TO: The Executive Committee and the Academic Senate
FROM: The Committee on Instruction and Curriculum (CIC)
The General Education Subcommittee
SUBJECT: 14-15 CIC 3: Approval of PHYS 3080 for B6 Status
PURPOSE: For approval by the Academic Senate; upon the president’s agreement, effective Winter, 2015

BACKGROUND INFORMATION:
At its meeting on May 12, the GE Subcommittee unanimously recommended the approval of PHYS 3080 for area B6 designation. The application for GE designation and sample syllabus are attached for the Committee’s information. It was discovered during the discussion that this course is only 2 units, whilst the B6 requirement is 4 units. However, it is also the case that CHEM 3080 (see 13-14 CIC 27) is also 2 units. So, students who take both courses may satisfy the B6 requirement.

ACTION REQUESTED:
That CIC approve and forward to the Academic Senate the request to give PHYS 3080 Area B6 General Education credit.
Application for General Education Credit
for Upper Division Science (B6)

Course title: Hands On Physics Laboratory
Course number: 3080

Courses approved for general education credit must provide students with explicit instruction in the approved student learning outcomes. Please be as specific as possible, describing topics, readings, assignments, activities and assessments that illustrate how the course meets the requirements. Attach the course syllabus and any assignments or assessments needed to support your explanations.

Please use this template as a guide to address ALL of the following learning outcomes.

Goal of upper division science: upper division physical, life, or interdisciplinary science GE courses build upon scientific principles and quantitative skills gained in lower division science and quantitative reasoning courses. Students must complete their lower division B1-5 requirements prior to taking their B6 course. Students are strongly encouraged to take any lab associated with the upper division course. Courses meeting the B6 requirements must support students’ acquisition of advanced numeracy, information literacy, and critical thinking competencies.

1. Students will demonstrate advanced and/or focused science content knowledge in a specific scientific field using appropriate vocabulary and referencing appropriate concepts (such as models, uncertainties, hypotheses, theories, and technologies).

Students will demonstrate science content knowledge in three ways. Firstly and most importantly, students will learn the background information needed to man one of several “science stations” during visits by K-8 classrooms. They will communicate with the children in asking probing questions and answering childrens’ questions. In this, they will need to use appropriate vocabulary and concepts as they help deepen the childrens’ understanding. Secondly, they will maintain a journal and/or turn in weekly responses to focus questions in which they will reflect on the connections between their science stations and concepts being taught, alternative ideas on teaching the concepts, and connections to the Next Generation Science Standards. Thirdly, their own understanding of the science content knowledge will be assessed by comparison of a pre-test and post-test. Examples of specific concepts covered in the course include concepts of electricity (simple, series and parallel circuits), classification of materials into conductors vs. insulators, magnetism, the cause/effect of motion (forces and interactions), energy conservation, transformations of energy and waves.

2. Students will apply advanced quantitative skills (such as statistics, algebraic solutions, interpretation of graphical data) to scientific problems.

Students will use algebra and interpretation of graphical data in the course. At the electrical circuits stations, students will quantitatively relate the brightness of a lightbulb to the current flowing in that part of the circuit. Using the relationship between current, resistance and voltage of the battery \( V=I \times R \), and realizing that the battery voltage and bulb resistances are constant, the students can quantitatively analyze the amount of current flowing in simple, parallel and series circuits. In a motion experiment, students will analyze the relationship between distance, \( d \), rate of speed, \( v \), and time elapsed, \( t \), \( : d = v \times t \). Given two side by side tracks that start at the same height and then end at the same height (but, of course, lower down), pairs of marbles can be rolled along the track. However one track has a dip in it so, during that stretch, the marble picks up extra speed for part of the trip, thereby finishing first. This will help children realize that though the distance
travelled is the same, the rate of speed, \( v \), is affected by the shape of the track, thereby reducing the time of travel.

3. Students demonstrate understanding of the nature of science and scientific inquiry and the experimental and empirical methodologies utilized in science to investigate a scientific question or issue.

This laboratory course was intentionally designed to emphasize inquiry-based learning, which more closely matches science practices. As such, students in this course develop an appreciation of the scientific method through their own practice in using it and in helping children develop their own. In particular, they are asked to estimate, predict, observe, hypothesize, analyze, interpret, and reason at the science stations.

4. Students will critically analyze scientific claims and data.

Students will assist children in writing conclusions for each science station. The format of the conclusions uses the CI-Ev-eR model: claim, evidence, and reasoning. Students will help children form a claim based on the experiments they conducted at the science station. They will review the evidence they have collected in the course of the experiment that supports their claim as well as any prior knowledge needed. In the reasoning section, the students will assist the children in making a logical interpretation of their evidence. The students will also have the opportunity to listen to the children’s explanations and, when there are logical flaws in their reasoning, guide them to ways that they could test their beliefs.

5. Students will apply science content knowledge to contemporary scientific issues (e.g. global warming) and technologies (e.g. cloning), where appropriate.

Two key features of the Next Generation Science Standards that are applicable to this learning outcome are the emphasis on engineering design practices and technological applications. These will necessarily be present in this course. The electricity themed lab and naturally the Energy themed lab will have connections to contemporary scientific issues and technologies. For example, one of the electricity stations will focus on determining the energy used to light an “old-fashioned” incandescent lightbulb as compared to a more efficient LED-based bulb. Students will learn that informed consumer choices can lead to a direct impact on conserving energy. Energy stations will include a demonstration of a hydrogen fuel cell and measurements of solar photovoltaic panels. The Fuel Cell kit includes the pre-process of electrolysis to create the Hydrogen and then the generation of electricity to run a fan. This emphasizes the role that Hydrogen can play in developing technologies that aren’t contingent on fossil fuels. The students will learn how a solar panel functions; sunlight on the panel is converted into electricity, creating a circuit element that can be thought of as a source of voltage and current, just like a battery. These lab stations offer a natural way to have a subsequent discussion of green-house gasses and their impact on society.

6. How does your course support students’ acquisition of advanced information literacy skills?
(See description below.)

In order to support the acquisition of advanced information literacy skills, students will be challenged to man a science station during classroom visits and to give constructive
feedback to their peers in practice sessions. To do this effectively, students will need to increase their Physics content knowledge and confidence in communicating it. As such, they will need to draw on their own observations, prior knowledge, and outside sources for both science content information and topics such as research-based instructional models. Through their journals and oral communication with their peers and children, they will share the choices they made while manning the stations, how they fielded questions, and their ideas for teaching the concepts and improving the stations.

7. How does your course support students’ development of advanced critical thinking skills? (See description below.)

This course will support the development of advanced critical thinking skills in three ways. Students must learn science content, but also must be able to plan how they will conduct their station with children, provide constructive feedback to their peers during practice sessions, and reflect on their own growth as both a student and educator in science. At all times, they will be constantly deepening their science content as they are questioned by their peers and children and helping them develop their own understanding and evaluate their own data. In all cases, both students and children will need to follow a deductive path in order to make and support valid claims using the CI-Ev-eR format.
In addition, courses receiving upper division science approval must support students’ acquisition of advanced numeracy, information literacy, and critical thinking skills. Outcomes are attached.

General Education
Advanced Information Literacy Outcomes
for GE Areas

B6 Outcomes for Advanced Information Literacy in Science
D4 Outcomes for Advanced Information Literacy in the Social Sciences
(approved by Academic Senate 2/05)

Information Literacy is a prerequisite for lifelong learning. It enables learners to engage critically with content, extend their knowledge, assume greater control over their own learning and become self-directed learners.¹

Whether taught within a specific discipline or in a multi-disciplinary context, advanced information literacy curricula should encourage students to seek multiple perspectives and use diverse sources of information to inform conclusions. Further, students should develop an understanding that information and knowledge in any discipline is in part a social construction and is subject to change as a result of ongoing dialog and research. Teaching advanced information literacy helps students understand and participate in this scholarly conversation.

Faculty can enhance student information literacy by providing problem- or inquiry-based assignments where learning results from the use of multiple information sources thereby encouraging self-directed learning and critical thinking. The development and evaluation of these types of assignments may require significant commitment and investment of time on the part of students and faculty alike.

In addition to the lower division information literacy outcomes, students who are information literate at the advanced level are able to:

1. identify the main disciplines, fields, and organizations which generate and publish knowledge in their area of research,
2. develop in-depth knowledge of the literature from the above information producers in their area of research,
3. evaluate the significance and validity of information found, both in the context of the disciplines and fields consulted, and also within their own knowledge base and value systems,
4. analyze the implications of research and publishing patterns in their area of research,
5. formulate and reformulate research inquiries based on the objectives above and,
6. demonstrate their ability to perform the above objectives when they communicate the results of their inquiry to others.

¹ This quote and other ideas contained here are drawn from the Council of Australian University Librarians’ Information Literacy Standards, (Canberra, 2001) and from Learning for Life: Information Literacy Framework & Syllabus published by the Queensland University of Technology Library (Brisbane, 2001).
Upper Division Critical Thinking Across the Curriculum

GOALS
Overall, the goals for critical thinking in the upper division would be essentially the same as the goals enumerated for the lower division, but would entail more complex and sophisticated ways of using those same skills. These goals would include:

- The general ability to use reason (both inductive and deductive)
- The ability to identify fallacious reasoning
- The ability to present one’s own original argumentation

These skills will be reflected in the upper division not as specific testing and evaluation on argumentation skills, but argumentation skills in practice within a particular discipline or disciplines. These upper division skills would include:

- The ability to weigh proffered evidence
- The ability to uncover the implicit assumptions of others
- The ability to reconstruct and evaluate complex arguments encountered in the course of reading and discussion within the discipline(s)
- The ability to frame one’s own positions logically and coherently
- The ability to construct one’s own persuasive arguments in support of carefully considered positions
- The ability to defend this position against thoughtful objections
- The practice of thinking and arguing in the mode of a practitioner of a particular discipline or disciplines
- The practice of applying the special concepts and theories developed in the particular discipline or disciplines

The goals of upper division critical thinking should be to develop these abilities.

ASSESSMENT:
Various strategies could be used to measure these goals. Instructors will be able to witness and evaluate these abilities within the proper realm of the discipline(s), and through written, oral, and discussion assignments.
Instructor: Erik Helgren  
Office: South Science 251  
Phone: 885-4064  
e-mail: erik.helgren@csueastbay.edu  
Lab Hours: TBD  
Discussion: TBD  
Office Hours: TBD and by appointment  
Prerequisite: PHYS 2701, 1001 1700 or 1500; or Instructor consent

Course Materials: *Physics 3080 Intern Laboratory Manual* (with background, instructions and student lab booklet)

Dress Code/Safety Notes: You will be working with children and their teachers in a public setting. You will be expected to dress at the same level of professionalism as you would at a school site. Closed-toe shoes are required at all times in the laboratory. When needed, safety glasses or goggles must be worn during all laboratory work. Long hair should be tied back. You will be provided with a lab coat. Further details on safety guidelines provided on the first day of lab must also be observed for the duration of the quarter.

Grading: Grades will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Participation</td>
<td>100</td>
<td>(10 points each x 10 weeks)</td>
</tr>
<tr>
<td>Debrief Participation</td>
<td>100</td>
<td>(10 points each x 10 weeks)</td>
</tr>
<tr>
<td>Journal Entries</td>
<td>90</td>
<td>(10 points each x 9 weeks)</td>
</tr>
<tr>
<td>Pre-Survey</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Pre-Content Test</td>
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<td></td>
</tr>
<tr>
<td>Post-Survey</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Post-Content Test (Final Exam)</td>
<td>45</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>350</strong></td>
<td></td>
</tr>
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</table>

Course Policies: Lab and debrief participation is mandatory. If a student is unable to attend either, the instructor should be notified of the absence immediately upon their return to class, if not earlier. If a valid excuse is discussed with the instructor, the student may be given an alternate assignment and granted credit. Journal entries should be completed and handed in upon the student’s return to class. If the absence is not excused, zero points will be assigned for participation. *A maximum of one absence can be excused per quarter.*

Journal entries are due at the start of the period. Points will be deducted from late journal entries (10% per day).

Communication: It is each individual student’s responsibility to make sure that they have a working Blackboard account and that you check it regularly for notices.
Furthermore notifications and other course information may be posted on blackboard. It is expected that you check both blackboard and your student e-mail regularly, as you are responsible for information and announcements that will be sent to you from the University.

Any student in need of accommodations, please contact me. You must obtain the proper authorization forms from the Accessibility Services office, Library Complex 2400.

COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Lab</th>
<th>Debrief</th>
<th>Assignments</th>
<th>Due:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction, safety</td>
<td>Introduction, pre-quiz, survey</td>
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<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Motion Background</td>
<td>Practice Motion</td>
<td>Journal Entry 1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Teach Motion</td>
<td>Class Visit 1</td>
<td>Journal Entry 2</td>
<td>Journal Entry 1</td>
</tr>
<tr>
<td>4</td>
<td>Teach Motion</td>
<td>Class Visit 2</td>
<td>Journal Entry 3</td>
<td>Journal Entry 2</td>
</tr>
<tr>
<td>5</td>
<td>Electricity Background</td>
<td>Practice Electricity</td>
<td>Journal Entry 4</td>
<td>Journal Entry 3</td>
</tr>
<tr>
<td>6</td>
<td>Teach Electricity</td>
<td>Class Visit 3</td>
<td>Journal Entry 5</td>
<td>Journal Entry 4</td>
</tr>
<tr>
<td>7</td>
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<td>Class Visit 4</td>
<td>Journal Entry 6</td>
<td>Journal Entry 5</td>
</tr>
<tr>
<td>8</td>
<td>Energy Background</td>
<td>Practice Energy</td>
<td>Journal Entry 7</td>
<td>Journal Entry 6</td>
</tr>
<tr>
<td>9</td>
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<td>Class Visit 5</td>
<td>Journal Entry 8</td>
<td>Journal Entry 7</td>
</tr>
<tr>
<td>10</td>
<td>Teach Energy</td>
<td>Class Visit 6</td>
<td>Journal Entry 9</td>
<td>Journal Entry 8</td>
</tr>
<tr>
<td>Final</td>
<td></td>
<td>Final Exam</td>
<td>--</td>
<td>Journal Entry 9</td>
</tr>
</tbody>
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Learning Outcomes

Global Outcomes
- Gain hands-on experience with chemistry labs and activities with increased emphasis on inquiry-based learning
- Improve science practice skills such as observation, questioning, predicting, and communicating.
- Demonstrate understanding of the types of activities including basic and applied research that Physicists perform.
- Write a reflection regarding knowledge gained during teaching experience.
- Demonstrate understanding of the K-12 Next Generation Science Standards, specifically those related to Physics under the Physical Science Standards.

Specific Outcomes
- Explain the key properties of matter and describe various laboratory experiments that can be used to demonstrate these properties to K – 8 students.
- Explain the key properties of water and describe various laboratory experiments that can be used to demonstrate these properties to K – 8 students.
- Explain the key properties of energy and describe various laboratory experiments that can be used to demonstrate these properties to K – 8 students.