Academic Program Review
Of
Department of Physics

Southern Polytechnic State University
July 2004

Committee Members

Dr. Rebecca Rutherfoord
Professor of Information Technology
Southern Polytechnic State University

Dr. Thomas Currin
Professor of Civil Engineering Technology
Southern Polytechnic State University

Professor Dennis Missavage
Professor of Physics
Chattahoochee Technical College

Table of Contents

I. Mission of Southern Polytechnic State University

The following are parts of the Mission Statement of Southern Polytechnic State University that pertain to the Program Review for the Department of Physics.

"Our mission at Southern Polytechnic State University is to provide the residents of Georgia with university-level education in technology, engineering technology, arts and sciences, architecture, management, and related fields….We produce academically and technically proficient graduates for the economic development of the state, region, and nation…All of our programs include a strong general education course of study that integrates science, technology, and liberal arts…The faculty strives for excellence in teaching and service, providing a laboratory-centered and/or professionally oriented education that fosters problem solving, ethical awareness, and a desire for lifelong learning."

The Department of Physics also has a mission statement that addresses the rigor of the program, professional development of faculty, and employer satisfaction. The university catalog states that "The Physics degree program is designed to prepare students for industrial employment or for graduate study in Physics or in a variety of other disciplines."

The mission of SPSU strongly supports a degree program in Physics. According to the self-study, a recent article by Rigden and Smith (*Physics Today,* Nov. 2003, p. 45) states "A physics education is a solid foundation for a diverse range of careers…For physicists, new knowledge is the basis for still further new knowledge, and physicists are adept at exploiting that supply chain." They state the additional concern that "one of the vital raw materials-students who choose physics as a course of study-is in dwindling supply. The declining number of physics students raises serious concerns." This concern is voice in the self-study done by the department as well.

The following sections will address the self-study review process and findings of the committee.

II. Reason for Review and Process for Review

The Department of Physics received a triggered review from the system office. The reason for this was the low number of students graduating from the physics degree program. The department then carried out a self-study of their program. The self-study was done during the fall term 2003 and the review process was completed during the summer 2004.

The Acting Vice President for Academic Affairs at SPSU appointed a two person committee from on campus, and one person from off campus to examine the results of the self-study and make available the findings and recommendations to the President and Vice President.

The committee reviewed the self-study itself and any other documents it thought necessary. The committee chair interviewed the Department Chair of Physics for further clarification and explanation of material. Research data was provided by the Institutional Researcher, Ms. Jocelyn Clark.

The committee members are: Dr. Rebecca Rutherfoord, Professor and Graduate Coordinator of Information Technology at SPSU, Dr. Thomas Currin, Professor of Civil Engineering Technology and immediate past Moderator of the Faculty Senate at SPSU, and Professor Dennis Missavage, Professor of Physics at Chattahoochee Technical College located in Marietta, GA.

III. Committee Findings

A. Mission of Program and Curriculum Description

As stated previously, the Physics degree program at SPSU is designed to prepare students for industrial employment or for graduate study in Physics or in a variety of other disciplines.

The Physics program currently offers two degrees in Physics, the Bachelor of Science and the Bachelor of Arts. Both degrees require 60 hours of core courses (general education), 27 hours of required physics major courses, and 4-10 hours of upper division physics elective credits. Other supporting courses include a Technical Writing Course, and Ordinary Differential Equations in mathematics. The B.S. degree requires that the student complete a Foreign Language and International Studies minor.

In additional to two calculus based introductory physics courses, the students must complete the following major courses:

1. PHYS 3210 Intermediate Mechanics
2. PHYS 3220 Electromagnetism I
3. PHYS 3410K Electronics Laboratory
4. PHYS 3500K Introduction to Computational Physics
5. PHYS 3710 Modern Physics
6. PHYS 3720L Modern Physics Laboratory
7. PHYS 4210 Quantum Physics
8. PHYS 4230 Thermal Physics
9. PHYS 4410K Advanced Measurements Laboratory
10. PHYS 4430 Capstone Physics Project

In addition, the following are elective physics courses that students may choose (in additional special topics occasionally offered):

1. PHYS 3220 Optics
2. PHYS 3730 Relativity
3. PHYS 4220 Electromagnetism II
4. PHYS 4240 Solid State Physics

Students may also pursue double majors at SPSU. Students who desire a second major in physics must take a required 22 hours of course work from the major courses listed above.

Since the majority of majors at SPSU are of a technical nature, most of the program require physics courses as part of their curriculum. Thus, the Department of Physics has a very large offering of service courses each term. A survey of courses for fall term 2004, shows that ten sections of the two introductory physics courses, with two

laboratory sections are being offered. The department must support a large number of service courses in additional to their major courses.

Committee Findings and Recommendations

The committee found that the course offerings are consistent with other national physics programs. With the small number of physics majors, upper level major courses can only be offered once or twice a year. However, this is consistent with other programs that have lower enrollments for upper level courses.

The committee found that the curriculum is very rigorous and allows for the students to "practice" their classroom theory with the "hands-on" laboratory experience. Examination of several of the syllabi for supper level courses showed the courses were appropriate for the upper level physics student. The committee believes that the curriculum for the two bachelor's degrees is at a sufficiently rigorous level as appropriate for such programs.

B. Dedicated Resources

1. Faculty Qualifications

All full-time faculty who teach physics have at a minimum the Master's degree and most faculty hold the doctorate degree. This is consistent with SACS requirements for faculty requirements.

Committee Findings and Recommendations

The committee finds that the faculty hold the proper credentials to teach in the physics program. The committee does note that in the last 10 years, six physicists in the department have retired, and none have been retired. There are currently four physicists in the department to handle the major and service courses. Hiring searches for the last two years have had to be canceled due to lack of funds. It is also difficult for the department to find qualified adjunct faculty who are willing to accept the pay scale offered at SPSU.

The committee recommends that the President and Vice President for Academic Affairs continue to examine the needs of the Physics Department for full-time faculty and allow for hiring as funding permits.

2. Faculty/student Ratios

Looking at the comparison data concerning student enrollment, most of the service courses can allow for 40 students to be enrolled in each section, with two separate 20 seat laboratory sections. The upper level physics courses tend to have between 7 and 9 physics students in each class.

Committee Findings and Recommendations

The committee finds that the faculty/student ratios (particularly for the upper level physics courses) are find. The lower level service courses are consistent with class and laboratory sizes.

3. Instructional Technology

Both faculty and students are supported with instructional technology assistance on campus through the Center for Instructional Technology. This is a computer laboratory setting that supports faculty and student using specialty software. In addition, on-campus general purpose computer laboratories are available for all students. Faculty have computers in their offices that are supported through instructional technology. In addition, faculty have support for their teaching through the Center for Teaching Excellence that offers seminars and other sessions to assist faculty in the classroom.

Committee Findings and Recommendations

The committee finds that the instructional technology support is adequate for the program faculty and students.

4. Facilities and Support

Recent renovations (completed in 2001) to the building that houses the laboratories and classrooms for physics have greatly improved the facilities for students. Several of the rooms and hallway were updated for use as lab, classroom and gathering space. The Modern/Advanced Measurements Lab room contains the equipment to support the upper level lab courses. An adjacent room has proven to be a gathering place for the physics majors that allows for interaction and study groups.

There is also a full-time laboratory assistant that helps faculty to set up the various labs for student laboratory classes.

Committee Findings and Recommendations

The committee finds that the newly renovated laboratory facilities has greatly enhanced the laboratory experience for the students. The committee recommends that the administration continue to examine the needs for laboratory equipment and supplies as this is a critical on-going problem.

5. Learning Resources

As mentioned previously, the instructional technology lab supports both faculty and students. In addition, the SPSU library provides the support for library materials needed

for the students and faculty. The Galileo system and inter-library loan programs help students and faculty obtain needed materials. On-line databases provide many technical journals and articles.

Committee Findings and Recommendations

The committee finds that the learning resource support is adequate for the program.

6. Budget Resources

The renovations to the building have been a big plus for the program. Since the state is in a tight budget constraint, programs have suffered, especially in the ways of supplies. The physics program has a very large laboratory component and requires not only up-to-date laboratory equipment (with maintenance), but also expendable supplies. The department has done an admirable job using their budget wisely. Funding from student technology fees have helped supply laboratory equipment.

Committee Findings and Recommendations

The committee finds that the budget is adequate to sustain the minimum for the program, but we suggest that as funds become available, that the department be given additional funds for operational laboratories supplies.

C. Program, Learning, and Service Outcomes

1. Graduation Rates

This was the area of concern that triggered the program review. Looking at the comparison data provided by the institutional researcher for the number of physics BS degrees awarded in 2001-2002, SPSU is consistent with the other schools. The program at SPSU is NOT out of line with the other schools in the university system, and other data suggests that the national average for physics graduates each year is between 3 and 4.

Committee Findings and Recommendations

The committee finds that the number of graduates is consistent with other physics programs and is NOT out of the norm. Therefore, the program should be considered a viable program and should continue to operate.

2. Success of Graduates

In looking at the post-graduate survey data, the level of satisfaction with the physics degree and department, students believed that the degree provided them with the skills necessary to be competitive in the marketplace. The degree also prepared the students to analyze problems, communicate scientific ideas and prepared them for their first job.

Students also stated that their careers had advanced after graduation. In additional, starting salaries have been very competitive for the graduates.

Comments from students ranged from acquiring the needed skills to the personal attention from professors. Weaknesses sited were the need for some additional state-of-the-art equipment and a need for a greater concentration on mathematical physics.

Committee Findings and Recommendations

The committee believes that the graduates of the physics program have attained the necessary education to enter the marketplace and advance in their careers.

3. Scholarly Contribution

Looking at the data provided for professional publications and presentations by the physics faculty show that the four physics professors are taking part in scholarly activities. Several publications, including laboratory manuals (not counting solutions manuals) have been done. Presentations have been made in conjunction with mathematics as well.

Committee Findings and Recommendations

The committee finds that the faculty are keeping current in their scholarly activities. The committee recommends that the faculty continue to give presentations at professional conferences as funds permit.

4. Community Service & Outreach

One of the largest efforts by the department for community service and outreach, has been to help host the Science Olympiad regional competition each year. This is a competition where regional high schools come and compete in a variety of scientific events. The faculty have been active in volunteering for this effort each year. This brings solid attention to SPSU and our science programs.

Committee Findings and Recommendations

The committee finds that the department is carrying out sufficient and adequate community service and outreach.

5. Retention Rates

Examining the data for retention supplied from the institutional researcher, show that retention rates have been increasing since 1998. However, the numbers still show that retention rates need to be improved. The strategic plans for the department show that plans have been made to assist in retention through several means of adding additional courses, student intervention and improved facilities.

Committee Findings and Recommendations

The committee finds that the retention rates could be improved, but they are in line with other retention rates for the university as a whole. The committee suggests that the department continue to explore ways to improve retention and implement them as soon as possible.

6. Student Learning Outcomes

Students were given the Outcome Assessment on exit interviews and post-graduate surveys. Institutional research data shows that students believe that they are receiving a good education and that the preparedness they received from the program was good. The students all responded positively to the outcomes assessment. Very few weaknesses were identified during the exit interview process carried out by the department. The students are given these surveys on a regular basis to assure linear data for assessment and improvement.

Committee Findings and Recommendations

The committee finds that the outcomes assessment data supports that the physics program is preparing students according to their mission and the mission of SPSU.

D. Processes

1. Curriculum Review

The Department of Physics conducts a period review of its curriculum to ensure that it follows the guidelines of national physics programs. The full-time faculty of the department examine each courses, the course requirements (objectives) and learning outcomes to be certain they meet the requirements of the program. New courses are added (electives) as time and budget permit in keeping with new/current trends. The curriculum changes follow the standard approval process through the undergraduate curriculum committee and general faculty approvals.

Committee Findings and Recommendations

The committee finds that the Physics Department conducts relevant and adequate curriculum reviews consistent with SPSU policy.

2. Design of Learning Experiences

The Department of Physics encourages students to enroll in co-op programs and internships. This gives the students another experience in the “real world” work environment that enhances the degree program. Many of the students take advantage of

these options. Also, the capstone course gives real-world experiences for the students to work on.

Committee Findings and Recommendations

The committee finds that the students have good learning experiences in additional to their regular classroom and laboratory experiences.

3. Attrition Rates

The department is concerned about retention and attrition and as mentioned previously, is working to have more students stay in the program and graduate using methods previous stated in this report.

Committee Findings and Recommendations

The committee believes that the department is making positive efforts to change the attrition rate percentages. The committee recommends that the department continue to make progress in reducing the number of students leaving the program.

IV. Conclusions

The committee believes that the physics program at SPSU is a viable program that should continue to operate and offer the bachelor of science and bachelor of arts degrees. The department should continue to look for ways to improve retention and attrition rates wherever possible. The university should continue to address the needs of faculty hires and operational budgets. The committee believes that the physics department is strong and that the faculty and staff have done a good job with their programs.