

# Skyline College

## Physics

### Program Review

### Executive Summary



#### Short Summary of Findings

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*The new physics lab and modern equipment have had a tremendous positive impact on the program. Students have a better and more enjoyable learning experience, and faculty moral is much improved. There is uncertainty looming, however, in the next year or so. One of the two physics faculty member will be retiring and a replacement will have to be made. At the same time, Building 7 will be remodeled, and the Physics Lab will have to be moved to a temporary home at the Pacific Heights campus. The last time the physics department moved (to make way for the telecommunications lab), the impact on the department was disastrous. The chaos of a move along with the training of a brand new faculty member will undoubtedly throw the department into disarray. Good planning for this move has to be made well in advance to prevent a repeat of the previous move (and to convince the remaining faculty member not to retire!). As of this report, nothing but the most general notion of a move across the road has been forthcoming.*

#### Three Strengths of the Program

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- New, clean, well-equipped laboratory.
- Ability to acquire and analyze real-time computer acquisition of data .
- Small, intimate department with some of the most motivated and capable students in the College.

#### Three Suggestions for Improvement

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- The laboratory space is too small. It needs to be expanded *without* increasing the number of students per section.
- It would be desirable to have a storage and preparation area to allow a physics instructor to easily bring demonstration equipment into a lecture. The room would ideally be adjacent to the lecture room.
- A lab technician to set up and take down laboratory activities as well as repair equipment, similar to what is done in chemistry and biology, is desirable. Absent that, physics faculty should be awarded release time to perform those tasks.

**SKYLINE COLLEGE**  
**PROGRAM REVIEW SELF STUDY**  
*Physics*

**PART A: Overview of Program**

***1. State the goals/ focus of this program and how the program contributes to the mission and priorities of the College and District.***

Goals and Focus:

- To provide lower division physics courses that will allow transfer students to be fully prepared for their upper division courses at their transfer institutions.
- To provide fully for transfer students to fulfill their necessary physical science proficiency requirements when they are non-science majors.
- To provide a foundation to understand the role of physics and physical thinking in applied subject matter areas such as engineering, architecture, biology, and chemistry.
- To expand the use of technology and new pedagogical methods in the teaching of physics.

Contribution to the Mission and Priorities of the College:

- The physics program provides lower-division transfer programs which prepare students for continued education in four-year colleges and universities. Most of our students who complete the physics 210-220 sequence transfer to four-year colleges to study health-related subjects, while those who complete the physics 250-260-270 sequence go on to study pure science or engineering.

***2. Discuss how this program coordinates, impacts, and/or interacts with other programs in the College.***

The program coordinates well with the mathematics program:

- Physics 250-260-270 students also take the Calculus sequence, Math 251-252-253. It is doubtful whether either of these sequences could exist without the other.
- Physics 210-220 students have all completed Intermediate Algebra, and many go on to take Trigonometry, Precalculus, statistics and Calculus.
- Physics 211 and 221, the calculus supplements to Physics 210-220, allow students with one or two semesters of calculus to satisfy a physics-with-calculus requirement for biology majors transferring to UC campuses.

***3. If the program utilizes advisory boards and/or professional organizations, describe their roles.***

The physics program has no advisory boards. However, both members of the physics faculty are active in regional and national professional physics associations, most notably the American Association of Physics Teachers. One of us (P.G.) is a member of the Mathematics Association of America and keeps abreast of calculus reform and its effect on physics education.

***4. Explain how this program meets the needs of our diverse community.***

- The physics program supplies the graduation and transfer courses needed by those students who are appropriately prepared. It should be noted that, in large part, the students who take the courses in our department are at the sophomore or higher level and are highly motivated when they arrive.
- In conjunction with the MESA program, the physics program is able to attract and retain students who traditionally would have by-passed the department.

***5. If the program has completed a previous self-study, evaluate the progress made toward previous goals.***

Since our last program review in 1997, facilities and equipment have made an order-magnitude improvement. We have a new, clean, well-equipped laboratory facility designed by the faculty who use it. We have been able to purchase enough state of the art equipment for six lab stations with four students each. We have laptop computers, physical sensors, and the necessary software so that roughly half the labs can be done with computer data acquisition. Most of the lab handouts can be accessed by students on-line, making it unnecessary to purchase a laboratory manual, and allowing faculty easily to modify handouts. Without exaggeration, we have gone from one of the worst facilities in the state to one of the best.

## **PART B: Curriculum**

***1. Describe how the courses offered in the program meet the needs of the discipline(s) and the students. (This may be answered through descriptive narrative evaluation or quantitative research).***

The courses offered in this program are very much in the style of first year physics courses offered at other community colleges and four year institutions. Most of the students in the calculus-based sequence go on for engineering degrees, and some for pure science degrees. Most of the students in the algebra-based sequence go on for degrees in health related fields. Anecdotal evidence suggests that transfer students are served well by the program; however, no formal follow-up survey has ever been conducted.

***2. State how the program has remained current in the discipline(s).***

- The fundamentals of classical physics have not changed in the recent past; however, pedagogy and technology within the discipline have changed. Research in physics education suggests new ways to approach some physical concepts. We have kept up with these new approaches by attending professional meetings of the American Association of Physics Teachers, and by changing to more modern textbooks. In the laboratory, computer acquisition of data has become standard, and our new laboratory facility allows us to do that with ease. The laboratory also has computer and computer display equipment that allow us full use of the Internet in our teaching.
- Honors sections of Physics 210, 220, 260, and 270 have recently been offered, and expose students to some topics of modern physics.

***3. If the student population has changed, state how the program is addressing these changes.***

The makeup of the student population has not changed, but it has grown substantially. Twelve years ago we offered but a single section of Physics 210 in the fall and one of Physics 220 in the spring. Now we offer a double section of Physics 210 in the fall and a single section of Physics 220 in the spring. Physics 211/221, the calculus supplements to Physics 210/220 have been added to the curriculum and have steadily increased their enrollment. The enrollment increase in Physics 250/260/270 is particularly dramatic. We used to offer only a single section of Physics 250 each fall, and a single section of Physics 260 in the spring. It was not unusual for these classes to have single digit enrollments. Now we offer double sections of Physics 250 every semester, a double section of Physics 260 in the spring, and a single section of Physics 270 in the fall. We could easily add more sections if we had more faculty and more laboratory space. Keep in mind that this growth in Physics 250/260/270 has occurred at the same time that similar classes at CSM have been cancelled for lack of enrollment. Clearly Skyline is attracting the physics students.

***4. All courses in this program should be reviewed and, if appropriate, modified every six years. If this has not occurred, please list the courses and explain.***

All courses in the physics program, except Physics 211 and 221, have been reviewed and modified appropriately in a regular and timely manner. Physics 211 and 221 did not exist six years ago.

***5. If external accreditation or certification is required, please state the certifying agency and status of the program.***

There are no external regulations with which the physics program must comply.

***6. Discuss plans for future review and program modification.***

- There is no procedure other than program review itself by which the physics program undergoes formal review. On the other hand, with only two physics instructors (one full time and one half time) it undergoes almost constant informal review, both through exchanges between ourselves, and with colleagues at other institutions within and outside the district.

- Building 7 will be remodeled in the next several years and the physics lab will be made larger as part of that process. *We cannot emphasize enough that this enlargement is to accommodate more comfortably the current population of students and not to increase the laboratory enrollment. An increase in enrollment would entail even more space, and a significant equipment purchase.*
- Opportunities should be provided to allow for underprepared students to gain confidence and experience necessary to be successful in a conventional physics course. Science illiteracy is a national problem. Skyline, like most two-year colleges has a high percentage of students whose preparation and experiences in math and science are very limited. If those students are to succeed in physics courses, they must first develop the necessary conceptual underpinnings. Courses in conceptual physics and mathematical preparation for physics are desirable, but would necessitate the hiring of new faculty.
- In June 2006, George Goth will retire, and this will necessitate hiring a new instructor. At the same time this occurs, Building 7 will be remodelled, and the physics lab moved to temporary quarters in the the Pacific Heights facility. This will have a significant negative impact on the program unless the move is well-planned. At this point only the most general notions of the move have been discussed.

## **PART C: Faculty and Staff**

### ***1. List major development activities completed by faculty and staff in this program in the last six years and state what development is needed or proposed by faculty in this program.***

In the last six years both Paul Goodman and George Goth have embarked on major professional development projects with respect to the new physics lab. We designed the lab facility; we designed the new lab experiments and ordered the new equipment; we each received a Professional Development grant to learn the necessary skills to implement computer acquisition of data; and we each received a Trustee Grant to write the new laboratory exercises to utilize the new equipment.

### ***2. Describe the orientation process for new faculty and staff ( include student workers such as tutors and aides).***

There are only two physics faculty members, utilizing about 1.5 FTE. Except for an occasional part timer we have not hired any new faculty in almost thirty years, so orientation for new faculty has never been a concern. This will change with George Goth's retirement in 2006. George has agreed to compile most of his course and lab material on a CD to ease the way for his replacement.

### ***3. If recruitment of new and/or diverse faculty is needed, suggest recruitment techniques.***

In June 2006, George Goth will retire, and that will necessitate hiring a new instructor. Local physics graduate programs are a good place to look for part timers. Tenure track faculty can be

attracted through advertisements in THE PHYSICS TEACHER (a professional journal published by the American Association of Physics Teachers), as well as in PHYS-L (an internet mailing list of university and high school physics teachers). Along with the usual district hiring procedures, this should suffice in locating a new full time faculty member

## **PART D: Facilities, Equipment, Materials and Maintenance**

*1. Discuss the effectiveness of the facilities, equipment, equipment maintenance, and materials for the program to meet its goals and focus. Include if they impact success and if they are accessible to all students.*

- The new facility is first rate, but small. With a full lab of 24 students, four around each of six tables (one of which is wheelchair accessible), it is difficult for an instructor to make the usual rounds. This will be corrected after Building 7 is remodeled. It should be emphasized that under no circumstances can one instructor supervise more than 24 students in a physics laboratory, regardless of the size of the facility.
- Equipment is first rate. Within the last six years we have completely redesigned most of our lab activities around new computers and sensors that take data and make graphs and tables, freeing the students to concentrate on physics concepts. We also have excellent display and sound equipment at the instructor's table at the front of the room. A laser printer is available in the laboratory to allow students to print out data.
- It would be desirable to have a storage and preparation area to allow a physics instructor to easily bring demonstration equipment into a lecture. The room would ideally be adjacent to the lecture room.

*2. List projected needs.*

- In June 2006, George Goth will retire, so hiring a new instructor will be a top priority.
- Adequate support personnel should be provided so that the laboratory instructor can focus on teaching and learning. Each weekly lab session requires tasks in addition to pedagogical responsibilities. These include distribution and storage of weekly lab equipment, maintenance of equipment, computer maintenance and upgrades, software installation, safety inspections, inventory updates, and ordering or designing new equipment. It is recommended that the division hire a part-time technician or award released time to physics faculty members.
- A wireless internet network in the lab would cut down on tabletop clutter. This would be easy and inexpensive to achieve.
- Equipment to accommodate an honors section in modern physics would be desirable.
- Computer upgrades and replacements will be necessary in the next five years or so.

- More demonstration equipment would be desirable, particularly if a conceptual physics course is implemented.

***3. Describe the use of technology in the program and discuss if technology is current and comparable to other college and business or industry.***

See Paragraph 1 above.

***4. If appropriate, describe the support the program receives from industry. If the support is not adequate, what is necessary to improve that support?***

The Physics department does not depend on industry for support.

## **PART E: Budget Request**

***1. What resources (staff, facilities, equipment and/or supplies) will be needed in the next six years?***

- At least one full-time instructor will be needed to replace George Goth, who is retiring June, 2006.
- At least one part-time instructor will be needed if the course offerings are enlarged to include a conceptual physics course and a mathematical preparation for physics course.
- The physics lab needs to be enlarged to comfortably hold 24 students. This is scheduled to happen with the remodeling of Building 7.
- Computers and software will need to be upgraded.
- New physical sensors used for computer acquisition of data will need to be purchased, and current sensors will need to be upgraded.
- Equipment to allow experiments in modern physics will be needed to expand the honors program.
- A wireless network needs to be built into the physics lab to cut down on table-top clutter.
- Lab supplies (e.g., graph paper, rulers, protractors, and the like) will need to be replenished.

***2. If appropriate, discuss methods by which the program could share resources with other programs in the College and District.***

- The physics program and chemistry program often share measuring equipment and power supplies

- It should be emphasized that other classes should never be scheduled in the physics lab, since equipment often must be left set up to accommodate multiple sections.

## Skyline College Program Review Worksheet for Enrollment, Performance and WSCH/FTE

### *Weekly Student Contact Hours – WSCH*

Report the 3 previous **Fall** semesters with the most recent on the right.

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Year	2001	2002	2003
WSCH	699	754	787
% Change	---	+7.9%	+4.4%

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**Please comment on program enrollment and expected trends.**

- Enrollments are limited by laboratory constraints of 24 students per section. We are just about at the maximum, so future growth in the laboratory courses (Physics 210, 220, 250, 260, and 270) is not possible without adding more sections, and hence more faculty.
- Enrollments in the calculus supplement courses (Physics 211 and 221) has leveled off and is not expected to grow significantly unless CSU requires a calculus-based physics class for their biology majors.
- Some of the growth in the calculus-based sequence (Physics 250, 260, and 270) comes at the expense of decreasing enrollment at CSM. This semester, for example, Physics 270 at Skyline has an enrollment of 38, while the same course at CSM is in the single digits. In previous semesters our some of our courses have been overflowing while the equivalent course there has been cancelled due to lack of enrollment. It is not known if this trend will continue. It should be noted that the enrollment in some Physics classes (Physics 220, 250, 260, and 270) above the laboratory constraint of 24 students comes at a cost. The class must be split informally into two groups: one week the first group does a lab and the second group does a problem set; the next week they switch. The result is that the students do only about half the number of labs they might normally do.

***FTE and WSCH/FTE (LOAD)***

Report the previous 3 Fall semesters with the most recent on the right

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	2001	2002	2003
FTE (Phys)	1.5	1.5	1.5
Load (Phys)	476	514	537
% Change (Phys)	---	+7.9%	+4.4%
Load (Sky)	539	586	640
% Change (Sky)	---	+8.7%	+9.2%

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**Please comment on the comparison of this program to College trends.**

The load in physics is increasing, but at a slower pace than the college as a whole. Most likely this is due to laboratory constraints on enrollment.

***Retention and Success***

Report data on program retention and success rate with the most recent on the right.

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	2001	2002	2003
Retention	75.8%	87.1%	87.9%
Success	66.7%	81.4%	81.2%

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***Please comment on the programs success and retention rate. Include factors that affect the rates and how college services are used to provide multiple avenues for student success.***

*The large increase in retention and success rates from 2001 to 2002 is stunning. It may simply be a statistical fluctuation, or possibly due to the success of the MESA program: almost all physics students take advantage of it.*

A statistic that does not appear above is the small number of women enrolled in the engineering physics sequence: typically less than 10% of a class. This is a national problem and not confined to Skyline College. (The algebra-based sequence does not have the same problem as many more women plan for futures in health related fields than in engineering.) Attracting more women into physics and engineering is an obvious source of growth; however, since calculus is a prerequisite for engineering physics, and pre-calculus for calculus, and intermediate algebra for pre-calculus, and so on; any changes to encourage more women into the field will have to be made down the pipeline in conjunction with the mathematics department.