POINT LOMA NAZARENE UNIVERSITY

DEPARTMENT OF PHYSICS AND ENGINEERING

PROGRAM REVIEW

ROUND TWO
JANUARY, 2008

Table of Contents

Departmental Environment

Faculty and Staff

The Department of Physics and Engineering consists of three full-time faculty members, two emeriti faculty members and one active adjunct faculty member. Each of these is committed to the concept of Christian Liberal Arts education. For the past several decades the department has purposefully tried to maintain a faculty with diverse strengths and abilities and continues to do so today.

Professor Dee Puntenney, Ph.D., is currently acting chair of the department. Dr. Puntenney has a background in Health and Medical Physics. He is in his twenty-fourthyear of service to the University and his thirty-fifth year in Christian higher education. He has been actively engaged in recruitment efforts for the department for many years and works to build and maintain community among the students and faculty. Currently his main goal is to mentor his younger colleagues to prepare them to administer the department as he approaches retirement. In addition to teaching general education and beginning courses in physics and engineering he typically teaches courses in modern and nuclear physics and in mechanics (both in physics and engineering).

Associate Professor Kendall Mallory, Ph.D., is currently in his third year at the University but comes with a long background as both a physics professor and as a practicing engineer. Kendall enjoys engaging students in engineering projects both in and outside of class. He is currently involved in proposing a new general education course in astronomy based on his previous experience at another university and is also reviewing our engineering program, the result of which will be the major thrust of our next five-year plan. It is hoped that Kendall's status as a PLNU alumnus will be helpful in strengthening our ties to our alumni. It should be noted that Kendall served as an outside reviewer during our department's first review in 2000 and so is unusually well placed to work on our current review notwithstanding his brief tenure here. Kendall teaches our electronics sequence and a wide range of upper division courses in addition to teaching general education and beginning level physics and engineering courses.

Assistant Professor Paul Schmelzenbach, Ph.D. is currently in his third year at Point Loma and his fifth year of teaching overall. Paul has a particular interest in and skill at using current methods of peer-based instruction in the classroom. This skill coupled with his youthfulness makes him a very popular teacher in the general education and beginning level physics courses. Paul is interested recruitment and will be heading our department's efforts in the Science Honor Weekend starting this year. His degree is in nuclear physics but he chose his advisor because of his notoriety in peer-based physics education. Paul purposefully chooses to teach many general education and beginning level physics courses but is also involved in teaching a wide range of upper division physics courses.

Adjunct Associate Professor David Nichols, ABD, has taught classes in our department for nearly twenty years. His doctoral work is in space science (a part of our Earth Science course content), where he studied the earth's magnetopause (giving him a strong background in Electricity and Magnetism (for our beginning and upper division courses). He did all of his data analysis on a computer using advanced numerical methods and continues to do so in his current full-time position (qualifying his for our electronic and engineering courses and for teaching in the computer science department). We are particularly fortunate to have so skilled an adjunct who can teach almost any course in our curriculum. In recent years he has regularly taught Earth Science and occasionally Physical Science and also teaches an occasional laboratory section for us in both beginning and advanced courses. It is anticipated that we will rely on David even more as Dr. Puntenney moves into a less than full-time position in next year or two.

Professor Emeritus Ken Aring, Ph.D., retired from full-time teaching in 2006 after spending 33 years at Point Loma. Ken remains active in the Science and Religion discussion group on campus and continues to display parts of his coin collection in our library. Ken lives nearby and might be available for teaching an occasional course for us.

Professor Emeritus Keith Walker, Ph.D., retired from full-time teaching in 2007 after nineteen years at Point Loma. Keith has moved out of the area but, when requested, continues to give guidance and direction to the department he chaired for so many years. He also maintains an active research program that might still involve an occasional Point Loma student.

Programs and Curriculum

The Department of Physics and Engineering maintains the following programs:

- Courses in general education. Two currently, PSC 103 and PSC 110, and one just proposed, PSC 105 (The Cosmos). These serve about 250 students each year.
- Service courses for other majors. PHY 141-142, and for math majors PHY 241. These serve about 70 students each year (counting PHY 141 and 142 separately).
- Departmental majors
    1. PHBS: Physics B.S. Currently having about three students.
    2. PHBA: Physics B.A. Currently having about two students.
    3. EPBS: Engineering Physics B.S. Currently having about 23 students.
- Pre-professional programs
    1. Pre-architecture: Currently having no students.
    2. Pre-engineering: Currently having one student considering the option

The curriculum of the department is listed in the University Catalog and follows the guidelines established in the 2000 departmental review. Our course offerings have slightly increased over the past few years because of increased demand for the PHY 141-142 sequence which now often has two laboratory sections and because of increased general education demand which has increased our general education courses to nine sections per biennium (up from eight during our last review).

Concerns about our Engineering Physics major were expressed in our last review. But we concluded that we would make only minor changes until we hired new faculty, including (hopefully) a licensed engineer. We now have that person (Mallory) in the department and will be addressing concerns with our program during the next five years.

See later section

Equipment

The department is in dire need of new equipment. There have been only very few purchases made in the past four years as former faculty planned to retire and as new faculty were learning their way around the department. We made a substantial purchase of computer interfacing hardware last year and there is currently a proposal for adding telescopes for our general education classes. But we need to replace much or our antiquated (often non-functioning!) equipment. Just adding equipment for a single week's laboratory experiment in a freshman level class can run over $10,000. Additionally we need considerable upper division equipment for electronics and engineering. And we anticipate proposing a new senior-level laboratory course which will require many thousands of dollars to equip. The department has saved some monies in the Physics Department Fund to aid in these purchases but the administration needs to know that significant support will be needed. Our students pay significant laboratory fees and soon the university will need to return those monies to equip those laboratories.

Physical Environment

Before discussing the specifics of our facilities, we need only say that we are located in the Rohr Science Center, a building that is outdated, woefully overcrowded and intentionally lacking maintenance as we look forward to a possible new science center. The Department of Physics and Engineering has actually **lost**! over a third of the space it had twenty years ago due to the addition of a computer laboratory in our second floor space and loss of much of the basement to the Biology Department. We desperately need to expand, but at least to grow back to our previous size!

The department occupies approximately one-half of the second floor of the Rohr Science Building. This amounts to about 2800 ft^2. This space allocation is presented in more detailed form in the following paragraphs.

Offices—700 ft^2

There are three faculty offices. They reside adjacent to one another and allow for good communication and camaraderie. The physics department secretary resides in the Math department and is a shared resource with the Math/CS department. No workroom is available for the Physics department.

Storage—100 ft^2

There is only one small room in the department that is given entirely for storage of equipment, etc. Most equipment is stored in cabinets located in the laboratories. Note: The administration has also allocated around 150 ft^2 of storage at a temporary storage area in the bottom of the Fine Arts facility (hardly a convenient venue).

Machine Shop – 300 ft^2

The Physics Department has had a semi equipped machine shop for many years. The quality of the shop was improved several years ago due to the efforts of Dr. David Brown, then of the biology department. This machine shop has trained selected physics/engineering physics majors in machining techniques and procedures but has gone unused since Dr. Brown's retirement. It is hoped that Dr. Mallory or possibly an Adjunct Professor can re-establish the shop.

Intermediate Lab—100 ft^2

A small area has been allocated for the intermediate laboratory. Included in this area are storage cabinets containing most of the equipment for this laboratory.

Research/Advanced Lab—300 ft^2

This lab is presently being used for two purposes. It houses the equipment and research facilities for Atomic and Molecular Physics as well as serving as a basic facility for the Advance Physics Lab. It is well supplied with storage cabinetry.

Lecture/Lab Room #1—700 ft^2

This laboratory is organized in such a manner as to serve a dual purpose—classroom and laboratory. As a classroom it can service about 20 students and as a laboratory facility it can handle 10-12 students. Such a situation was required since the campus is painfully short of classrooms. This room has served mainly the General Physics and University Physics lectures and labs. It has also increasingly come to serve as the laboratory for the general education Physical Science course. With the growth of General Physics beyond the capacity of the room and the addition of a second laboratory section and the additional use of the room for general education labs, it is not generally available for lectures in the intended courses. Thus some of our introductory courses are being taught outside the building preventing the use of needed classroom demonstrations.

Lecture/Lab Rooms #2 and #3—300 ft^2 each

Partitioning a previous upper division laboratory room formed these rooms. The remodeled rooms were to serve two purposes, as classroom for the advanced courses and for Special Projects Lab, and the electronics and robotics course laboratories. As classrooms they can each service four or, at most, five students and as a laboratory they can each handle about 4-6 students. These rooms have necessarily also become storage facilities further reducing their size and desirability for lectures. Furthermore, when partitioned, the capacity seemed adequate for at least some upper division classes. Since that time the number of upper division students has increased so that these can seldom be used for instruction and are therefore under utilized at present. What to do with these rooms should be addressed during the next five years but may become moot if finally funds become available for the new science facility.

Strengths

One of our great strengths is our recruitment program that is centered on the Science Honor Weekend (SHW). The SHW typically produces about four incoming students each year, most of which bring in at least one-third tuition scholarships either from the Admissions Office or the SHW scholarship program. These student go on to serve not only as our academic core but also our social core since they enter as a coherent group to which the other incoming students join. The SHW program is so important to our recruitment and operation it is difficult to imagine the department's vitality without it.

Probably the greatest strength of our department is the quality and character of our students. Our students come in with high academic achievement (see the previous paragraph). Over the past five years, our students have had an average SATM = 700, SATV = 640 and average university GPA = 3.4. Nearly 40% have enrolled in graduate

programs in the physical sciences or engineering or in professional programs in medicine or law. Our upper division students are a coherent group that spends time together in the laboratory, in study groups and in socializing. They are also instrumental in our recruitment, taking active roles in the SHW academic and social activities.

Our academically diverse and faculty is also a strength. The backgrounds of our faculty members enable us to place well prepared teachers in each of the courses we teach in both physics and engineering.

We also have a strong physics curriculum given the size of the department and the limitations placed on us to offer an absolute minimum of courses. We offer more laboratory courses than many schools in our curriculum. And we offer all standard courses required of entering physics graduate students (with the possible exception of a second semester of quantum mechanics).

We have introduced intern programs since the last department review. This has been a long-term need of the department which could not be met when internships had to be voluntary. We are still in the beginning stage of our internship program and realize that much still needs to be done.

Weaknesses

The age and condition of the Science Building and limited space limitations and facilities of the department represent our biggest weakness. Until this is addressed (hopefully in a new science building) most of our other weaknesses cannot be fully resolved.

While we have had an excellent recruitment program (see above), the current trends our a concern. The yield of SHW students has been declining, especially among the best of them. Is this a result of the University's new scholarship program which emphasizes more scholarships of less value (we think so!), the dilapidated state of our facilities, the lack of an ABET accredited engineering program, the quality of our academic or research program (we hope not), or other unknown reasons. Or is it just a temporary fluctuation in a statistically small sample. Whatever the case, this must be studied carefully if our department is to remain strong.

Currently on-campus research availability is lacking in our department. Dr. Walker maintained an on-campus research presence that is sorely missed. Dr. Puntenney had one student engaged in research this year in conjunction with SDSU. Our new faculty have not yet had time to establish research programs. Furthermore, they are both engaged in teaching general education classes during the summer. We have stressed off-campus summer research programs for the past several years and believe the opportunity for our students to mingle with students and faculty from other institutions is quite beneficial. But nonetheless an ongoing on-campus research presence is an obvious weakness.

There has been a lack of direction in Engineering and Engineering Physics programs for some time and this continues to be so. The previous faculty members (Walker, Aring and Puntenney) recognized this problem but felt that the direction taken should be determined, in part, by the backgrounds and interests of the incoming faculty. The options have been and remain as follows:**(see also later section)**

(1) Maintain a pre-engineering program with sufficient breadth to allow students to major in various "structural" engineering fields while maintaining our overall emphasis on electrical engineering.
(2) Strengthen the electrical engineering component of our program at the cost of the pre-engineering courses and produce better qualified electrical engineers.
(3) Build a modern Engineering Physics major around our current program but adding the courses necessary to receive ABET accrediting. This option could have significant recruiting advantages but could weaken both our pre-engineering program and our electrical engineering emphasis.

Any decision reached about our engineering programs could lead to both new strengths and new weaknesses in the department. Furthermore, there is no agreement yet among the faculty on this matter. The final decision may need to be put off until a new full-time faculty member replaces Dr. Puntenney at which time the background and interests of that faculty member can be taken into consideration.

Another weakness (or at least area of concern) is lack of gender balance in the department. We have had no female students enrolled during the past two years and none apparently this coming year. If this turns out to be the case, it will be the longest we have ever gone without female students. What is especially frustrating is that the graduation rate among our female students has been somewhat higher than among our male students. But we cannot graduate women is no girls apply! A special assessment questionnaire was sent to each female graduate of the past ten years. Hopefully they will give us helpful insights on this issue. **(see assessment questionnaire)**

Action taken since the 2000 Departmental Review

The 2000 Departmental Review made four main proposals. These were:

(1) The introduction of B.S. degree programs in both Physics and Engineering Physics
(2) A modified B.A. degree program in Physics with less required courses
(3) The introduction of a minor in Physics
(4) A new major shared with the Computer Science Department called "Physics and Computing"

The first three of these proposals were acted upon with the introduction of each degree

program or minor. The change to B.S. programs was so popular that three engineering physics majors changed to the B.S. program during their senior year. The feedback from the first generation of students involved in the change has been universally positive and most changed catalogs so they could be in a B.S. program. Another indication of the popularity of the B.S. program is its quick adoption in Biology, Chemistry, Math and Computer Science. In recent commencement exercises it is obvious that most graduates in all of the sciences have chosen B.S. programs.

The B.A. in Physics has been chosen by those going into high school teaching (something which almost never used to happen at all) and by those going to professional programs (such as medicine and dentistry). The department has graduated only about one B.A. physics major per year after the new programs were approved. But its affect on the department is minimal and it has given extra flexibility to our students.

It is difficult to judge the benefits of the physics minor to the department. Did we lose a larger than expected number of majors who chose only to minor in physics? Or did some who chose to drop their physics majors go on to minor? Anecdotally, I would say that we gained students on the change. Clearly the students have appreciated having the minor and we have averaged about one graduating per year since first offering it.

The Physics and Computing major was a more complicated proposal than the others because it required cooperation of the departments of Physics and Engineering and Computer Science. Meeting the basic requirements of both departments in a hybrid major that could be completed in four years was offered both pedagogical and scheduling difficulties. As the discussions continued the educational *zeitgeist* no longer favored computer technology as it had in the 1990's. Furthermore, the addition of minors in Physics and Computer Science gave students the opportunity to reach the same goal without an additional major. As a result this new major was never introduced.

Departmental Assessment Plan

A disadvantage of a small department assessment instruments run the risk of not having a statistically significant number of responses. An advantage of a small department is that the faculty can contact nearly all recent graduates and conduct personal interviews. For this departmental review we sent out two assessment instruments, one for all recent graduates and the other for women graduates. These were circulated as follows:

Alumni Survey:	Sent to all graduates of the past five years plus a select group of engineering graduates who graduated between six and nine years ago living in the San Diego area who have maintained knowledge of our curriculum (See appendix **??**)

Women in Science Survey: Sent to all women graduates of the past nine years. (see appendix **??**)

In addition, most of these same alumni were interviewed about during the past two years to gain additional insights to the strengths and weaknesses of the Department of Physics and Engineering.

Appendices:

Alumni Survey

Department of Physics and Engineering

Please circle your answers

The following demographic questions will help us build meaningful analysis of the data. The data from these questions will only be used in aggregate reports. Individual identity will be kept confidential.

What was your status when entering college?

1. Directly from High School
2. Transfer from Community College
3. Transfer from 4-year Institution
4. Nontraditional student
   (Entered college after working, returning to college after raising a family, etc…)

When did you enter PLNU?

1. Prior to 1970
2. 1970-74
3. 1975-79
4. 1980-84
5. 1985-89
6. 1990-94
7. 1995-99
8. 2000-07

Major **(choose all that apply)**

1. PHBA (BA in Physics)
2. PHBS (BS in Physics)
3. EPBS (BS in Engineering Physics)
4. EGRP (BA in Eng. Phy. Before 2004)

Gender

1. Male
2. Female

What year did you graduate from PLNU?

1. 1975-80
2. 1981-85
3. 1986-90
4. 1991-96
5. 1997-00
6. 2001-07
7. Current Student

Approximate GPA in major courses:

1. 2.0-2.5
2. 2.5-3.0
3. 3.0-3.5
4. 3.5-4.0

Approximate GPA for all courses:

1. 2.0-2.5
2. 2.5-.3.0
3. 3.0-3.5
4. 3.5-4.0

What further education have you attained since PLNU?
(Choose all that apply)

1. None
2. Some courses
3. 2nd BA or BS
4. Teaching credential
5. MA/MS
6. MBA
7. M.D.
8. J.D.
9. Ph.D.
10. I am currently in graduate school
11. Other (specify)_____

Very Much Enhanced	Much Enhanced	Enhanced	Not Enhanced	Not Applicable	**The following are values that people may hold. Indicate how much you think that your college experience enhanced these values**.
1	2	3	4	5	A strong commitment to Christ
1	2	3	4	5	Engaging in a life of service to society
1	2	3	4	5	Demonstrating a sensitivity toward and concern for others
1	2	3	4	5	Affirming the equality of all people
1	2	3	4	5	Taking action on moral and ethical issues

<u>Employment Questions:</u>

What is your current employment status?

1. I am currently employed full-time
2. I am currently employed part-time
3. I was employed after leaving college but am currently not employed and looking for work
4. I was employed after leaving college but am currently not employed and not looking for work
5. I was employed but have chosen to stay home
6. I never was employed after leaving college

What category best describes your current job?

1. Engineer in a corporation
2. Engineer in an engineering firm
3. Teaching
4. Applied physics
   (geology, astronomy, medical physics, etc.)
5. Academic physicist
   a. two year institution
   b. four year institution
   c. M.S. or Ph.D. granting institution
6. Other (specify)_____

What company do you currently work for?

_____

Did you continue your education after graduation? If so, in what field?

1. No
2. Yes – in _____

If you went to graduate school, how many years after leaving PLNU did you begin graduate school?

1. Started immediately after graduation
2. 1 year
3. 2 years
4. 3-5 years
5. 6-10 years

After finishing your education, how closely related was your first job to the training you received in the department?

1. Very
2. Considerably
3. Somewhat
4. Barely
5. Not at all

How closely related is your current job to the training you received in the Department?

1. Very
2. Considerable
3. Somewhat
4. Barely
5. Not at all

How well did your education at PLNU prepare you for your current job or the advanced education needed for it?

1. Very Well
2. Considerably
3. Somewhat
4. Barely
5. Not at all

Which statement best describes how you regard your current job?

1. Job with little career potential
2. Job with possible career potential
3. Job with increasing career potential
4. Job with career potential realized
5. Other (specify)_____

Questions about the Department:

Very Much Enhanced	Much Enhanced	Enhanced	Not Enhanced	Not Applicable	**Please tell us if your departmental course work enhanced your abilities in the listed areas:**
1	2	3	4	5	Think analytically and logically
1	2	3	4	5	Write effectively in the discipline
1	2	3	4	5	Working cooperatively in groups
1	2	3	4	5	Effective oral communication
1	2	3	4	5	Use of a computer
1	2	3	4	5	Problem solving
1	2	3	4	5	Integrate knowledge from many sources

You can choose to remain anonymous or you may sign this questionnaire.

Name (Optional)_____

Women in Science Survey

Department of Physics and Engineering

POINT LOMA
NAZARENE UNIVERSITY

The following questions will help us determine possible changes to be made in the Physics and Engineering Department at PLNU. Your answers will only be used in aggregate reports. Individual identity will be kept

Please circle your answers

When did you enter PLNC/PLNU?

1. Prior to 1980
2. 1980-84
3. 1985-89
4. 1990-94
5. 1995-99
6. 2000-07

When was your Bachelor's degree completed?

1. 1980-84
2. 1985-89
3. 1990-94

4. 1995-99
5. 2000-07

Major **(choose all that apply)**

1. PHBA (BA in Physics)
2. PHBS (BS in Physics)
3. EPBS (BS in Engineering Physics)
4. EGRP (BA in Eng. Phy. Before 2004)

Did you complete a major in our department?

5. Yes
6. No, I transferred to another department
7. No, I transferred to another university
8. No, I did not complete a degree program

What was your status when entering college?

9. Directly from High School
10. Transfer from Community College
11. Transfer from 4-year Institution
12. Nontraditional student
    (Entered college after working, returning to college after raising a family, etc…)

If you went to graduate school, how many years after leaving PLNC/PLNU did you begin graduate school?

13. Started immediately after graduation
14. 1 year
15. 2 years
16. 3-5 years
17. 6-10 years

What further education have you attained since PLNU?
(Choose all that apply)

18. None
19. Some courses
20. 2nd BA or BS
21. Teaching credential
22. MA/MS
23. MBA
24. M.D.
25. J.D.
26. Ph.D.
27. I am currently in graduate school
28. Other (specify)_____

Employment Questions:

What is your current employment status?

29. I am currently employed full-time
30. I am currently employed part-time
31. I was employed after leaving college but am currently not employed and looking for work
32. I was employed after leaving college but am currently not employed and not looking for work
33. I was employed but have chosen to stay home
34. I never was employed after leaving college

What category best describes your current job?

1. Engineer in a corporation
2. Engineer in an engineering firm
3. Teaching
4. Applied physics
   (geology, astronomy, medical physics, etc.)
5. Academic physicist
   a. two year institution
   b. four year institution
   c. M.S. or Ph.D. granting institution

1. Other (specify)_____

Which statement best describes how you regard your current job?

1. Job with little career potential
2. Job with possible career potential
3. Job with increasing career potential
4. Job with career potential realized
5. Other (specify)_____

<u>Questions about the Department:</u>

How many women majors were there in the Physics Department during your time as a student?

_____

Please answer the following:

Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	**Please tell us how you felt about the Physics Department in each of the following areas:**
1	2	3	4	5	How you were treated by the Physics faculty as a woman?
1	2	3	4	5	How you were treated by the male physics majors as a woman?
1	2	3	4	5	How satisfied were you with the number of women majors in the department during your time as a student?

How beneficial do you believe it would be for recruitment and retention of women students if the department had a female faculty member?

1. Very Beneficial
2. Beneficial
3. Neutral
4. Not beneficial

Open Ended Questions:

1. Is there anything you could suggest to help the department attract and recruit female students?

2. Is there anything else that you would like to tell us that could help us retain a larger proportion of our female students?

Thanks for your help in our evaluation.
The information will be kept confidential unless you choose to sign your name

Name (Optional)_____