Education students shall:
1: Understand how different themes of science make connections within and between the different scientific disciplines. Examples of underlying themes are science as inquiry, scale and structure, energy, balance, evolution and patterns of change.
2: Understand and apply the scientific method.
3: Use experimental and observational results to evaluate the validity and limitation of theories, and scientific claims.
4: Increase understanding of the dynamic and evolving natural world.
5: Investigate problems that require knowledge of scientific concepts and reasoning.
6: Appreciate issues raised by science for contemporary society and of science in everyday life.

Our Science Major students shall additionally:
7: Know, understand, and use principles of physics.
8: Use reasoning and logic to define a problem in terms of principles of physics.
9: Design experiments or solve problems using principles of physics, mathematics and instrumentation.
10: Analyze and interpret physical data.
11: Be able to communicate their knowledge to other scientists, and understand others as they communicate their knowledge.
12: Take pride in their understanding of principles of physics and feel a sense of belonging to the community of scientists.
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<tr>
<td><strong>Physics course</strong></td>
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<tr>
<td>1500 How Things Work</td>
<td>Devices involve several fields</td>
<td>Developments are not just guesswork</td>
<td>Devices are opened and dissected</td>
<td>Technology changes fast</td>
<td>Things work by cause and effect</td>
<td>Technology has great impact</td>
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<tr>
<td>1600 Evol. of Universe</td>
<td>Geology, astronomy religion</td>
<td>na (can't experiment on the universe)</td>
<td>Current views based on telescopes, etc.</td>
<td>Change views with changing data</td>
<td>Deduce past from present situation</td>
<td>Religious, polit. implications</td>
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<td>1700 Elem. Physics</td>
<td>Physics, with signif. for society etc.</td>
<td>How discoveries are verified</td>
<td>Since Galileo, observation is key</td>
<td>Latest developments are reviewed</td>
<td>Evaluate claims and plan checks</td>
<td>Importance of ongoing research</td>
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<tr>
<td>1800 Astronomy</td>
<td>Geology, religion, philosophy</td>
<td>Base views on observed facts</td>
<td>Space probes give experimental basis</td>
<td>Our place in the Universe</td>
<td>Decide among competing theories</td>
<td>Evolution versus Creationism</td>
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<td>2005 Science of Energy</td>
<td>Energy is basic to everything</td>
<td>na (no current experiments)</td>
<td>One always finds energy conserved</td>
<td>Energy is getting harder to find</td>
<td>How to maximize efficiency</td>
<td>Need for energy has caused wars</td>
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<tr>
<td>2021 Phys in 21st Century</td>
<td>New discoveries will impact others</td>
<td>Verification of new discs. uses Sci. Meth</td>
<td>Observation leads to new laws</td>
<td>New physics will cause changes</td>
<td>Utilize new physics constructively</td>
<td>Society will be affected</td>
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<td>2023 Physics of Perception</td>
<td>Involved physiology and psychology</td>
<td>Apply Sci Meth to other areas</td>
<td>Perceptions of our perceptions</td>
<td>Our view of the world will change</td>
<td>Perception leads to wise action</td>
<td>Social interactions use perceptions</td>
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<td>3700 Big Bang, etc.</td>
<td>Religion, evolution, philosophy</td>
<td>na (can't experiment on the Universe)</td>
<td>Past conditions deduced from obs.</td>
<td>History of change</td>
<td>Deduce past conditions</td>
<td>Creation of world impacts religion</td>
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<td>Science Major Students</td>
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<td>Physics course</td>
<td>7: Physics principles</td>
<td>8: Define problems</td>
<td>9: Solve problems</td>
<td>10: Interpret data</td>
<td>11: Communicate results</td>
<td>12: Professional participation</td>
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<tr>
<td>1001-3 Gen Phys</td>
<td>Principles are introduced</td>
<td>Relate principles to specific probs.</td>
<td>Use equipment and math to solve</td>
<td>Lab data require analysis</td>
<td>Lab books are prepared</td>
<td>Current developments</td>
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<td>3101,2 An. Mechanics</td>
<td>Mechanics principles are applied</td>
<td>Mechanical world is examined</td>
<td>Employ advanced math tools</td>
<td>Astronomical data</td>
<td>na</td>
<td>na</td>
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<tr>
<td>3150 Therml Physics</td>
<td>Fundamental laws of Thermodynamics</td>
<td>Efficiency of engines</td>
<td>Employ advanced math tools</td>
<td>Therm. data, sp hts, etc.</td>
<td>na</td>
<td>na</td>
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<tr>
<td>3180 Comptr Physics</td>
<td>na</td>
<td>How to interface computer with eqpt</td>
<td>Learn LabVIEW and C++</td>
<td>Gather data using computers</td>
<td>na</td>
<td>na</td>
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<td>3280 Electrons</td>
<td>Construction of electr. elements</td>
<td>Making electronics perform tasks</td>
<td>Knowledge of laws of circuits</td>
<td>Troubleshoot circuits</td>
<td>Lab books and class presentations</td>
<td>Reports resemble actual research</td>
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<tr>
<td>3281 Exptl Physics</td>
<td>Experimental use of physics principles</td>
<td>Particular expts</td>
<td>Learn experimental techniques</td>
<td>Gather data and analyze</td>
<td>Lab books and class presentations</td>
<td>Reports resemble actual research</td>
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<td>3301,2 Quant Mech</td>
<td>Quantum principles</td>
<td>How to deal with atoms and nuclei</td>
<td>Employ advanced math tools</td>
<td>Apply QM to observations</td>
<td>na</td>
<td>na</td>
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<td>4001,2 El &amp; Magnetism</td>
<td>Electromagnetism and radiation</td>
<td>Communication and power transmission</td>
<td>Employ advanced math tools</td>
<td>Electrical properties of materials</td>
<td>na</td>
<td>na</td>
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<tr>
<td>4250 Select Topics</td>
<td>All physics</td>
<td>Find gaps and needs in student knowledge</td>
<td>Lecture and/or lab as appropriate</td>
<td>Use data as needed</td>
<td>Student seminar reports</td>
<td>It resembles professional seminar</td>
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<td>4700 Mod Optics</td>
<td>Current communication technology</td>
<td>Observe industry practices</td>
<td>Lecture and lab</td>
<td>Analysis of lasers</td>
<td>Lab reports</td>
<td>Cutting-edge physics</td>
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