

CALIFORNIA STATE UNIVERSITY, EAST BAY

Designation Code: 2005-06 **CAPR 10**

Date Submitted: February 16, 2006

TO: The Academic Senate

FROM: Committee on Academic Planning & Review (CAPR)

SUBJECT: Five-Year Program Review for the BS and BA degree programs in Physics

PURPOSE: For Approval by the Academic Senate

ACTION

REQUESTED: Acceptance of the Five-Year Program Review of the Physics Programs and approval of the continuation of the program without modification

BACKGROUND

INFORMATION: The Physics Department offers the Bachelor of Arts and Science Degrees in Physics. On 10 November 2005, the Chair of Physics, Professor Robert Good, and the Dean of the College of Science, Michael Leung, met with CAPR members. At this meeting the review process, the submitted report, and the outside review of the Physics programs were discussed.

The Physics Program has recently hired a fourth tenure-track faculty member. While student enrollment in the program is still small, the program is beginning to grow.

As a result of suggestions from both outside reviews in 2000 and 2005, the Department of Physics has revised its curriculum to attract more students and to align with similar programs in the CSU and the UC at Davis and Berkeley. While a direct course by course comparison is not present in the report, the total number of units required is similar. The department has used the results from assessment outcomes to revise course content and modify curriculum. CAPR found the emergence and identification of assessment commendable for a program just developing assessment measures. Physics needs to identify a few Student Learning Outcome goals that they can measure and track over time.

The Physics Department is strengthening its ties with alumni and local businesses. It is hoped that needed resources can be supplemented from these sources. CAPR believes that the Physics Program can also build on its natural relationship with engineering to the betterment of both programs.

There is a noticeable lack of diversity in both the student body and in recent faculty hires. CAPR expects that these trends must be reversed in the future to attract a diverse student population to Physics.

The degree programs in Physics do not require more than the minimum requirements for graduation at the University. The number of units required for both the BA and BS degrees in Physics are aligned with similar degrees throughout the State of California and tend toward the low end of the number of units required for graduation. CAPR suggests the development of a smaller minor that utilizes the natural requirements from other sciences.

CAPR RECOMMENDATION:

CAPR recommends the continuation of the Physics Bachelor of Arts and Science degree programs without modification, with a recommendation that the University support the Department's needs related to increased student enrollment. A Student Learning Outcomes Report based on data collected from the program should be reported to CAPR by the end of AY 06-07.

The next CAPR review will be in 2009-10.

Additional Background:

Overview description of the program: The Bachelor of Science and Bachelor of Arts degree major programs are designed to give students an understanding of the fundamentals of physics including concepts of atomic and nuclear physics, classical mechanics, wave motion and sound, electromagnetism and optics, heat and thermodynamics, relativity, quantum mechanics, and elementary particles and their interactions.

In physics, one attempts to discover, formulate, explain, and apply the basic laws of nature. A physics major could work in areas as diverse as astrophysics, relativity, properties of materials, or the standard model of fundamental particles and interactions. Principles of physics provide the foundation for other sciences as well as engineering. Some of the examples of modern technological development from the application of physical principles include radio and television, computers, laser scanners, and communication by fiber optics. In addition, physicists explore problems in astronomy and theories for the origin and evolution of the universe.

With relatively small classes and teaching as a major emphasis of faculty members, the physics major involves a considerable amount of individualized instruction. In addition, research done by faculty members often includes student participation.

Overview of the documents submitted to CAPR: As required, the report to CAPR included a self study; plan for the degree programs; program assessment plan; outside review; a departmental response to the outside review; applications submitted for new tenure-track positions since 1998; the outcome of those searches; and enrollment and graduation data.

Five-Year Program Review/Self-Study (AY 2004-2005)

- Summary of specific areas of the Self-Study
 - Four searches were initiated since 1998 resulting in 3 hires, with two of those junior faculty leaving, in addition to senior faculty retirements. (A fourth potential hire declined the position offered.) In effect, faculty have decreased from four to three: Drs. Harper and Preston have retired, and Dr. Singley has been added.
 - The number of physics majors declining in the 90's, followed by a gradual increase over the past five years was discussed. Enrollment has increased from an average of two upper-division majors in 1997-2000 to about ten currently. (Comparable institutions have averaged 20 to 30 majors throughout this time.)
 - Changes in curriculum were implemented specifically to address the past decline in physics majors. (Regret was expressed over the lack of minority student majors and outreach efforts were discussed.) In 2001 the program was significantly modified. A more thorough revision will take effect in Fall 2005.
 - Lower division labs have been computerized to a large extent.
 - Content of comparable programs is not specifically discussed, but number of units is comparable to other physics and physical science programs in the UC and CSU.
 - Assessment plan is in progress. It is short on Student Learning outcomes and is limited to: faculty effectiveness using student evaluations and occasional peer visitation, a questionnaire for graduating seniors, discussion of concerns with other departments, and attention to national trends in education apparent at meetings and in journal reports.
 - Available space for upper division student labs and for faculty projects and research has been halved: Physics had two large rooms (N236 and N237) but it became necessary for the new Engineering Department to take over one of them.
- Summary of supporting data
 - Enrollment has increased from an average of two upper-division majors in 1997-2000 to about ten currently. (Comparable institutions have averaged 20 to 30 majors throughout this time.)

Outside Reviewer's Comments & the Department's Response

- Dr. Richard J. Noer of Carleton College reviewed the Physics Department on February 3 and 4, 2005, and submitted a six-page detailed report. The outside reviewer's observations include the following points:
 - Maintain contact with alumni by creating newsletters and other means of keeping them involved with departmental events and opportunities.
 - Provide more supports for graduates by maintaining employer contacts in the Bay Area and beyond.
 - Establish a more active advising program for students.
 - Include current topics in physics into the curriculum at an early stage.
 - Team-teach the introductory sequence.
 - Increase release time, lab space, and funding for young faculty.
 - Provide a reliable annual schedule for degree program courses.
- Recognizing the importance of each of these recommendations, the departmental response to outside reviewer's comments indicates that:
 - Physics intends to establish a newsletter, annual or semi-annual, and to encourage the continued participation of our graduates in departmental life wherever possible.
 - The department intends to increase its distribution of information on employment and internships, flyers, and invitations to local schools and industries.
 - In addition Physics will actively seek outside opportunities that might interest students. This will involve the Chair and perhaps others in a combination of phone calls and interviews with local employers, and interviews with upper-division majors, looking for potential fits.
 - Advising currently occurs from any instructor the student chooses. Physics will formally send each major a letter quarterly, requiring that they make an appointment for advising and discussion with faculty. The Department feels that further informal contact would be desirable, e.g. an end-of-quarter pizza party.
 - Physics added current topics to Physics 1001-3, and faculty already consider this suggestion in place. Modern physics is a regular and important part of the course, and in particular the four subjects mentioned by Dr. Noer are all discussed at various times during each academic year. The course stresses current events: every few weeks a physics-related story appears in the daily newspapers or in a science magazine, and that story is projected on the screen and presented to the class the same day. These articles are posted on the departmental bulletin board as well. Students must be made aware, especially in beginning classes, that physics is not just what's in the textbook; rather, it's going on all the time all around us, and it is very important ecologically, economically, and even politically. The faculty will consider team teaching the introductory sequence in physics.
 - The Department already provides some release time for young faculty, startup funds, and more lab space—funding restrictions prevent more resources at this time. The Department is willing to work around grants and other opportunities and is willing to argue for more resources based on student growth in the department.
 - The Department is committed to arguing for a return to annual program offerings in support of student success. They are also realistic about the financial limitations of the University as a whole.

Program's Five-Year Strategic Plan (2004-2009)

- Curriculum and changes in effect Fall 2005:
 - Physics now offers both BA and BS degrees, of size (180 units for the degree programs) corresponding to comparable institutions and needs to monitor our newly implemented changes as itemized below.

- Most 4-unit upper-division courses become 3-unit, and corresponding two-quarter sequences become 3-quarter sequences. Physics plans to determine assessment and evaluation of these changes in the curriculum and program as a whole.
- Effective Fall 2005 the faculty added Solid State Physics, a second quarter of Thermal and Statistical Physics, and more mathematics including linear algebra, and partial differential equations in response to student demand. The faculty needs to determine assessment and evaluation of these changes in the program and their effect on enrollments.
- Physics introduced an optional Undergraduate Research course, Physics 4850. Physics needs to determine assessment and evaluation of these changes in the program and their effect on enrollments.
- The faculty introduced a Physics Capstone course, Physics 4950. The Department needs to determine assessment and evaluation of these changes in the program and their effect on enrollments.
- The faculty revised upper-division scheduling beginning in Fall 2004 as follows: formerly faculty taught 4-unit courses twice a week, and now they are teaching 3-unit courses 3 times a week. The Department plans to determine assessment and evaluation of these changes in the program and their effect on enrollments.
- Finally, Physics at CSU East Bay reflects on their programs and changing trends in the world of physics. The faculty is watching the situation for new opportunities for growth.
- Students and changing trends:
 - The number of majors will increase. In 1997-2000 the Department of Physics averaged only 2 upper-division majors total; the number is around 10 now, and it should reach 20 in a few years, given that there were over 20 in the 1980's and that comparable neighboring 4-year institutions have been averaging 20 to 30.
 - Ethnically Physics students have always been mostly white, despite a formidable outreach program (Dr. Harper primarily) in the 1990's.
 - Physics improved course scheduling in our most recent program revision.
 - Career opportunities have increased in the field of Optics in the past few years, and Physics has introduced a Modern Optics course to help prepare students for this field of physics.
 - To more closely mirror the needs of graduates and employers, the programming language LabVIEW, is now an expectation of Physics students, for interfacing lab equipment with computers.
 - Their outreach activities have been strong. They have been particularly attentive to things that might improve student retention, such as a room to congregate in, and picnic, and so on. Faculty hope to resuscitate our SPS (Student Physics Society: Sigma Pi Sigma) Chapter soon.
- Faculty and changing trends:
 - The current faculty comprises three regular members (tenure or tenure-track) and one emeritus who is teaching half-time (Faculty Early Retirement Program, FERP).
 - Physics expressed a need for another instructor to help carry the increased teaching load. Their top priority now is the recruitment of someone in experimental optics, in view of the great importance of the field and of its adaptability to study in modest laboratory facilities.
 - As enrollment grows, they expressed the need for yet another tenure-track member, perhaps in theory.
- Resources and changing trends:
 - The faculty feel that current resources are inadequate. They feel that more money is desperately needed for summer salaries and equipment.
 - The Department expressed the need for additional lab room for upper division students as well as faculty to replace the one that was transferred to Engineering.

CAPR Analysis of the Program's Five-Year Review

- Program changes and challenges

- We praise the innovative revamping of the curriculum and scheduling and the attempts to increase the student population. Physics faculty make sacrifices for the University and its students; for example, full time faculty teach General Education courses.
- CAPR suggests the development of a smaller minor that utilizes the natural requirements from other sciences. For example, a minor in physics might credit all physics courses required of the Engineering or Biology majors with the minimum number of additional courses required in a minor (a total of 20-24 units). The current minor requires a year of calculus not required for the 2701-2703 sequence. Requiring either the 1001-3 or 2701-3 plus 2 or 3 additional physics electives increases the number of students who might actually attempt a minor in Physics. These electives might even include the new area B6 courses from Physics.
- CAPR also appreciates the beginning steps that the Department of Physics has made toward assessment of its degree programs. However, more work remains including data collection and analysis.
- Physics participates in General Education in an attempt to advertise its programs effectively.
- However, we see the following as remaining challenges facing the Department of Physics.
 - There is a continuing lack of diversity in the faculty and student body. These may be related.
 - There is a lack of discussion of current personnel other than attaching vitae of tenure/tenure-track faculty and no appraisal of the current full and part-time faculty to cover the curriculum or of staff to carry out the day to day work of the Department. An appreciation of current personnel seems overlooked at least in the report.
 - Although assessment is emerging in the Department of Physics there are still no apparent specific Student Learning Outcomes for the programs and no demonstrated vision for measuring and presenting trends in these outcomes over time. This deficiency is particularly critical in evaluating the extensive programmatic changes that Physics has undertaken in the past few years.
 - There is no mention of service areas and little mention of collaboration with other programs such as engineering to improve both fields positioning at the University. Some resource gains or sharing expenses might be made in this way. An accessible minor in physics for biologists or engineers might increase enrollments in upper division courses.
- Resource challenges and needs
 - We agree that resources are tight all over the campus and that the Department of Physics is striving mightily to perform with what it has. Shared student and research space with similar majors such as engineering and computer science could be a good resource for the College.
 - Funding might improve if collaborations among faculty with similar programs in the College were more closely developed and joint research interests explored.
 - More progress in enrollment targets and diversity might be made if an effort to match faculty needs with student needs were considered more closely. For example, consider more carefully the goals of future faculty in making offers for employment at CSU East Bay, particularly considering the lack of diversity in both faculty and students.
 - We support an increase in funding and faculty as appropriate dependent upon growth in the Physics programs.

CAPR Recommendation for Continuation of the Program: CAPR recommends the continuation of the BA and BS degree programs in Physics without modification.

Date of the Program's next Academic Review: The next CAPR review will be in 2009-10.