Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

contact: Paul Schmelzenbach

Section One: History of the Program and Consistency with University Mission

Criteria	Indicators	Response (200 word limit)
History of the Program	Describe why and when the program was established. How and why has the program evolved over the years?	The beginnings of the physics department can be traced back to Phil Carlson in the 1930s at Pasadena College. The program began to take on its current shape through the 1960s and 70s as Dr. Morse helped develop and guide the department. As the University grew financially and physically, more faculty were added. By 1986 three full time Ph.D. physicists were involved with the program. For the past several decades we have purposefully maintained a faculty with diverse strengths and abilities. The department continues to thrive with three full-time faculty members that bring expertise in the areas of engineering, physics, pedagogy, nanotechnology, and material science. In viewing historical data in this it is notable that no current faculty member was present before 2006. This report combines the degree programs of physics (BS and BA) and engineering physics (BS). Slight differences in curriculum and extra curricular experiences have allowed for strong preparation in physics and engineering while balancing the need for university efficiency. The BS allows for more extensive preparation, while the BA allows for more cross-disciplinary flexibility. A more recent, but important change within our curriculum was the establishment of an emphasis of mechanics and electrodynamics within the Engineering Physics Degree.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Consistency with Mission and Strategic Direction	Describe how the program supports the PLNU mission and strategic direction.	Physics and Engineering contributes to the excellent education provided at PLNU. We teach with a challenging and rigorous curriculum, while engaging students with research based pedagogies. We foster a strong departmental community which lends itself to modeling and shaping. We send our students with guidance and preparation tailored for them. We also play an important part in the preparation of students in health related fields, and engage students through their general educational experience in matters such as integration of faith and science. Specifically we: • Innovate within our curriculum utilizing educational research and applying it to our context and are working toward interdisciplinary interactions. • Increase access by offering strategic courses in summer session, particularly the pre-med introductory sequence (saving some students an entire semester or year in school, and bringing in students from outside PLNU.) • Having only 3 faculty, each with various specialties, we are able to be quite agile within our programs reacting to trends in our field • An increased degree of accountability is being created within the department. Historically often small numbers allowed for wise changes without consistent documentation or assessment. An increased emphasis has been placed in this area in the last few years.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Section Two: External and Internal Demand for the Program

Criteria	Indicators		Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Comments (200 word limit for each comment)
External Demand	FTF App Conversion Rate (Completed Apps/Inquiries)	Eng Phys	15.1%	19.3%	13.4%	14.2%	12.6%	11.7%	What does this collection of data say about the external demand for your Program?
		PHYS	46.2%	51.9%	27.5%	18.5%	7.3%	12.5%	
		Total	**16.7%**	**22.4%**	**14.3%**	**14.5%**	**11.7%**	**11.8%**	
		PLNU*	19.2%	26.4%	24.0%	23.4%	21.4%	20.5%	
	FTF Admission Rate (Admits/Completed Apps)	Eng Phys	89.2%	96.0%	88.9%	90.9%	92.1%	86.5%	Summary: These data indicate an increased number of inquiries and admitted students to our programs, while the number of students enrolled fluctuates and no statistically significant increase or decrease is observed. This, along with the Noel-Levitz data, supports a maintained or perhaps a slight increase of external demand.
		PHYS	100.0%	85.7%	90.9%	70.0%	77.8%	100.0%	
		Total	**90.7%**	**93.8%**	**89.2%**	**88.5%**	**90.6%**	**88.2%**	
		PLNU*	83.5%	87.0%	72.4%	68.2%	67.8%	69.1%	
	FTF Yield (Enrolled/Admits)	Eng Phys	33.3%	33.3%	21.9%	14.3%	24.3%	29.7%	Further Explanation: In examining the data, we see that the program's increase in inquires followed the general trend of the University. Interestingly the percentage of inquires about our programs compared to the University increased from around 3.5 percent (2008-09) to around 5 percent (2010-13). (These numbers can be extracted from the fractions listed in individual cells.) This may point toward an increased demand as more students are become interested in STEM disciplines as a field of study. Another possible interpretation is that students considering engineering are more likely to apply to a higher number of universities than the overall population (a trend that has increased considerably in the last several years) which would point to an increased ability to possibly recruit students.
		PHYS	16.7%	50.0%	30.0%	0.0%	28.6%	27.3%	
		Total	**30.8%**	**36.7%**	**23.0%**	**13.0%**	**24.7%**	**29.3%**	
		PLNU*	37.2%	27.5%	29.4%	26.5%	29.2%	31.6%	
	Noel-Levitz High School Market Demand Share						Above PLNU Median	2.0%	
	Noel-Levitz PLNU Share of Regional Deg Awd						Above PLNU Median	1.4%	
	Share of PLNU Undergrad Headcount	Eng Phys	1.2%	1.6%	1.7%	1.7%	1.9%	2.3%	What does this data say about the internal demand for your program?
		PHYS	0.1%	0.4%	0.4%	0.4%	0.5%	0.3%	
		Total	**1.3%**	**2.0%**	**2.1%**	**2.1%**	**2.4%**	**2.6%**	
	Indicators		**2010-11**		**2011-12**		**2012-13**		

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Internal Demand	Share of PLNU UG Units Taught	**PHYS/ ENG**	**2.7%**	**2.7%**	**2.6%**	Summary: Internal demand for the program has increased, particularly in engineering physics and has maintained at this increased number. Our share of units taught has remained relatively constant in the past 3 years. Further Explanations: It is relevant how inclusion of the department's offerings in summer session would impact these numbers. This last year we taught three 4 unit classes each with approximately 30 students. Some of these students would have also likely taken these classes during the fall and spring semesters if they had not been offered during the summer. (To get a sense of the impact, if all of these students had just taken courses in the 2011-12 year instead of the summer this would increase the percentage to 3.0 %.) Overall there is likely a small increase in the percentage of the units taught by the department due primarily to increased enrollment in service courses as well as the GE cosmos course.
	Based on some of PLNU's academic initiatives (e.g. expanding number of traditional undergraduate students, programs for new types of learners, expanding and creating new graduate programs, etc.), what new demands do you expect to be placed on your program?					As we increase the number of traditional undergraduate students in combination with the trend of global and national emphasis placed on technical and specifically engineering vocations, we would tend to project a strong demand for the program in the foreseeable future.
	Look at the provided resources about fast growing areas of employment in the next decade. Which of these professions could be occupied by students majoring in your program?					STEM fields are among the fastest growing sectors nationwide, as well as in the California region. Graduates from our programs will enter jobs in many different fields in engineering, physical sciences, and computer sciences. We further specifically equip majors with skills that will be required in many vocations in the next decades. These include skills in critical thinking, problem solving tenacity (particularly piecing together complicated ideas, numerical data, and innovating solutions such as jobs in the financial sector, energy, and the environment) as well as sought after skills in computers and electronics, applying mathematics, and analysis.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Professional Trends for Graduates	What changes could you make in your program that would better prepare your graduates for these professions?	We are: • Making relatively minor shifts in curriculum, which will have potential major impacts to our students. Several of these changes can likely be made to not only increase the strength of program but also decrease costs. These changes will be made in conjunction with our program review. • Increasing interdisciplinary work. Increased experiences in interdisciplinary work will likely become important for future graduates. We have already been working throughout the science building on ways to make this happen. The computational science minor has been one major facilitator in this. We also may want to consider: • ABET accreditation. In our current program review we are also considering the pros and cons of ABET accreditation for our engineering physics degree. In the future this may have increasing importance. • Developing a stronger program for students with a variety of interests wishing to move directly into the work force. Currently, several branches of engineering that PLNU graduates enter, require a Master's degree paired with their engineering physics Bachelor's degree. This also may be of future importance if we wish to increase enrollment of students who specifically want to enter engineering jobs immediately after completion of their undergraduate degree.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Three: Quality of Program Inputs

Criteria	Indicators		Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Comments (200 word limit for each comment)
Incoming Student Data (First-Time Freshmen)	Average SAT Composite Score	Eng Phys	1255	1195	1191	1195	1244	1187	What does this data say about the quality of the students entering your program? As might be expected by the nature of the programs our students tend to have a higher math SAT than the typical PLNU student. Incoming GPA is slightly higher than the PLNU average. Generally speaking, as the program has increased in size over the last five years there has been a slightly lower average high school GPA and perhaps lower SAT scores (tending toward the PLNU average) though this is on the edge of statistical significance. Grouping 2008-09 and 2010-13 together as distinct groups we might see some lowering of input quality in the process of increased enrollment in the programs. We have seen an increased number of students initially choosing engineering who have a variety of incoming backgrounds and aptitudes. Best serving this population (for example the student who comes in starting at a math level below calculus) is an important consideration within our department.
		PHYS	sm	1347	sm	sm	sm	sm	
		Total	**1255**	**1239**	**1201**	**1195**	**1259**	**1196**	
		PLNU*	1140	1125	1147	1150	1168	1161	
	Average SAT Reading Score	Eng Phys	585	573	554	564	591	571	
		PHYS	sm	632	sm	sm	sm	sm	
		Total	**584**	**590**	**565**	**564**	**603**	**575**	
		PLNU*	565	561	573	572	583	582	
	Average SAT Math Score	Eng Phys	671	623	637	631	653	616	
		PHYS	sm	715	sm	sm	sm	sm	
		Total	**671**	**649**	**637**	**631**	**656**	**621**	
		PLNU*	575	564	574	578	585	578	
	Average High School GPA	Eng Phys	3.95	3.78	3.74	3.81	3.81	3.79	
		PHYS	sm	4.16	sm	sm	sm	sm	
		Total	**3.96**	**3.89**	**3.71**	**3.81**	**3.84**	**3.78**	
		PLNU*	3.73	3.70	3.74	3.77	3.81	3.82	
	Percent of full-time faculty with a terminal degree					**Physics & Engineering**		**100.0%**	

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Faculty	Summarize the most recent scholarly and creative activities of the faculty in this program. If desired, include information about peer reviewed scholarship.	Chen has been primarily involved at developing methods to grow graphene (an important nanostructure) here at PLNU and exploring the biological effects of certain nanostructures, and guiding other student research. This research has resulted in several important peer reviewed publications and presentations at national meetings in 2011 and 2012. Chen has also helped in the development on an Honor's project in dealing with radiation therapy. This student presented the poster at a national physics meeting. Mallory has been primarily involved in interactions in faith and science, working on complex systems (such as applying physics to brain functions), as well as guiding student driven projects in engineering. Most recently Mallory help guide students' engineering projects in developing a robotic quad-rotor. Schmelzenbach has been primarily involved in curriculum development, physics education, student driven projects, and interdisciplinary interactions. Most recently he has been working on developing a Just-in-Time teaching platform (talk presented at a national meeting), student driven projects including: Holographic Interferometry and Brownian motion through video analysis (resulted in development of curriculum for advanced laboratory) Curriculum development at PLNU: approximately 50 labs based on physics education research.
	Summarize the grants received by the faculty.	Though individuals within the department have sought after external grants none of our current faculty has received grants while at PLNU.
	Describe how the scholarly and creative activities of the faculty impact the program.	Bringing examples from research interests and results can be very engaging for students and provides a level of motivation and interest to students that helps increase the quality of the program. Many of the faculty interests are very accessible to undergraduate students and overlap with areas in the curriculum. Several of our students participate directly in research with our faculty. This research is an extremely important aspect of education for our students, and plays an important part in program outcomes of students moving forward into their careers or graduate school education. Recently, we have begun to increase summer research at PLNU within the physics and engineering physics majors. We are excited to see how this will continue to grow and maintain as part of the culture of the department.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

	What are the faculty in the program doing to learn about and use the best teaching practices in their discipline?	The faculty is quite active in learning about and using best teaching practices in physics and engineering. Some of the ways we accomplish this are through: the PLNU science learning community, attendance at workshops (internal and external to PLNU) and conferences, keeping current Physics Education Research (through colleagues, and reading journals), and communication within the department and with others throughout the science building and across PLNU.
Program Support	Describe the current quality of the holdings/facilities/equipment needed to execute this program.	The department occupies approximately one-half of the second floor of the Rohr science building (roughly 2800 square ft) Including 3 faculty offices, one introductory lab room, three advanced lab rooms (combined with research equipment and storage areas), one small storage area, and one study/community room. The department has been quite conservative in the purchase and upkeep of lab and research equipment, often fixing items in-house or making do in creative ways. Because of the heating/cooling system present in Rohr Science there is considerable exposure to salt air, as well as apparent organic solvents (possibly through either cleaning supplies, or jet fuel) that tend to corrode and degrade equipment. Any new purchases are carefully considered for longevity in this environment. We are looking forward with anticipation to renovations within the Rohr science building that may come in conjunction with the new science building. (Such as areas for faculty research, and classrooms designed with research based learning environments in mind).

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Four: Quality of Program Outcomes

Criteria	Indicators								Comments (200 word limit for each comment)
Student Data	One-Year Retention	Eng Phys	87.5%	90.0%	58.8%	50.0%	90.9%	77.8%	What does this student data say about the quailty of your program?
		PHYS	sm	sm	sm	sm	sm	sm	
		Total	**88.9%**	**91.7%**	**66.7%**	**60.0%**	**90.9%**	**77.8%**	
		PLNU*	84.8%	86.1%	86.3%	84.9%	85.8%	90.8%	
	Indicators		**F02 Coh**	**F03 Coh**	**F04 Coh**	**F05 Coh**	**F06 Coh**	**F07 Coh**	
	Six-Year Graduation Rate	Eng Phys	40.0%	57.1%	40.0%	sm	sm	60.0%	
		PHYS	sm	sm	sm	sm	sm	sm	Our one year retention rates tend to fluctuate, and are statistically within the average PLNU retention rates. Our 6-year graduation rates fluctuate, and statistically are below the average PLNU rates, though primarily represent data before any of the current 3 faculty members of the department were present. (Though we are troubled by these historical rates, data after about 2008 are probably more representative of the culture of our program.) We can see the expansion of the engineering physics major embedded with the data, and is just beginning to emerge from the number of degrees awarded.
		Total	**50.0%**	**57.1%**	**50.0%**	**sm**	**sm**	**66.7%**	
		PLNU*	73.2%	75.5%	76.1%	75.5%	78.1%	74.5%	
	Indicators		**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	
	Number of Bachelor's Degrees Awarded	Eng Phys	4	2	7	1	7	10	
		PHYS	2	0	0	2	0	2	
		Total	**6**	**2**	**7**	**3**	**7**	**12**	
	Share of PLNU Bachelor's Degrees Awarded	Eng Phys	0.7%	0.3%	1.3%	0.2%	1.3%	1.8%	
		PHYS	0.4%	0.0%	0.0%	0.4%	0.0%	0.4%	We noted that a number of our students particularly in 2010-11 left PLNU for financial reasons. (Our numbers are still small enough we can recall many of the individuals.) Also information that can be indirectly extracted from this data is the slow increase in the number of transfer students (looking at degrees and one year retention data, noting that nearly all of our students graduate in four years), which I believe also speaks to the quality of our program.
		Total	**1.1%**	**0.3%**	**1.3%**	**0.5%**	**1.3%**	**2.1%**	
	Indicators		**Fall 2008**	**Fall 2009**	**Fall 2010**	**Fall 2011**	**Fall 2012**	**Fall 2013**	
	% of enrl UG who are race/ethnically diverse	Eng Phys	14.8%	16.7%	35.9%	33.3%	34.9%	34.5%	
		PHYS	sm	30.0%	40.0%	62.5%	50.0%	57.1%	
		Total	**16.7%**	**19.6%**	**36.7%**	**38.3%**	**38.2%**	**37.1%**	
		PLNU*	20.1%	21.8%	24.0%	29.0%	32.3%	34.2%	We see that the level of diversity within the program is roughly at the PLNU University level (though again with relatively low statistics).

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Four: Quality of Program Outcomes (continued)

It is not expected that departments will be able to answer all of the following questions. Answer those that apply.		
Curricular Information	Describe the significant changes that you have made to this program based on assessment of student learning outcomes data, program reviews, etc.	Some significant changes made in the last five years based on assessment and program reviews include: • Development of emphases within the engineering physics degrees (allowed for better preparation in each of the two broad categories) based on program review and alumni survey • Changes in curriculum to allow for more mechanics and structural coursework (based on alumni survey) • Shift in the curriculum of lab work – more of a focus is being placed on written communication in modern physics lab (taken at the sophomore level) • Development of a Senior Capstone and Lab – a particular focus on written and oral communication is being developed in this coursework. • Encouragement of women in science – we have more actively sought to encourage women in engineering and physics. The last few years we have supported a trip to a women's in physics conference. This has been a great experience for several of our students.
	Describe regular opportunities for students to apply their knowledge (internships, practicums, research projects, senior projects, etc.). Estimate what percentage of your majors participate in these opportunities.	Students apply their knowledge within the physics or engineering physics curriculum through senior projects, summer research and internships. Starting next year 100% of our majors will complete a senior project. (Some students were graduating under old catalogs and not required to take this course, though some students choose to take it even though it was not required, speaking to the value of this experience!). Approximately 50% of our students participate either in summer research at PLNU or an outside REU (Research Experience for Undergraduates at a research university) or at an internship. About 10 percent of our students complete an honors project.
	Describe any public scholarship of your undergraduate students (conference presentations, publications, performaces, etc.). What percentage of your undergraduate students are involved in these activities?	Less than 10% of our students participate in public presentation of scholarship (presentations outside the department). This is a number that we would like to see increase. This number is beginning to increase as we increase the number of students involved in summer research. These public presentations most often occur in honors projects (approximately 1-2 annually), and we occasionally have students present at conferences. We are excited about the development of our senior capstone experience and expect several of these projects could begin to be at the level that they could be presented at conferences.
	Describe your undergraduate student success rate for passing licensure or credentialing exams.	We have not tracked this (most students would take such licensure after graduate school).
	Describe any study abroad opportunities organized by your program. What percentage of your majors are involved annually (annualize the number)? How many students outside of your department participate in this program (Annualize the number)?	We do not organize a study abroad program, though we help facilitate the possibility of studying abroad, which a small percentage of students do within our majors (perhaps averaging 0.5-1.0 students per year)

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

	What are the distinctives of your program?	Some of the very best students at Point Loma choose to major in physics and engineering. During the last two out of three years, graduates from our program have held the highest GPA of any student in their graduating class. Our students are challenged intellectually, while we simultaneously encourage and support student's growth in all aspects of their lives. We have had student athletes in our program in soccer, golf, and track, while other students are involved in student government, student ministries, and music. In our programs we have several ROTC students. Some recent graduates are attending graduate programs in physics, material science, structural engineering, medical physics, and other engineering programs at institutions around the country including UCSD, Georgia Tech, UC Riverside, University of Texas, and University of Oregon. Our graduates have found their vocations in engineering companies, research labs, and other technical fields. We emphasize a collaborative learning environment which allows students to thrive academically, build personal confidence, and develop interpersonal skills. The atmosphere at Point Loma Nazarene University allows you to receive individual attention from faculty members. We provide a Christian environment for students to learn values and judgment, and pursue integration of scientific knowledge and Christian faith.
	Describe your success with student acceptance into post-baccalaureate education.	Acceptance rate at grad schools is quite high. Nearly every student who has applied has been accepted into some graduate program. This has not been very carefully tracked in the past. Previously the number of graduates was small enough, everyone who wanted to get into graduate school did. In the last 8 years we do not know of any case that a student wanting to get into graduate school failed to do so (though sometimes this was not their first choice school)
	Describe your success with students acquiring jobs in their discipline.	Students have been successful at acquiring jobs within the discipline of engineering, physics, or closely related field (such as programming etc.) Most have a job directly in the field. In the last few years (with the economic downturn) some students had more difficulty immediately finding work in engineering. Many of our students (60%+ go to graduate school) these students also successfully find STEM jobs quite quickly.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Post-Baccalaureate Information	Describe the findings from any alumni surveys that you have conducted for your program.	The latest alumni survey was conducted in 2009. We examined ideas into: Department Curriculum, Abilities and Values and employment. Overall, over 80% of the respondents were either satisfied or very satisfied with the curriculum. Aspects of the electronics sequence seemed like they had the least satisfaction. The respondents indicated that their ability to think analytically and logically, problem solve, integrate knowledge, and use computers were very much enhanced or much enhanced. The ability to think analytically and problem solve were one of the top strengths of the department's curriculum. A significant number of respondents indicated that their ability to write effectively in the discipline and oral communication was not enhanced. The majority of alumni indicated that the PLNU department did either an “outstanding” or “good job” in preparing them for work in their field and graduate school, while remaining alumni said we did an “okay” job. No alumni said we did a poor or very poor job in these areas. Multiple free responses indicated that problem solving skills and analytical thinking were some of the most useful skills they utilize in their employment There was also an indication from our Alumni that we should perhaps consider ABET accreditation.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Five: Scope, Productivity and Costs of the Program

Criteria	Indicators		F02 Coh	F03 Coh	F04 Coh	F05 Coh	F06 Coh	F07 Coh	Comments (300 word limit for each comment)
Student Data	Six-Year Graduation Rate	Eng Phys	40.0%	57.1%	40.0%	sm	sm	60.0%	When considered collectively what does this student data say about the productivity of your program?
		PHYS	sm	sm	sm	sm	sm	sm	
		Total	**50.0%**	**57.1%**	**50.0%**	**sm**	**sm**	**66.7%**	
		PLNU*	73.2%	75.5%	76.1%	75.5%	78.1%	74.5%	The numbers in our program are relatively small shown in this data. The increased enrollment (over the last 5 years) in our programs are just now beginning to be reflected in this data. From this data we could tentatively project a trend of increasing productivity. (Cohorts in later years 2011-13 are larger, and if a moderate number of these students continue to graduation, degrees awarded will increase or maintain at higher rates.)
	Indicators		**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	
	Number of Bachelor's Degrees Awarded	Eng Phys	4	2	7	1	7	10	
		PHYS	2	0	0	2	0	2	
		Total	**6**	**2**	**7**	**3**	**7**	**12**	
	Share of PLNU Bachelor's Degrees Awarded	Eng Phys	0.7%	0.3%	1.3%	0.2%	1.3%	1.8%	
		PHYS	0.4%	0.0%	0.0%	0.4%	0.0%	0.4%	Our unfilled course capacity may be close to appropriate. It would be difficult to sustain upper division courses at 28 students without substantial equipment upgrades. If the program were to grow, and sustain, this number this kind of investment might be worth it. (It might be difficult to compete with other institutions that would maintain smaller class size, as this is one feature that helps recruit some of our top students.)
		Total	**1.1%**	**0.3%**	**1.3%**	**0.5%**	**1.3%**	**2.1%**	
	Indicators		**Fall 2008**	**Fall 2009**	**Fall 2010**	**Fall 2011**	**Fall 2012**	**Fall 2013**	
	FTF App Enrollment Rate (Enrolled/Completed Apps)	Eng Phys	29.7%	32.0%	19.4%	13.0%	22.4%	25.7%	
		PHYS	16.7%	42.9%	27.3%	0.0%	22.2%	27.3%	
		Total	**27.9%**	**34.4%**	**20.5%**	**11.5%**	**22.4%**	**25.9%**	
		PLNU*	31.1%	23.9%	21.3%	18.1%	19.8%	21.8%	Basically, the department has, and will likely continue to teach a large number of students in 100 level courses (usually 40-50+ students per class), and smaller numbers of students in courses numbered 200 and above. We believe this model is sustainable, and of benefit to PLNU.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Five: Scope, Productivity and Costs of the Program (continued)

Criteria	Indicators		Fall 2010	Fall 2011	Comments (300 word limit for each comment)
	Student credit units taught (UG fall only)	PHYS/ENG	**956.0**	**953.0**	When considered collectively, what does the data above say about the productivity and efficiency of your program?
		% of PLNU*	2.7%	2.8%	
	% of credit units taught by full-time faculty	PHYS/ENG	**79.2%**	**77.4%**	
		PLNU*	75.5%	75.7%	
	Student credit units per faculty FTE	PHYS/ENG	**227.6**	**265.5**	
		PLNU*	197.0	198.8	
	Student/Faculty Ratio (Student FTE/Faculty FTE)	PHYS/ENG	**14.23**	**16.59**	
		PLNU*	12.32	12.42	
	Indicators		**2010-11**	**2011-12**	The program shows a higher student to faculty ratio than the PLNU average. The cost per credit hour is 25 percent lower than the Delaware benchmark. Our 2012-13 data was at $193.00. Because of the way our courses are taught in a rotating basis this number is perhaps best compared to the $205 number (which is a 6% reduction.)
	Student credit units taught (UG & Grad - **full year**)	**PHYS/ ENG**	**1,689.0**	**1,671.0**	
	Cost per Student Credit Unit	PHYS/ENG	**$205**	**$189**	
		DE Bchmrk	$269	$262	
	Indicators			**Unfilled Capacity**	
	Unfilled Course Capacity		**PHYS/ENG**	**13.4**	
			PLNU Median	14.1	
	When considered collectively, what does the data above say about the aspects of your program that need further study?				We may want to consider if effectiveness of our program is appropriate. If we are 25% lower than the benchmark, is the quality of our program sufficiently high? Could the quality of the program be increased without increasing costs to the university? In the short term are we helping the University, but if we begin losing students who might have come to PLNU (because of facilities/equipment) for example is this worth it?
Cost and Revenues (From the Delaware Study)	**Indicators**		**2010-11**	**2011-12**	
	Extra revenue generated (lab fees, activity fees, etc.)	**PHYS/ ENG**	**$7,872**	**$7,008**	
	Extra revenue/student credit unit	**PHYS/ ENG**	**$5**	**$4**	
	Additional costs (See Glossary)	**PHYS/ ENG**	**$0**	**$0**	
	Additional costs/student credit hour	**PHYS/ ENG**	**$0**	**$0**	

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

	Describe efficiency gains and cuts made by this program in the last four years.	• Matching courses offered to demand – Our GE course Cosmos has maintained high enrollment, and is now being offered each semester (swapping an Earth Science offering for Cosmos) Each of these courses is still maintaining enrollment of around 50 students. • Minimizing lab sections –We accomplished this by increasing capacity expanding equipment holdings and changing pedagogy, and carefully managing registration to not establish a lab unless it was nearly or completely full (a practice that occasionally had occurred in the past.) • Load cuts – We reduced the teaching loads associated with the labs nuclear physics and modern physics by one unit. • Offering summer school – This last year we taught three 4 unit classes each with approximately 30 students. This was a thought-out strategic move that cut several units (taking courses that may have developed multiple sections and keeping them at levels that only required one section of approximately 50 students) • No very low enrollment class -- This semester we did not offer a low enrollment class that would have normally been offered. Instead we offered a class that had a high degree of interest that was accessible to many of our majors.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Six: Curriculum Analysis

This section asks you to consider your data from last year with a particular focus on your curricular data (the data that was color coded red, yellow and blue). If you need the data resent, please email Maria.

Criteria	Indicators	Current Catalog		Comments (300 word limit for each comment)
	Number of menu and elective units required in the program.	PHY PHBA	6	No comments, see questions below.
	Number of menu and elective units offered by the program	PHY PHBA	0	
	Menu/Elective Ratio	PHY PHBA	0.00	
	Number of menu and elective units above required	PHY PHBA	-6	
	Middle Third (33%-66%) of Majors for m & e units above required	PLNU	0 to 5	
	Number of menu and elective units required in the program.	PHY PHBS	4	
	Number of menu and elective units offered by the program	PHY PHBS	0	
	Menu/Elective Ratio	PHY PHBS	0.00	
	Number of menu and elective units above required	PHY PHBS	-4	
	Middle Third (33%-66%) of Majors for m & e units above required	PLNU	0 to 5	
	Number of menu and elective units required in the program.	EGR EPED	3	
	Number of menu and elective units offered by the program	EGR EPED	0	
	Menu/Elective Ratio	EGR EPED	0.00	
	Number of menu and elective units above required	EGR EPED	-3	
	Middle Third (33%-66%) of Majors for m & e units above required	PLNU	0 to 5	
	Number of menu and elective units required in the program.	EGR EPMC	3	
	Number of menu and elective units offered by the program	EGR EPMC	0	
	Menu/Elective Ratio	EGR EPMC	0.00	
	Number of menu and elective units above required	EGR EPMC	-3	
	Middle Third (33%-66%) of Majors for m & e units above required	PLNU	0 to 5	

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Curriculum Breadth	How can you adjust your curriculum to reduce the size of your menus of courses?	Our menu items are minimal and removal would significantly reduce quality. All courses we teach are required of at least some major (and most courses are required of all our majors). Though it is a bit difficult to tell from the data above, in the spirit of the question, there is perhaps one "menu" item that should be considered. Engineering physics majors choose between one of two upper division physics courses. This choice was recently created to allow more room in the programs for an engineering course. This increased the richness of the engineering physics curriculum while potentially reducing the class size in these courses. Also, both of these courses are required of the physics major. A brief explanation of other menu: physics majors interested in pre-med can take an organic chemistry course in place of an electronics course. This only slightly impacts enrollment and significantly benefits students interested in attending medical school and earning a degree in physics. The other menu items are those chosen by our physics BA. This allows a tailoring of interests, while keeping the number of units lower in the program to allow for significant courses to be taken in other areas.
	Are there other ways that you can contract the course offerings in your program to reduce the number of low enrollment courses?	The primary change that will be made in our department is compressing courses that are required only for the engineering physics major (particularly those that have labs associated with them) with the electrodynamics emphasis. The department notes that such compression should be done with care because there may be some increase in enrollment in many of our courses due to the relatively new choice between mechanics and electrodynamics. We also can replace a low enrollment class with another course students sense is particularly relevant (For instance this semester a topics course was offered on Solid Works, and effectively removed a low enrollment class 3 students with a class with 18 students even though it is not required of any major! This class may also help achieve some of the SLOs that the low enrollment class would have.)

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

What GE courses does your department teach? Are there changes that you could make that would make your part of the GE more efficient and effective (e.g. reducing the number of low-enrollment sections, resequencing of classes, reallocation of units)?					Our department teaches Earth Science, Cosmos, and co-teaches Physical Science (PSC103, PSC105 and PSC110) Other courses that can be taken for GE but are typically service courses or major courses are PHY141, and PHY241 (introductory and University Physics) All of these courses are typically high enrollment courses. More often we are dealing with the question of whether to go above 50 students in these courses. (Historically we have elected not to expand a class of 60 into two classes of 30.) We also have purposely taught summer school classes in PHY141 and PSC103 with the goal in mind of not only helping PLNU by the course itself, but by reducing our enrollment during the year (helping reduce the need for splitting classes and labs.) The last two years this has reduced the need for additional lecture and lab sections. This might not be a sustainable option, but has worked well in the past few years. In conjunction with chemistry we recommend that the following re-allocation of units for students signing up for the course: PSC110 – 3 units PSC110L – 1 units (rather than 4 units/0 units) This will reduce unfunded load by 1 unit.
What service courses (non-GE courses that primarily support a program in another department) does you department teach? Are there changes that you could make that would make your service courses more efficient and effective?					PHY141 and PHY142 are the main service courses that we teach (PHY241 also serves as service to chemistry and math to a smaller degree). We have made changes in the last year to increase the capacity of our labs, and the pedagogy used in them to reduce the number of lab sections needed.
Indicators		**2010-11**	**2011-12**	**2012-13**	**Comments (300 word limit for each comment)**
Unfunded Workload Units	**PHYS/ ENG**	**23**	**18**	**21**	

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Unfunded Load	What curricular changes can your department make to reduce the amount of unfunded load? (e.g. reducing the number of labs/studios/lessons, increasing lab or activity fees to cover the unfunded load, etc.)	By restructuring our electronics course we will remove 4 units of unfunded load (a 20% cut) and have removed another 2 units already (totaling a 30% reduction). These changes will reduce our quality slightly, but the benefit seems quite high. Finally with careful management of labs we will be looking at a total of between 30%-40% reduction in unfunded this upcoming year. It is worth noting that much of the unfunded load comes from our introductory courses, which are effectively supplemented by offering larger than ordinary lecture sections. (For instance General Physics has a lecture section of 50 students and two labs of 25 students.) Students pay for 4 units and we in total use 7 units of teaching load. This is similar to teaching fully funded loads of classes with 28.5 students. Typically half our unfunded load comes from "favorable" situations like this (effective class sizes between 20-30 students). The next category would be much of the remaining which would represent "effective class size" of between 10-20 students. With our efficiency gains described our department's unfunded load will almost always be coming from effective class sizes of at least 10.
	What faculty loading changes can your department make to reduce the amount of unfunded load in your program?	All unfunded load comes from labs offered in the curriculum. We want to emphasize again that in the department's opinion these labs are essentially at the bare minimum that would be offered at any comparable institutions. Cutting these labs would be cutting into "real meat" of the program.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

Seven: Impact and Opportunities

Criteria	Indicators	Response (200 word limit)
Impact	How is this program essential to PLNU?	We believe the physics and engineering physics degrees offered through our department are essential to PLNU in the twenty-first century. In a climate of rapidly changing technology, and an increased national and global emphasis placed on the STEM disciplines, it is vital that we continue to provide the opportunity for students with the skills and interests in the STEM disciplines to attend a distinctively Christian University. Indeed, in order to maintain full, and perhaps expanded enrollment in the future, strong engagement of the STEM disciplines (which physics and engineering play an important piece) is likely necessary. It would be very hard to imagine a University striving to being a national prominent without physics and engineering.
	How is this program related to the success of other programs at PLNU?	Our department helps prepare students in other sciences (biology, chemistry, and biochemistry), mathematics, health related fields (such as some kinesiology students), educators, and ROTC students primarily through our introductory physics sequences. Without the physics and engineering physics degree programs the quality of these offerings would be severely diminished. There are also less obvious, but important connections throughout the University. For example we have had several students come to PLNU in part because they can pursue physics or engineering and still participate in a significant way in other interests such as through the music department (which we believe enhances both programs).
	What are the benefits to PLNU of keeping this program as it is?	We have historically worked to be quite efficient and we continue to strive to continue doing this both through this process and in the future. Keeping the investment in engineering small (keeping it at its current level) would be of very little risk, and tends to be advantageous to PLNU as a whole. We are at a place where we keep flexibility for our students at a maximum while the investment of the university is kept to a minimum. We maintain expenditures below comparable institutions. (We are well below the Delaware benchmark.) If one were to invest to a greater degree into engineering there would be a greater risk (though the possibility of greater return) which might not be a direction that best suits PLNU at this time. Thus, keeping the program as is, would still allow this possibility in the future, and serve our current student population well.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

What would the benefits be of merging this program with another program either in your department or in another department? With which other program would you partner?	There are no clear programs with which either physics or engineering physics could merge. It may be important to highlight why there is no benefit to merging the degree programs of engineering physics and physics, though most of our students are engineering physics majors. Through careful crafting of the curriculum in the majors there are no classes ever taught that just have physics majors in them (keeping enrollments higher). Physicists (and associated vocations) serve very important roles to society as a whole even though they represent a low percentage of the population. We would argue that having this preparation available within the climate of a Christian University is very important.
Could this program make use of some courses from another program to create an interdisciplinary major?	Biophysics, or bioengineering may be options to consider. Majors in software engineering or chemical engineering might also be of benefit to PLNU. (Both of these majors would be more rooted in computer science and chemistry) but may slightly increase enrollment in courses from our departments. These options might ultimately be of benefit to the University from an efficiency and enrollment standpoint, but would not simply use other existing courses to create a major and would likely require significant restructuring and creation of other classes (which might ultimately be more efficient than some existing courses.)
Aside from additional staff, what would it take to make this program grow and become outstanding?	We have been implementing several strategies over the past few years that have, perhaps in combination with increased external demand, helped our program grow. We still have some room for growth without adding additional faculty members. Many of our strategies seem to be effective, and most of them are still in process. • Continue our efforts to purposely build departmental community and expand our efforts to help freshman more quickly feel a part of this community • Continue to build and grow a stronger summer research program. • Continue revisions within the curriculum to build a stronger engineering physics degree • Continue developing a strong disposition of evaluation and change based on this evaluation • Bettering syncing our program with mathematics to help students with a variety of backgrounds succeed in our programs We of course would like updated facilities, and particularly classroom and community spaces as well as equipment, and better financial support particularly for our top students that are heavily recruited by other institutions, but we are excited about physics and engineering physics potential for growth and increasing excellence whatever resources are determined to be allocated for the best of PLNU.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

	What have you learned about changing trends in your discipline from looking at similar programs at our comparators?	PLNU Comparator List	Several universities have committed to investing in engineering as a potential growth area. Previously in a capped environment, this did not make sense at PLNU. There may be some opportunity to consider this if PLNU would invest further in the engineering component. We also may tend to lose students that were previously coming to PLNU because of better offers with better facilities from other institutions. Becoming ABET accredited is increasing in importance. We are also investigating this question in our program review.
Opportunity	Are there new developments in pedagogy in your discipline? What would be required to implement these changes in pedagogy in your department?		Physics education research has historically been leading the way in applying science to pedagogy. There are a number of different very successful strategies developed. (Often centered around active enjoyment of the students) Many of these strategies would be significantly aided by classrooms that are created with these ideas in mind.
	Are there national trends in higher education or industry that are particularly important to your discipline? If yes, how is your program reacting to those trends?		Interdisciplinary interactions have been, and are perhaps becoming , increasingly important in physics (biophysics, computational physics, etc.) and engineering (environmental engineering, bioengineering, etc.) We have been involved in discussions throughout the building, and encouraging some of the top students who may want to engage in this kind of activity to do so. Also, there has been an increased number of jobs within the mathematical and computational sciences (and the interfaces within the physical sciences.) The Computational Science minor in physics has been an exciting development between MICS and physics. Trends in engineering fields have continued to highlight the utility of an engineering physics degree. The engineering physics degree offers students a greater depth of fundamental understandings, and as technology continues to develop, our graduates are well suited to adapt.

Academic Prioritization Curricular Metrics - Undergraduate Programs

Physics & Engineering

	What additional cost savings could you recommend for your unit? What could you give up to help the university trim costs?	The cost savings recommended for our unit beyond those already implemented (though also discussed in the unfunded load section) are primarily curricular changes that reduce unfunded load and convert potentially very low enrollment classes (5 or less students) to classes with moderate enrollment (10+) Specifically within our programs we have four, 2 unit courses each of which has a lab (8 units unfunded). These can be converted into two 4-unit lab courses each (4 unit +1 unfunded), which could achieve moderate enrollment. These cuts would represent direct losses to our students, but also represent the most inefficient part of our program. If the unfunded load can then be converted into a higher enrollment course which would effectively serve to achieve the student learning outcomes, ultimately the program as a whole would maintain its quality, and perhaps with the creativity of the department improve the program as a whole, while saving the University money.

POINT LOMA
NAZARENE UNIVERSITY

Office of the Provost

To: Physics and Engineering

From: Kerry Fulcher

Date: 4-29-14

Re: Prioritization Decisions Related to PHY

With the prioritization process complete, visits to departments impacted by prioritization decisions are taking place in advance of any detailed public announcements. The Cabinet recognizes that these types of decisions are both difficult to make and difficult to accept. While we believe that these decisions are in the best interest of the University moving forward, we recognize that some faculty may disagree. However, with these decisions made, we are asking all members of the community to exhibit great care for the wellbeing of our students. It will be particularly important to assist students in impacted programs with a specific plan to complete their degree, transition to a modified program or transfer to another program that will prepare them for their desired occupational path. Since our system uses faculty advisers, your interactions with your student advisees will be key in enabling them to successfully navigate the ramifications of any prioritization decisions while continuing to have a positive educational experience at PLNU.

Guiding Principles for Prioritization:
Recognizing the rapid changes across American higher education, and working from PLNU's position of vitality and strength, we have engaged in review and prioritization of our present programs and practices in order to set a strong future course for the university. Decisions of prioritization have been made to:

I. Exercise responsible stewardship in order to ensure a sustainable future for PLNU.
II. Provide a mission-centered, high quality student learning experience.
III. Care for the people in our community through this process.

Data used to inform these decisions were pulled from the most up-to-date information from Institutional Research and from what was provided in the self-study reports. With this in mind, the following decisions have been made that impact programs within the PHY department:

1. Convert 4 two-unit courses to 2 four-unit courses as proposed in the PHY Prioritization report

Rationale: This was offered by the Department of Physics and Engineering as part of its prioritization report and it provides some modest cost savings due to a reduction in unfunded load.

Ramifications: This change would reduce unfunded load through the reduction in the number of labs. This should be implemented as part of the current program review process.

2. Convert PSC110 to 3 unit lecture with a 1 unit lab as proposed in the PHY prioritization report

Rationale: This change was suggested by the Department of Physics and Engineering and the Department of Chemistry as part of their reports. While this change does not reduce unfunded load, it does provide a model for assigning student units to both the laboratory and lecture portions of classes.

Ramifications: This change should be implemented via normal APC processes.