Basic Program Information

Department Name:

Physics/Engineering/Nanotechnology

Division Name:

PSME

Program Mission(s):

Physics - Provide undergraduate education founded on a rigorous, applied treatment of physics fundamentals coupled with experiential exercises and a broad commitment to generate and disseminate knowledge.

Engineering - Provide undergraduate education founded on a rigorous, applied treatment of engineering fundamentals coupled with modern engineering tools.

NANO - Develop materials engineering skills in workforce and incumbent worker training, and prepare transfer students for advanced courses in materials science and engineering

Please list all Program Review team members who participated in this Program Review:

Name	Department	Position
David Marasco	Physics	Instructor
Sarah Parikh	Physics/Engineering	Instructor
Sue Wang	Physics/Engineering	Instructor
Frank Cascarano	Physics	Instructor
Robert Cormia	NANO	Instructor

Total number of Full Time Faculty: PHYSICS	*There are 2 FT faculty in Physics, in addition 2 more split time between Physics and Engineering*
Total number of Part Time Faculty:	6

Total number of Full Time Faculty: ENGINEERING	*See Physics*
Total number of Part Time Faculty:	4

Total number of Full Time Faculty: NANO	*1*
Total number of Part Time Faculty:	0

Please list all existing Classified positions:
JENNY LIANG: Instructional Lab Coordinator is shared between Physics and Engineering, with additional responsibilities to meet the needs of the PSME division at large.

List all Programs* covered by this review & check the appropriate column for program type:

Program Name	Certificate of Achievement Program	Associate Degree Program	Pathway Program
Physics		X	
Engineering	**X**	X	
Nanotechnology	**X**	X	

* If you have a supporting program or pathway in your area for which you will be making resource requests, please analyze it within this program review (i.e. Integrated Reading and Writing, Math My Way, etc.) You will only need to address those data elements that apply.

Section 1: Data and Trend Analysis

a. Program Data:

Data will be posted on http://foothill.edu/staff/irs/programplans/programreviewdata.php for all measures except non-transcriptable completion. You must manually copy data in the boxes below for every degree or certificate of achievement covered by this program review.

Transcriptable Programs	2011-2012	2012-2013	2013-2014	% Change
Physics	4	1	**3**	**200%**
Engineering	2	5	**6**	**20%**
Nanoscience Certificate of Achievement	2 eligible	2 eligible	**1**	**-50%**
Nano Associate Degree	2 eligible	2 eligible	**2**	**0%**

Please provide any non-transcriptable completion data you have available. Institutional Research does not track this data; you are responsible for tracking this data.

Non-Transcriptable Program	2011-2012	2012-2013	2013-2014	% Change
Nanocharacterization	~6 eligible	~3 eligible		
Nanofabrication	~6 eligible	~3 eligible		

If you have a non-transcriptable certificate that serves a workforce need, and/or has external certification, please provide a brief narrative explaining the industry need for this certificate, and attach any supporting data.

Engineering has started two certificate programs, one in Rapid Prototyping and another in the Biomedical field. With the recent surge in 3D printing popularity, we have decided to prepare students to be technicians in order to operate and maintain the 3D printing equipment at companies. The Biomedical certificate program is intended to help students to be more marketable as interns and technicians at any of the many new biomedical companies in Silicon Valley. This is based on the current surge in the number of Biomedical companies in the area.

Nano has three non-transcriptable certificates for nanostructures, nanocharacterization, and nanofabrication. Usually students will complete all three advanced courses, rather than just one of the individual courses. This provides a more complete understanding of materials, and process and characterization tools and techniques used in industry.

If it does not have external certification, and/or is not a workforce program, please provide a brief narrative justifying the need for a certificate that is not state approved, and attach any supporting data.

b. Department Level Data:

PHYSICS

	2011-2012	2012-2013	2013-2014	% Change
Enrollment	1,252	1,309	1424	8.8%
Productivity (College Goal 2013-14: 535)	461	423	415	-1.7%
Success	69%	71%	71%	0
Full-time FTEF	2.4 (36%)	3.0 (41%)	3.3 (42%)	10%
Part-time FTEF	4.2 (64%)	4.4 (59%)	4.6 (58%)	5%

ENGINEERING

	2011-2012	2012-2013	2013-2014	% Change
Enrollment	247	289	393	36%
Productivity (College Goal 2013-14: 535)	335	303	357	17.6%
Success	80%	83%	86%	4%
Full-time FTEF	1.0	0.9	1.4	50%
Part-time FTEF	0.4	0.8	0.9	13%

NANO

	2011-2012	2012-2013	2013-2014	% Change
Enrollment	65	38	32	-15.8%
Productivity (College Goal 2013-14: 535)	268	170	153	-10.0%
Success	73%	73%	70%	-4.1%
Full-time FTEF	0.4	0.4	0.4	0%
Part-time FTEF	0	0	0	0%

c. Associate Degree Transfer (ADT)

There is a fall 2014 legislated deadline for approval of ADTs (AA-T/AS/T degrees). **If there is a Transfer Model Curriculum (TMC) available in your discipline/program, you are *required* to offer an approved AA-T/AS-T.** Indicate the status of your program's ADT:

PHYSICS

Check one	Associate Degree Transfer Status
X	**State Approved**
	Submitted to State Chancellor's Office
	Submitted to Office of Instruction
	In Progress with Articulation
	Planning Stage with Department
	Not Applicable

If you are required to offer an approved ADT and it has not been state-approved, please comment on the program's progress/anticipated approval date.

Physics has an approved ADT. Engineering as a field is exempt from SB1440, but is working on having an ADT once the state approves the TMC. Nanotechnology will not have and ADT (we are the only approved program in the State).

Using the prompts and the data from the tables above, provide a short, concise narrative analysis for each of the following indicators. If additional data is cited (beyond program review data sheet), please indicate your data source(s).

d. Enrollment trends: Over the last three years, is the enrollment in your program holding steady, or is there a noticeable increase or decline? Please comment on the data and analyze the trends.

In Physics, enrollment has seen modest but steady growth over the past three years. Enrollment is up 14% since 2011-2012 and 8.8% since 2012-13. WSCH has increased by 7.3% and 5.5% over the same spans. However, this has been accompanied by a drop in productivity, which will be addressed below.

In Engineering, enrollment has seen steady double-digit growth. Coupled with these trends in enrollment, we have been increasing our course offerings.

Enrollment trends in Nano have been steady with ~10-20 students enrolled in the survey course and 8-10 enrolled in the advanced courses. Not all students begin the program in the survey course, nor do students enroll in each of the advanced courses. A trend of attending two to three of the courses is the most noticeable.

e. Student Demographics: Please comment on the enrollment data, comparing the program-level data with the college-level data. Discuss any noticeable differences in areas such as ethnicity, gender, age and highest degree.

In Physics, the most glaring difference comes in the category of gender, where our student population is 33% women, comparing unfavorably with the campus-wide percentage of 51%. This is a slight improvement over last year's 30%. However, this should be seen in the proper context. Only 32% of the students in the highest-level AP courses are women (http://scitation.aip.org/content/aapt/journal/tpt/50/2/10.1119/1.3677282) and women account for just 19% of all physics bachelor degrees in the United States (http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1294&context=advance). Our problems with the gender divide in physics are part of a larger problem in society, and assuming such trends do apply to our department, the fact that we offer no Gen Ed survey-type classes also depresses our enrollment of women (in most physics departments these classes skew the female participation numbers upwards). We have asked for and will continue to ask for resources to explore solutions.

It should be noted that the success rates are indistinguishable across gender. While there are many factors that affect participation, student success is a place where we have much more control, and this is reflected in our numbers. Starting this year, we will also track our SLO assessments by gender (and self-reported ethnicity).

Physics sees a 49% Asian population compared to 26% college wide, this may be due to a combination of our strong international presence, and cultural attitudes surrounding Asian-Americans and science. We see roughly half as many African-Americans (2%) and Latino/as (10%) as the college as a whole. We should make a concerted effort to better understand why this is, although we suspect that once again we are seeing a reflection of society at large. According to the AIP, of the 6177 undergraduate physics degrees granted in 2012, only 342 went to Hispanics (5.5%). While comparing a national average to California will lowball expectations (as the Hispanic population in California is percentage-wise much higher than it is nationally), it does point to a societal problem. (http://www.aip.org/sites/default/files/statistics/minorities/hispbach-psg-12.pdf)

In Physics the age cohort skews younger than the college as a whole, as we are mainly a transfer department.

Engineering sees similar demographics as Physics, and for some of the same reasons. Our 18% women is better than the 10% historical national average for the most common engineering majors, Electrical Engineering and Mechanical Engineering. The number of students in each targeted demographic category is very small, so the success rates that seem to vary considerably are the effect from just one or two students deciding to take a different pathway. Success rates across gender and age are generally consistent.

Nano is a reasonably diverse program similar to other engineering programs at Foothill. Our students are both young (~20) and mature (30-40) and are both traditional students as well as post baccalaureate. We have slightly more men than women in the survey course and that ratio increases with the advanced courses (resembling industry).

f. Productivity: Although the college productivity goal is 535, there are many factors that affect productivity, i.e. seat count/facilities/accreditation restrictions. Please evaluate and discuss the productivity trends in *your program*, relative to the college goal and any additional factors that impact productivity. If your productivity is experiencing a declining trend, please address strategies that your program could adopt to increase productivity.

Productivity in Physics has dropped to 415. There are several factors that play into this. The first is that we have tried and failed to introduce a new "Physics 5" sequence, which meant that we offered and then needed to cancel several classes, and in order to not "strand" students, ran several very-low attendance sections. This will no longer be an issue as we have abandoned Physics 5. In addition, as we on-ramped the Physics 2AM/BM/CM classes, when they were taught for load they were often low enrollment. Currently we are seeing better (near or above 20s) enrollment in these classes.

A deeper structural issue is the way that the lab sections dictate enrollment management. Our seat count for labs is 28. This means that for most courses we will offer double sections, featuring a lecture of up to 56 students and a pair of 28-student labs. When we have a lecture with 40 students, this means that we'll have a pair of labs that average 20 students, which has a big effect on productivity. In addition, while for the most part the daytime classes have had strong enrollment in double-lab lectures, some of the night offerings have been single-lab lectures, and in essence the daytime instructors have subsidized the nighttime instructors. In an era where productivity is stressed over WSCH, we can be more selective with our nighttime classes.

The lowest productivity classes in Physics are the 2M calculus-booster classes, which are needed for articulation reasons to UC, however, as discussed above, these are trended upwards

When and if the department offers large enrollment GE courses, productivity should also increase, however, this possibly will only be at the cost of other science GE departments.

Overall, Engineering's productivity is low. This comes from a variety of factors including the large unit requirements, lab requirements, and limited seat counts for lab sections. However, engineering courses bring students to Foothill, as we are offering courses that other colleges are not. Those students also take our Physics, Chemistry, and Math courses, so the productivity of Engineering isn't as simple as it seems.

Nano productivity is low due to the enrollment patterns. We have stayed near 12-13 in some courses and up near 15 once or twice in others. We offered NANO10 at Palo Alto High School and enrolled 20 in two sections, however only 60% or so will pass at C or better. NANO62, and online course, was added as an advanced course that condensed NANO52, 53, and 54, in a hybrid format, targeted toward working technicians and professionals

g. Course Offerings: Review the enrollment trends by course and consider the frequency, variety, demand, pre-requisites, etc. If there are particular courses that are not getting sufficient enrollment or are regularly cancelled due to low enrollment, please discuss how your program is addressing this issue.

There do not appear to be enrollment issues in our current offerings. As detailed above, we have taken the Physics 5 series off of the books, as those were facing severe enrollment and cancellation issues.

We have seen increased enrollment in Physics 4A and 4B, possibly due to the increased number of engineering students. Many of the engineering courses have low enrollments, yet have been offered anyway in order to establish the expanding program. These offerings have been based on a one-time trial in order to allow students to find out about our new offerings. This has been successful so far.

We offer NANO51 (F), 52 (S), 53 (F), and 54 (W) once a year. NANO10 will be offered each semester, once at Palo Alto High School, and once at Gunn High School. We advertise the courses through IEEE Bay Area Nanotechnology meetings, and have good awareness there. Many of the engineering students are also aware of the program.

h. Curriculum and SLOs: Comment on the currency of your curriculum, i.e. are all CORs reviewed for Title 5 compliance at least every five years and do all prerequisites and co-requisites undergo content review at that time? If not, what is your action plan for bringing your curriculum into compliance (Please use reports from the Curriculum Office to help you complete this prompt)?

Physics and Engineering are in compliance and reviewed on a regular schedule as directed by the Curriculum office.

The NANO program is reasonably current in content and practice, and each class is updated annually to integrate new material from the field as well as topics that students express interest in. SLOs and CORs are current. We don't have prerequisites or co-requisites; most students understand that chemistry and physics are foundational to the program.

i. Curriculum and SLOs: What are you doing to ensure that your curriculum is congruent with the most recent developments in your discipline?

The content in Physics moves at a glacial pace, most of the content in our courses has not changed in over 100 years (literally one fact in our courses has changed since Cascarano and Marasco were hired in 2004, we now believe neutrinos have mass). Through PD, the department stays current in the latest pedagogy. Several instructors are very involved in the Northern California / Nevada section of the American Association of Physics Teachers, including holding officer positions. The Engineering department chair goes to the ASEE meeting on an annual basis in order to stay current in the discipline. A faculty representative from the engineering department member of the department goes to ELC (Engineering Liaison Consul) meetings annually. ELC is working together with California 4-year schools to ensure collaboration between 2-year schools and 4-year schools and a smooth transfer pathway for community college students, and to stay current with curriculum in community colleges.

Nanoscience faculty attend at least one conference a year in spectroscopy, and attend monthly IEEE-NANO seminars regularly. Nanoscience faculty (Cormia) is also research faculty at NASA-ASL where he conducts research with students in materials engineering.

j. Innovation: Please comment on any innovative initiatives within your program, this could include areas regarding sustainability, stewardship of resources, collaboration, grants and/or curriculum.

The Physics department continues to produce The Physics Show, which will serve roughly 20,000 people this year, including roughly 3,200 children from local Title 1 schools. In addition we hold the Physics Olympics for Foothill students each Spring, and offer the F=ma competition for local high school students that serves as a try-out for the US Physics Team which competes at the international level. The department continues to push more instruction online, both in the form of problem-solving videos and the Physics 2M series which has streamlined transfer to the UC system.

Engineering is innovative in a number of ways. The STEM Summer Camp will be self-funded this year and is reaching a large number of middle school and high school students. The Engineering department has taken the lead on new programs including a weekly newsletter and coordinating STEM Day. Additionally, the engineering department has prioritized sharing knowledge about STEM pathways and careers with Foothill students through the engineering speaker series, the Leadership Lunch program, and the Frontiers in Science series that is just getting off the ground. Additionally, the engineering department has investigated the effects of curriculum changes on student recruitment and success within the introductory engineering course. The results are very exciting and will be published in the proceedings of the ASEE Annual Conference held this coming June. The Engineering department has also created a number of new courses in order to meet industry's demands for employability. Finally, the engineering department is preparing several grants for the coming year including a streamlined pathway between Foothill College and CalPoly for the Biomedical Engineering Track, an apprentice faculty grant for funding to attend the ASEE Annual Conference, and a research grant to investigate academic pathways of STEM students at Foothil College.

Our new NANO10 course at Palo Alto High School incorporated eight new hand-on labs from CNSI at UCLA, and additionally we are cross integrating NANO10 exercises with NANO Camp to develop an experiential learning practice. We collaborate with UCSC at NASA-ASL in nanoeducation, including pursuing opportunities to fund more lab activity.

Section 2: Student Equity and Institutional Standards

As part of an accreditation requirement, the college has established institution-set standards across specific indicators that are annual targets to be met and exceeded. Please comment on how these indicators compare at your program level and at the college level. (For a complete description of the institutional standard, please see the instructional cover sheet)

a. Institutional Standard for Course Completion Rate: 55%

Please comment on your program's course success data, including any differences in completion rates by student demographics as well as efforts to address these differences.

Physics has a success rate of 71%, this is due to fact that we are a transfer program rather than basic skills. For our Physics 2 sequence students must have completed Math 48C, and for Physics 4, Math 1A. Our rates are slightly better than the math courses at the same skill/preparation level.

Engineering has a success rate of 83%, this is due in part to the nature of the introductory courses and in part due to the outstanding math and physics preparation that our students have before taking Engineering courses beyond introductory level.

It should be noted that the success rate of targeted ethnic groups in Physics is 58%, fifteen points below the 73% of non-targeted groups. College-wide these two numbers are 69% contrasted with 81%. For a college as a whole the ratio is 85%, whereas Physics is at 79%. This may be a preparation issue, as the numbers in Math are also as troubling (48% and 65%, for a ratio of 73%), although these have not been broken down for basic skills vs. transfer (we would expect our numbers to track Math's transfer numbers).

Like the college as a whole, we see "Decline to State" as the top group in terms of success rate (76%), followed closely by White (74%) and Asian (71%). With a small sample-size, African-Americans have a 63% rate, with Latino/as at 56%. While it may be an issue of sample size, we as a department need to look at root causes of the poor performance of Latino/as.

As stated earlier, there may be societal effects here, as Hispanics have historically had low penetration in the Physics field. We also note that some of the problem here may be instructional, as the department uses a lot of small group work in its classrooms. While native English speakers do this in English, and many students from Asia do this in their languages, anecdotally we've heard very little Spanish in our classrooms. If students are hesitant in their speaking, then they will be left behind. So perhaps as we grow the number of Hispanic students to the point where they achieve a critical mass, this problem will lessen. We are working on our pipeline by inviting middle schools that are predominantly Hispanic to The Physics Show. It is our belief that no department our size has a stronger recruiting effort, we need to figure out how to get these students into our classes once they arrive at Foothill, and how to best support them when they arrive.

In Engineering, like Physics, success rates are consistent across gender. The numbers for targeted groups are statistically the same as non-targeted, although this is over small sample sizes.

In Nano, most students succeed in these courses, however there is a trend to either participate or not participate, and the majority who participate do reasonably well. There is also quite a diversity in preparation, where some students can do assignments fairly effortlessly, but other students struggle with writing, calculations, and some technical vocabulary, etc.

b. Institutional Standard for Degree Completion Number: 450

Has the number of students completing degrees in your program held steady or increased/declined in the last three years? Please comment on the data, analyze the trends, including any differences in completion rates by student demographics.

In Physics we deal with very small sample sizes, at the level we are looking at, noise dominates the data. Physics serves to train engineers, very few students actually go on to collect a degree in physics. In Engineering, the number of units needed for a degree precludes most students from earning a degree before transfer. As the number of units required to earn a BS in Engineering is large, most of our students who go on to earn the degree do not have the time to complete Foothill's requirements for a degree, and hence our numbers do not reflect our true success. Additionally, transfer schools do not need or want the students to complete GE requirements before transferring into engineering.

In Nano, the number of students who actually pursue a degree is small, as this is not a common transfer program, and most of the advanced students already have a bachelor's degree. However, a few students are now pursuing the program degree.

c. Institutional Standard for Certificate Completion Number (Transcriptable): 325

Has the number of students completing certificates in your program held steady, or increased/declines in the last three years? Please comment on the data, analyze the trends, including any differences in completion rates by student demographics.

Does not apply to Physics or Engineering.

In Nano, the first cohort of students was eager to complete the degree, and we now have 4-6 students who have expressed interest in attending one or more additional courses.

d. Institutional Standard for Transfer to four-year colleges/universities: 775

Based on the transfer data provided, what role does your program play in the overall transfer rates? Please comment on any notable trends or data elements related to your program's role in transfer.

This is hard for us to track, but based upon anecdotal evidence, nearly 100% of Physics 4D students go on to transfer, and higher-level engineering classes (37, 45) are the same. Many do not take local degrees as they wish to go into engineering at four year colleges, and the CC/CSU/UC pathways don't align well with local degrees at community colleges in general.

The Nanoscience program doesn't impact the transfer rate one way or the other, however we are starting to see a larger number of younger (18-20) students in the program. We have had two students transfer to SJSU and continue in engineering.

Section 3: Core Mission and Support

Please address all prompts that apply to your program.

Basic Skills Programs (English, ESLL and Math): For more information about the Core Mission of Basic Skills, see the Basic Skills Workgroup website: http://foothill.edu/president/basicskills.php

a. **Please comment on progression in sequenced courses, including ladder programs, alternative pathways and supplemental instruction. How successfully do students progress through the course sequence or pathways?**

None of the physics/engineering/nano programs are basic skills, and outside of serving as a goal for successful basic skills students, it is unclear how we support this population.

b. **Based on your analysis of student success in these pathways, what initiatives or strategies are being considered to increase student success?**

Physics/Engr/Nano: N/A

Transfer Programs: For more information about the Core Mission of Transfer, see the Transfer Workgroup website: http://foothill.edu/president/transfer.php

c. **Please analyze and discuss the available Transfer data regarding your programs, and discuss strategies or initiatives to improve transfer rates.**

No available transfer data.

d. Please analyze and discuss Articulation data regarding this program.

In Physics our courses are articulated to the UC schools and we have an AD-T degree for CSUs.

In Engineering we are working on getting our new courses articulated properly, and have had great success so far.

We articulate with UCSC in some NANO courses but that doesn't appear to have impacted enrollment, probably because most students aren't interested in transferring the program to a four-year school, and instead are interested in completing certificates.

Workforce Programs: For more information about the Core Mission of Workforce, see the Workforce Workgroup website: http://www.foothill.edu/president/workforce.php

e. Discuss how this program continues to meet a documented labor market demand?

Phys/Engr: N/A

Nano: There is a need for people employed in materials engineering to understand material structures, fabrication and characterization. Most employed professionals have advanced degrees and significant OJT experience, however some employed and transitional professionals have sought and benefitted from advance studies, especially the hands-on microscopy training that we offer through partner UCSC (NAS-ASL).

f. Analyze your program in relation to other programs in our region, defined as San Mateo and Santa Clara counties.

Phys/Engr: N/A

Nano: There are a handful of single course offerings in advanced training in microscopy (AFM/SEM) and materials characterization tools. These courses are targeted toward working professionals and more mature students in engineering degree programs.

g. Discuss any job placement and/or salary data available for your students after graduation.

Phys/Engr: N/A

Nano: We placed two students (out of about a dozen) into materials engineering and characterization profession. One was an MS student, and the other completing an AS degree. A third student (PhD candidate) will likely achieve an internship this year.

h. Please analyze and comment on average salary/wage data in the region, defined as San Mateo and Santa Clara counties.

i.

Phys/Engr: N/A

Nano: Technicians earn $60K to $80K starting salary, and professionals from $80K to $100K

j. Program accreditation: If applicable, please describe your program accreditation: the agency, the frequency of the process and the current status of the program by the accrediting body.

N/A

k. Service to the community: Please describe community service, outreach and special projects or initiatives that the program provides.

Nano: The program offers Saturday microscopy sessions for the community, attended by students and people on our STEM mailing list. We also have conducted tours of local industry where we invited students across the STEM/engineering mailing list. We offer training on advanced instruments at NASA-ASL, a very novel program offering.

l. Outcomes assessments: If applicable, please describe additional means of outcomes assessment for the program, such as graduate surveys, alumni surveys, employer surveys, national and state licensing board exams, etc.

Nano: We have an industry advisory board and I also speak with colleagues in industry about the work they are doing, the skills they need, and if our program would provide value. I also stay in touch with each and every student place into a job as long as I can.

m. Please attach minutes from your advisory board meeting(s) and discuss key issues, outcomes and action plans as a result of these meetings.

- Course content review
- Instrument review
- Topic review
- Skills review

Section 4: Learning Outcomes Assessment Summary

a. **Attach 2013-2014 Course-Level** – Four Column Report for CL-SLO Assessment from TracDat, please contact the Office of Instruction to assist you with this step if needed.

See attached

b. **Attach 2013-2014 Program Level** – Four Column Report for PL-SLO Assessment from TracDat, please contact the Office of Instruction to assist you with this step if needed.

Section 5: SLO Assessment and Reflection

Based on your assessment data and reflections, please respond to the following prompts:

a. **What curricular, pedagogical or other changes have you made as a result of your CL-SLO assessments?**

In physics, the strong gains shown in industry-standard exams give us confidence to embrace peer-instruction over lecture. In discussions of results, we've also explored better ways to flip classrooms.

In engineering, the SLO data has informed the structure of newly created courses. Because of the development of the SLOs before the new courses were developed, the course learning methods were guided by the SLOs. This has led to a strong foundation based on learning outcomes.

We realized that our foundational nanoscience course (NANO10) needed to have a much higher fraction of experiential learning. As a result we have spent the last 6 months, and will spend the next 6 months, working on laboratory exercises and demonstrations to accompany a stronger nanoscience and nanotechnology curriculum.

b. **How do the objectives and outcomes in your courses relate to the program-level student learning outcomes and to the college mission?**

The course-level SLOs for both physics and engineering build the skills we want to see in the long run. Students learn how to solve "real world" problems by applying physics concepts and apply proper mathematical reasoning to reach solutions. Students develop strong verbal skills to explain these issues to their fellow students. Through labs they both discover and explore the proper design of experiments, and sound approaches to error analysis, both needed for future careers in science or engineering. Finally, by producing lab reports they become effective written communicators. Our course-level SLOs push towards these program level outcomes. These skills serve our transfer students well in preparation for both four-year institutions and their future careers.

Nano: Our survey course is vocabulary and topic driven, the nanostructures course covers all important nanostructures, nanocharacterization is scenario based (industry focused) and the fabrication course is based on tools, materials, and industries, so it is designed for workforce, and to provide opportunities for students to learn about the field.

c. How has assessment of program-level student learning outcomes led to certificate/degree program improvements? Have you made any changes to your program based on the findings?

Both Physics and Engineering are constrained by C-ID and other articulation agreements, so large structural changes in our programs are not possible. That being said, a better eye is being kept on error analysis in lab classes earlier in the sequence.

The engineering certificate programs are being offered for the first time during the 2014-2015 academic year. After they are offered and SLO data is collected, we will be able to make assessments as to how to improve the programs.

Nano: The top level program goals are to prepare working technicians and professionals to do advanced materials engineering, either as assistants to experiments, operating instruments and tools (characterization and fabrication) or working in a related professional job (sales and marketing, etc). The PNPA-rubric, which funded the development of the program, is still embedded in the fabric of the NANO program.

d. If your program has other outcomes assessments at the program level, comment on the findings.

None for Physics/Engineering.

We do and we don't. We've been unsuccessful in getting a capstone program reapproved (NANO61) and now we just have 1, 2, and 3 unit independent study for students working as interns at NASA-ASL. This question is getting me to think about a capstone evaluation for students that apply for the certificate of achievement.

e. What do faculty in your program do to ensure that meaningful dialogue takes place in both shaping and evaluating/assessing your program's student learning outcomes?

The physics/engineering fulltime faculty enjoy weekly meetings (when allowed around conflicting schedules). We are a small cohesive group that collaborates well. We also took a half-day retreat last spring that was very beneficial. Additionally, in the engineering department, part-time faculty have actively participated in the SLO process.

An adjunct faculty member with a UCLA Ph.D. assisted in developing NANO 10 taught at Palo Alto HS, and has come to understand our nanoscience program over the last 6 months. We will be working with an NSF funded project (Nano-Link) for 6 months to perfect our design of curriculum and educational instruments.

f. Reviewing your most recent annual program reviews, discuss any emerging trends related to SLO reflections and any action taken.

Physics: While we are still above national norms, the gains we see in our introductory classes have dropped from several years ago. This tracks larger class sizes. There have been preliminary discussion about capping the introductory classes (2A, 4A) at one lab per lecture rather than allowing doubles, but these ideas are still embryonic. Labs continue to be upgraded. This year we are starting to look at equity issues in our SLO assessments.

Engr: In engineering, the trends indicate that we are in the process of refining our SLOs to be more specific and in greater alignment with our departmental goals. As the SLOs become more refined, the results will become more useful in determining program directions.

Nano: We have a continuing concern that we have two populations of students, one with bachelor's degrees in science that access nanoscience courses through a community college, and students that are at the beginning of their education in science and technology. Students with advanced degrees can handle the assignments with work, but are never 'strained'. Younger students have to work much harder to complete assignments, and do much better if they have completed math and physics.

g. What summative findings can be gathered from the Program Level Assessments?

In Physics, students who complete the Physics 4 sequence are well prepared for success in future science and engineering endeavors. They can solve problems, write at the required level and are at home in lab.

As the engineering program offerings are expanding rapidly, more time and additional assessment feedback is needed before summative conclusions can be drawn.

In Nano, a capstone course is sorely needed to give students practical lab experience in the field. While internships are always difficult to negotiate and manage, we do have the ability to train students at NASA-ASL (Advance Studies Lab) in the use of microscopy and thin film deposition and characterization. However, this would (will) take a significant increase in time (footprint) spent at NASA-ASL by Robert Cormia, which he is willing to do.

Annual Action Plan and Summary: Using the information above, list the program's action steps, the related Core Mission objective, SLO assessment data and the expected impact on student success.

Action Step	Related SLO assessment (Note applicable data)	Related ESMP Core Mission Goals (Basic Skills, Transfer, Work Force, Stewardship of Resources)	How will this action improve student learning/success?
1 Group presentations	Nanostructures	Workforce	Peer learning
2 Hands on tools	Nanofabrication	Workforce	Hands on experience
3 Spectroscopy SLO	Nanocharacterization	Workforce	Data analysis
4. Lab Improvements	Each Physics Class Has a Lab SLO	Transfer	Continue to upgrade our labs.
5. SLO Equity Data Mining	Across all Phys/Eng SLOs	Transfer	Examine where we are doing well and where we need to improve in terms of equity, our assessments are data-rich, but only now do we have the tools to drill down.

Section 6: Program Goals and Rationale

Program goals address broad issues and concerns that incorporate some sort of measurable action and connect to Foothill's core missions, Educational & Strategic Master Plan (ESMP), the division plan, and SLOs. Goals/Outcomes are not resource requests.

List Previous Program Goals/Outcomes from last academic year: check the appropriate status box & provide explanation in the comment box.

Goal/Outcome (This is NOT a resource request)	Completed? (Y/N)	In Progress? (Y/N)	Comment on Status
1. Introduction of Physics 5 Sequence	N	N	We attempted to offer these classes for two years, it never gained traction, despite the best efforts of department + counseling faculty. The addition of one more quarter made this unattractive to students. We are now focused on recasting Physics 6 as an onramp.

2. Updating and Broadening Existing Engineering Courses	Class Dependent	Y	Biomedical sequence has been introduced and is doing well. The rapid prototyping sequence now being offered. Dynamics is being offered this year for the first time. Matlab class is being developed.
3. Improving technology use in peer-instruction classes.	N	Y	Some faculty in the department are continuing their use of tablets in the classroom. By using recording software, much of the peer-interaction material is available for future study by the student, which addresses one of the big drawbacks of peer-interaction. Instructors should continue to get technical support from the institution.
4. Lab support	No	Yes	This is a permanent ongoing activity of the department. We should always be striving to improve our labs. Each year we attempt to replace or improve our bottom two labs.
5. Develop a sustainable cohort model in nanoscience.	No	Yes	A greater number of students need to be cultivated in order to develop a cohort. Nano classes at Gunn and Palo High Schools may be a potential source of students.
6. Learn new pedagogy directed at retention of women students (and retention in general).	N	Y	Engineering is investigating the results in changes in Eng 10 pedagogy. We plan on presenting a paper at ASEE annual

			conference. We did not get funding for this last year, and did not bring in outside help.
7. Community building for Eng/Physics Students	N	Y	We had a very successful STEM day event prior to opening day. The STEM newsletter has a circulation of 1200. The engineering speaker series and the lunch speaker series are successful. The Science and Engineering Association has been very active.
8. Workforce track for NANO	No	Yes	Additional employers need to be identified.

New Goals: Goals can be multi-year (in Section 7 you will detail resources needed)

Goal/Outcome (This is NOT a resource request)	**Timeline (long/short-term)**	**How will this goal improve student success or respond to other key college initiatives?**	**How will progress toward this goal be measured?**
1. None			Physics/Engineering is a very active department, and cannot commit to new goals beyond those already stated.

Section 7: Program Resources and Support

Using the tables below, summarize your program's unfunded resource requests. Refer to the Operations Planning Committee website: http://foothill.edu/president/operations.php for current guiding principles, rubrics and resource allocation information.

Full Time Faculty and/or Staff Positions

Position	$ Amount	Related Goal from Table in section 6 and how this resource request supports this goal.	Was position previously approved in last 3 years? (y/n)
Physics requests a new FT hire	1 FTE ($100K); salary + benefits	When all of the FT faculty are present, they have taught roughly 40% of the Physics load in the recent past. Only faculty willingness to teach overload is keeping the number above 40% With continued growth in both physics and engineering, this number will continue to drop. While a new faculty position is needed in its own right, this problem becomes amplified when a faculty member takes PDL. Physics/Engineering has a combined size of 4 FT faculty, and all take PDL in order to improve our skills and our program. In the lab sciences it is very difficult to do major development/modifications to the curricula outside of the PDL structure. FT faculty are on PDL 4 out of every 7 years, and when this happens the department becomes even more stretched. In previous years this could be addressed by moving FT from Engineering load to Physics load, but with the rapid growth of Engineering this will not be an option. In 2015-16 a Physics/Eng instructor will go on PDL. The percentage of load taught by FT will drop to below 30% Given the recent/current state of the PT pool, FT physics instructors will do additional overload, curtailing their outside-the-classroom	N

		activities. Even with that we anticipate that we will have to cut sections even though student demand will exist. In our 2013-14 program review our Dean suggested that the department pursue a FT hire. Cascarano and Marasco were hired in 2004. Parikh was hired in 2011, but will have 100% Engineering load in future terms.	

Unbudgeted Reassigned Time (calculate by % reassign time x salary/benefits of FT)

Has the program received college funding for reassign time in the last three years? (y/n) No	**If yes, indicate percent of time.**
Has the program used division or department B-budget to fund reassign time? (y/n) No	

Indicate duties covered by requested reassign time:

Responsibility	**Estimated $**	**Related Goal from Table in section 6 and how this resource request supports this goal.**	**Est hours per month**	**% Time**

One Time B Budget Augmentation

Description	**$ Amount**	**Related Goal from Table in section 6 and how this resource request supports this goal.**	**Previously funded in last 3 years? (y/n)**
Training concerning recruitment and retention of women in Physical Sciences and Engineering	$3000	6	No

Ongoing B Budget Augmentation

Description	**$ Amount**	**Related Goal from Table in section 6 and how this resource request supports this goal.**	**Previously funded in last 3 years? (y/n)**
Funds for community building activities/events/orientation	$4000	Many students in the engineering cohort feel separate from STEM as a	N

		whole. We wish to change this outlook and improve retention/enrollment	

Facilities and Equipment

Facilities/Equipment Description	$ Amount	Related Goal from Table in section 6 and how this resource request supports this goal.	Previously funded in last 3 years? (y/n)
Purchase/maintenance of equipment for physics labs	$30k	#4 Financial support of science teaching laboratories needs to be ongoing. We strive to improve/replace our bottom two labs each year. At fifteen stations per lab, and an estimated $1k per station, this is $30k.	Department has received budgetary support for purchase of new equipment.
Money for Part-Timer SLOs and Additional Participation		**Updating and Broadening Existing Engineering Courses** Given the diverse range of classes that are only taught by PT in the Engineering department, funds must be available for their participation in the SLO process and other departmental matters.	No.

a. Please review the goals and resource requests that were granted over the last three years and provide evidence that the resource allocations supported your goals and led to student success.

1. Physics Lab budget
   The Physics Department has over the years constantly upgraded the level of the experiments in its labs. This works along two dimensions, in one case new experiments are investigated and purchased, and along another additional class sets are purchased so that multiple sections can be run concurrently. This latter aspect has allowed for greater flexibility in scheduling. The freedom to try new experiments has allowed the department to go in new pedagogical directions, including more discovery labs in the E&M classes, more mathematical modeling in the calculus-based mechanics labs, and an integrated conceptual approach in the algebra/trig mechanics labs. The "modern physics" labs have seen improvement through incremental purchases of expensive equipment. As opposed to many other physics programs, our labs are not stale, and are being constantly upgraded.

2. Engineering Equipment + Materials
   The Engineering Department has used new equipment and materials in the new course that have been offered in addition to incorporating the new equipment and materials into existing courses, updating them to be more relevant. The new equipment, including the 3D printers, is essential to our new programs including the Rapid Prototyping program and the Biomedical Engineering Program. Students are gaining hands-on experience with up-to-date equipment in order to make them more marketable in the workforce.

3. USB Scantron
   The purchase of a USB Scantron machine did not come from general college funds, but instead was financed through PSME's B Budget. This machine allows for in-depth data mining, and we are very excited about using it to look deeper in our SLO assessments, especially in terms of equity issues. We can now examine how different populations perform on each and every question we ask in our pre and post tests.

4. Prior tablets
   Physics was an early adopter for using tablets in the classroom. These work well with our peer-instruction model, allowing two main actions. First, we can flip the classroom, pushing lecture online, secondly we can record the results of the day's discussions for future viewing. Both help students accept the deviation from the talking-head lecture model. Currently the full-timers use three tablets, one provided through PSME, one purchased with Physics Show funds, and one bought by the faculty member. It is our belief that these are instructional tools and should be bought by the school.

Section 8: Program Review Summary

Address the concerns or recommendations that were made in prior program review cycles, including any feedback from Dean/VP, Program Review Committee, etc.

Recommendation	Comments
1. New FT Faculty	Physics is requesting a new FTE. See comments above.
2. Retirement of Physics 5	After several false starts, Physics 5 has been removed. See prior comments.
3. Recruitment of PT faculty	This continues to be an issue. Physics lost two strong PT to FT hires elsewhere, and is well aware of this problem. Larger society problems are also coming into play, as local living expenses combined with the strong demand for STEM-trained people in higher-paying fields have restricted the number of applicants in the pool. The addition of a new FT hire would reduce the number of sections offered to PT, helping to alleviate this problem. Engineering continues to interview PT faculty.

a. After reviewing the data, what would you like to highlight about your program?

The Physics and Engineering departments feature strong front-line instruction. This is supported both anecdotally by stories from students returning from four-year institutions and pre and post-testing for SLO assessments. We continue to be at the forefront of pedagogy, have flipped many of our classrooms, and most faculty have a strong commitment to learning the latest in education research (for example, attendance at ASEE, NSF's ISIP workshop, CAPER, SETI, and AAPT conferences within the past two years).

The core of the departments is very collegial and we meet on a weekly basis to discuss instruction, curriculum and other departmental matters. We are agile, aggressive and work well together.

The biomedical sequence has seen a strong start and has the potential to be a flagship offering.

We have several signature events. The Physics Show has grown by leaps and bounds, and we expect to serve about 20,000 people this academic year, including roughly 3,200 students from local Title 1 schools. We have a self-funding model that enables us to bring these children to Foothill's campus, give them a show and tour, and even a free t-shirt. We believe this is the largest single-institution annual science outreach event on the West Coast. STEM Summer Camps are increasing in classes offered, students served, and donations from the community. They bring young underserved students from the local area to our campus at no cost to them.

Our department of four FT faculty also leads the following efforts. The STEM newsletter now has a subscription base of 1200 and informs our students of opportunities on our campus and beyond. We have an active Science and Engineering Club. We have STEM Day in the Fall, and the Physics Olympics in the Spring. This year we are offering leadership lunches that bring together our students with leaders from the local STEM professional community. We offer the F=ma contest for local Physics high school students (last year on of these students was selected for the US Physics Team and won a gold medal in international competition). The department also took the lead on the American Mathematics Association of Two Year Colleges' annual contest. We offer a departmental scholarship program that will award $2000 this year. In addition, we take leadership in the local (statewide) professional association for our field (which includes organizing and running two conferences a year), do outreach for NASA, and work towards better campus safety via improved door locking systems.

In addition, department faculty serve on a number of shared governance committees, including Academic Senate, BEST, Travel & Conferences, and faculty chair of the Scholarships and Elections committees. This is on top of both hiring and tenure committees.

Finally, Frank Cascarano was nominated to be a Fellow of the AAPT this year. If awarded, this is the highest professional recognition for a physics instructor.

Section 9: Feedback and Follow Up

This section is for the Dean to provide feedback.

a. Strengths and successes of the program as evidenced by the data and analysis:

The Physics, Engineering and Nanotechnology faculty are an extremely dedicated group of individuals who commit an extraordinary amount of energy to improve the department, curriculum, College and community. The following evidences this:

1. Physics and Engineering courses have strong growth trends in enrollment and productivity, and Nano enrollment has the potential to increase with courses being offered at local high schools in 2014-2015 AY.
2. Curriculum is regularly reviewed and improved, especially laboratory experiments.
3. All faculty attend professional conferences frequently and employ new pedagogical methods in the classroom and lab.
4. The expansion of engineering course offerings has greatly increased enrollment as well as interest from students from other local colleges and universities.
5. The Physics Show attracts over 20,000 students annually, helping advertise Foothill College but more importantly expose students to STEM majors.
6. The faculty are extremely cohesive, collegial and focused on student success, with FT faculty providing extensive support to adjunct faculty.
7. Faculty serve on numerous College committees, requiring dedication and a large time commitment.

b. Areas of concern, if any:

The following are areas of concern:

1. FT faculty taught only 34% of physics courses last year. With continued growth in Engineering, current split Engineering/Physics faculty will be devoted to that department's growth leaving only 2 FT faculty members in Physics, dropping the percentage even lower. Loss of FT faculty to PDL will drastically affect consistency in Physics department courses.
2. Financial support to purchase equipment for the expansion and improvement of engineering course offerings.
3. Funding to support implementation of new/enhanced physics experiments.
4. Although success rates are high for all three departments, being able to increase the success rates of targeted groups is of concern.

5. Resources to support faculty in developing new curriculum or ideas to increase recruitment and retention of women in STEM, targeted groups, and outreach to the community.
6. Support of adjunct faculty, who teach a majority of the classes, to maintain consistency in teaching standards and assist in their development.

c. Recommendations for improvement:

Areas identified above can be addressed in the following manner:

1. A new FT faculty to be allocated to the Physics Department (not joint with Engineering).
2. Increase of B-Budget funding to purchase additional equipment required for engineering courses.
3. Increase of B-Budget funding to permit faculty the flexibility of implementing new experiments and techniques in physics lab sections.
4. Funding for support services or development of a cohort model that specifically targets underperforming student populations.
5. Funding to support conferences and professional development of faculty to address the lower success rates of targeted groups and lower participation rate of women. The faculty have a strong record of being involved in conferences and organizations that advance these goals. Potentially, Foothill can host these forums to demonstrate our commitment to these initiatives.
6. Funding to support adjunct faculty to become involved in the SLO process, as

This section is for the Vice President/President to provide feedback.

d. Strengths and successes of the program as evidenced by the data and analysis:

As this program review clearly illustrates, this department has many strengths, including an innovative and dedicated faculty who not only keep current in their disciplines and regularly update the curriculum, but who also provide service to the college and the external community. The annual Physics show, the collaboration with local high schools by offering Nano courses on their campuses, and the growth in Engineering are just a few examples.

e. Areas of concern, if any:

f. Recommendations for improvement:

g. Recommended Next steps:

___ Proceed as planned on program review schedule
___ Further review/Out of cycle in-depth review

Upon completion of section 9, the Program Review should be returned to department faculty and staff for review, then submitted to the Office of Instruction and Institutional Research for public posting. See timeline on Program Review Cover Sheet.

Unit Assessment Report - Four Column

Foothill College

Program (PSME - ENGR) - Engineering AS

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Program (PSME - ENGR) - Engineering AS - 1 - Formulate logical problem solving approaches, generate solutions, and assess the reasonableness of the solutions for engineering type analysis problems. **SLO Status:** Active	**Assessment Method:** In class Brainstorming and House of Quality activities assessed during Engr 10. Engr 10 is offered every quarter, and will be assessed annually. For 2011-2012, it will be assessed in Winter 2012. **Assessment Method Type:** Class/Lab Project **Target:** 70% of the Engineering 10 class will complete the assignment with a B or better.		
Program (PSME - ENGR) - Engineering AS - 2 - Design, construct, and produce creative solutions to engineering problems by applying the engineering design process and identifying pertinent design parameters based on the fundamental physics governing a system. **SLO Status:** Active	**Assessment Method:** Large engineering design project in Engineering 10. Engr 10 is offered every quarter, and will be assessed annually. For 2011-2012, it will be assessed in Winter 2012. **Assessment Method Type:** Class/Lab Project **Target:** 80% of the class will get a B or better on the grades associated with the final report, presentation, and demo.		
Program (PSME - ENGR) - Engineering AS - 3 - Demonstrated understanding of the fundamental knowledge necessary for the practice of, or for advanced study in, engineering, including scientific principles, rigorous analysis, and problem solving. **SLO Status:** Active	**Assessment Method:** In class exam score. 20111-2012 Winter for Static class, E35 **Assessment Method Type:** Exam - Course Test/Quiz **Target:** 75% of the students earning a C or higher.		
Program (PSME - ENGR) - Engineering AS - 4 - Demonstrated clear communication			

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
skills, responsible teamwork, professional attitudes and ethics. **SLO Status:** Active	**Assessment Method:** Final presentations assessed during Engr 10. Engr 10 is offered every quarter, and will be assessed annually. For 2011-2012, it will be assessed in Winter 2012. **Assessment Method Type:** Presentation/Performance **Target:** 70% of students giving the final presentations earn a B or higher on the presentation portion of the final project.		
	Assessment Method: Survey of peer evaluation on teamwork assessed during Engr 10. Engr 10 is offered every quarter, and will be assessed annually. For 2011-2012, it will be assessed in Winter 2012. **Assessment Method Type:** Survey **Target:** 70% of students rated as "Satisfactory" or above.		
Program (PSME - ENGR) - Engineering AS - 5 - Demonstrated a preparation for the complex work environment and continuous learning. **SLO Status:** Inactive			

Unit Assessment Report - Four Column

Foothill College

Program (PSME - PHYS) - Physics AS

Primary Core Mission: Transfer

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Program (PSME - PHYS) - Physics AS - Problem Solving - Upon completion of the AS degree, students will demonstrate the ability to apply the laws of physics to word problems, properly manipulating basic mathematical formulae to arrive at the correct answers. **SLO Status:** Active	**Assessment Method:** Problems on the midterm(s) and final exam will be examined to verify that the students are properly solving physics problems. This assessment will be performed in Physics 4D. **Assessment Method Type:** Exam - Course Test/Quiz **Target:** 90% of students should meet a level satisfactory to the examiner.	06/27/2014 - Students are more than capable of solving word problems the proper use of mathematics applied to physics. The department is doing a strong job preparing students for future efforts in math, the sciences, and engineering. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** See Course-Level Resource Requests **Resource Request:** See Course-Level Resource Requests **Resource Request:** See Course-Level Resource Requests **Resource Request:** See Course-Level Resource Requests	
Program (PSME - PHYS) - Physics AS - Communication of Scientific Results - Upon completion of the AS degree, students will demonstrate the ability to effectively communicate physics by crafting written lab reports and/or giving oral presentations. **SLO Status:** Active	**Assessment Method:** In the case of written communication, student lab reports will be evaluated against a rubric. For oral presentations, students shall deliver a mini-lecture to the class. This assessment will be performed in Physics 4D. **Assessment Method Type:** Portfolio Review **Target:** 90% of students should show mastery.	06/27/2014 - Students as a whole showed mastery in communication, with some wide disparities on both the high and low ends. It would be helpful if there were more resources available for international students, and native English speakers who struggle with their communication skills. We should explore resources for students who struggle with English. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** See Course-Level Resource Requests	06/27/2014 - This year I cancelled lab during week three, and instead gave each lab group focused personal time aimed at improving the quality of their scientific writing. This gave rise to a large jump in quality, and this practice should be repeated every year. We need to explore resources for students who have English-related problems that go beyond the scope of instruction that can be provided by the physics department.

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Program (PSME - PHYS) - Physics AS - Lab Skills - Upon completion of the AS degree, students will demonstrate mastery of lower-level lab skills such as proper use of standard lab equipment and proper application of data analysis. **SLO Status:** Active	**Assessment Method:** Students will be observed in lab by the instructor for use of lab equipment, lab reports will be examined for mastery of data analysis. This assessment will be performed in Physics 4D. **Assessment Method Type:** Class/Lab Project **Target:** 90% of students should demonstrate mastery.	06/27/2014 - The students demonstrated mastery of the operation of lab equipment. Upon entry to Physics 4D there was a large disparity in skills surrounding data analysis. While this was addressed successfully in 4D, this wide range of prior preparation is an ongoing problem. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** See Course-Level Resource Requests. **Resource Request:** See Course-Level Resource Requests. **Resource Request:** See Course-Level Resource Requests. **Resource Request:** See Course-Level Resource Requests.	06/27/2014 - Faculty need to stress the importance of data analysis in earlier coursework. Perhaps this could also be addressed in Physics 6?

Unit Course Assessment Report - Four Column

Foothill College

Department - Physics (PHYS)

Mission Statement: The mission of the Physics department is to provide undergraduate education founded on a rigorous, applied treatment of physics? fundamentals coupled with experiential experiences and a broad commitment to generate and disseminate knowledge.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Physics (PHYS) - PHYS 12 - INTRODUCTION TO MODERN PHYSICS - Reflecting on Physics 12 - 1. Students will understand their objectives for taking this course 2. Students will, when the course is over, reflect on how well the course met their objectives (Created By Department - Physics (PHYS)) **Start Date:** 12/01/2010 **End Date:** 06/30/2011 **Course-Level SLO Status:** Active	**Assessment Method:** Students received a survey on the first day of the class and then received another survey (based on the first) on the last day of the class. Students were asked to reflect on their objectives and how well the course met them. **Assessment Method Type:** Survey **Target for Success:** The majority of students in the class report that the class met the objectives which they had set.		
Department - Physics (PHYS) - PHYS 12 - INTRODUCTION TO MODERN PHYSICS - Understanding Relativity - Students will demonstrate an understanding of how Einstein's theories of relativity changed our understanding (through measurables) of space, time, and mass. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Exam questions on both the quizzes and exams in Physics 12 will probe students' understanding of the ideas of relativity and ask students to apply this understanding to new situations. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Students should be able to answer a majority of these questions successfully (keeping in mind, however, that these are tricky concepts, and even the best students may not get all questions right.)		
Department - Physics (PHYS) - PHYS 2A - GENERAL PHYSICS - Kinematics, Newton's Laws, Energy, and Momentum - Students	**Assessment Method:** Students will be pre and post-tested with the Mechanics Baseline Test, a standardized	10/02/2014 - We were not able to administer the MBT, instead we compared some questions that were similar from this year's final and one from	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
should be able to solve problems involving Kinematics, Newton's Laws, Energy, and Momentum, and know when to use which concept. (Created By Department - Physics (PHYS))	test from the Physics Education Reseach community. **Assessment Method Type:** Exam - Standardized **Target for Success:** The class should show an improvement of 0.2 as measured by a normalized gain. This is the national average for physics courses.	Fall 2012. 1st) Rotational inertia / angular momentum Fall '12 = 58% Spring '14 = 69% 2nd) projectile motion Fall '12: 82% Spring '14: 67% The drop in performance in the projectile motion problem reflects that the instructor was using a new method of instruction based upon Physics Education Research. This was the first quarter this was implemented, and there were struggles. That being said, the department has a strong belief in cutting-edge research-based instructional models, and needs both financial and structural support to continue to develop as instructors. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** College should continue to fund travel for workshops at the current level.	
Department - Physics (PHYS) - PHYS 2A - GENERAL PHYSICS - Lab Experiments - Via lab experiments, students will have an understanding of the background science, error analysis, and how to perform experiments. (Created By Department - Physics (PHYS))	**Assessment Method:** Instructors will examine an experiment with an eye towards major revision. **Assessment Method Type:** Departmental Questions **Target for Success:** Instructors should be satisfied that implementation of lab revision will lead to improved student understanding in lab. These improvements should also reflect current best practices in pedagogy.	06/27/2014 - The Full-Timer continued to work with the RealTime Physics Active Lab program, and this is also being test-driven by a pair of PT. While it is still under development, it promises a strong alternative to watered-down 4A labs. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** A general parts fund should be in place to repair-and-replace sensors and instruments for this lab.	06/27/2014 - The Full-Timer should continue to work on these new labs, and bring them to full maturity.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Physics (PHYS) - PHYS 2AM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Derivatives in Mechanics - The student will be able to apply derivatives to problems in kinematics, dynamics, energy, momentum and related topics (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Roughly half of the problems on the final exam should involve taking derivatives to solve physics problems. Instructor will examine results. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% Success rate on these problems.	06/27/2014 - Students performed well on the final, displaying a mastery of the required skill. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	06/27/2014 - Instructor should continue to develop online problems.
Department - Physics (PHYS) - PHYS 2AM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Integrals in Mechanics - The student will be able to apply integrals to problems in kinematics, dynamics, energy, momentum and related topics. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Roughly half of the problems on the final exam should involve taking integrals to solve physics problems. Instructor will examine results. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% success on the integral problems.	06/27/2014 - Students satisfied instructor expectations on the final exam. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2AM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Simple Second-order Differential Equations - The student will be able to solve introductory second-order differential equations. (Created By Department - Physics (PHYS))			
Department - Physics (PHYS) - PHYS 2B - GENERAL PHYSICS - Concepts in E&M - Students should be able to solve problems involving the relationships between charges, forces and fields for both electricity and magnetism, the concept of voltage, and simple circuits. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:**	**Assessment Method:** Students will be pre- and post-tested using a standardized exam. **Assessment Method Type:** Exam - Standardized **Target for Success:** The class should show an improvement of 0.2 as measured by a normalized gain. This is the national average for physics courses.		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Active			
Department - Physics (PHYS) - PHYS 2B - GENERAL PHYSICS - Thermodynamics - Students should understand the following concepts from Thermodynamics: 1. Distinctions between temperature, heat and energy. 2. PV diagrams 3. First and Second Laws of Thermodynamics (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Students will be pre- and post-tested with a standardized exam. **Target for Success:** The class should show an improvement of 0.2 as measured by a normalized gain. This is the national average for physics courses.		
Department - Physics (PHYS) - PHYS 2B - GENERAL PHYSICS - Lab Experiments - Lab experiments should teach students the background science, error analysis, and how to perform experiments. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Either via examination of lab books or in class observation, instructors should evaluate labs for improvement. **Assessment Method Type:** Essay/Journal	09/16/2014 - We decided that the Ohm's Law lab took too much time as currently devised, and would be better presented over a two-week period. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** This can be implemented with our current materials, however, physics should have an equipment budget that is more responsive than the SLO cycle, as new labs should be implemented on a shorter timescale than the current funding model.	09/16/2014 - We should spread this out over two weeks, with the first week consisting of a discovery lab to determine parallel and series circuits, and the second to look at internal resistances and deviations from Ohm's Law.
Department - Physics (PHYS) - PHYS 2BM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Electric Fields via Calculus - The student will be able to apply the methods of calculus to calculate electric fields and potentials from charge distributions. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:**	**Assessment Method:** Instructor will have a question on the final exam to probe students' knowledge of the topic. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% of students should make significant progress on this exam problem.	06/27/2014 - Students were able to solve these problems. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Active			
Department - Physics (PHYS) - PHYS 2BM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Gauss's Law and Ampere's Law - The student will be able to apply the methods of calculus to calculate electric and magnetic fields for the appropriate symmetric distributions. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Instructor will have one or more questions on the final exam to probe students' knowledge of the topic. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** At least 80% of students should make significant progress on this problem.	06/27/2014 - Students struggled with this. Although they were able to solve the problems when they recognized the underlying concepts, some failed to see though the word problems. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2BM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Faraday's Law and Corrected Ampere's Law - The student will be able to apply the methods of calculus to solve for the electric/magnetic fields generated from changing electric/magnetic fields. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Instructor will have one or more questions on the final exam to probe students' knowledge of the topic. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** At least 80% of students should make significant progress on the problem(s).	06/27/2014 - Most students were capable of solving Faraday's Law problems. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2BM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Time Behavior of RC, LR, RL and LRC circuits - The student will be able to apply the methods of calculus to solve problems in circuits with time-varying behavior. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Instructor will have a question on the final exam to probe students' knowledge of the topic. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** At least 80% of students should make significant progress on this problem.		
Department - Physics (PHYS) - PHYS 2C - GENERAL PHYSICS - Waves - Students should demonstrate competence in waves, including: Sound	**Assessment Method:** A standardized exam will be used. **Assessment Method Type:** Exam - Standardized	07/01/2014 - The students had a normalized Hake gain of 0.29, which is better than the national average of 0.2. As 2C students they are high quality, having passed 2A and 2B. **Result:**	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
E&M Waves Interference (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active		Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2C - GENERAL PHYSICS - Optics - Students should demonstrate competence in optics, including: Relection Refraction Lenses Mirrors (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** A standardized exam will be used. **Assessment Method Type:** Exam - Course Test/Quiz	07/01/2014 - The students had a normalized Hake gain of 0.29, which is better than the national average of 0.2. As 2C students they are high quality, having passed 2A and 2B. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2C - GENERAL PHYSICS - Modern Physics - Students should demonstrate competence in Modern Physics, including Special Relativity Wave Nature of Quantum Physics (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** A standardized exam will be used. **Assessment Method Type:** Exam - Course Test/Quiz	07/01/2014 - The students had a normalized Hake gain of 0.29, which is better than the national average of 0.2. As 2C students they are high quality, having passed 2A and 2B. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	09/16/2014 - While we are seeing good student success in 2C, as a program, 2C has only been offered at night in recent memory. As a department we've seen growth mainly in the 2 sequence, and would like to establish a daytime 2C class. We need to translate our success in the 2C classroom to daytime students.
Department - Physics (PHYS) - PHYS 2C - GENERAL PHYSICS - Lab Experiments - Labs experiments should teach the students the background science, error analysis and how to perform experiments. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Either by review of lab reports, in-class observation, or independent study, instructors should evaluate the lab experiments on an ongoing basis. **Assessment Method Type:** Essay/Journal	07/01/2014 - Going back to the radioactivity lab, although the students learned what they needed to, there were big difficulties due to the shortage of recent Po-210 sources, we should buy more annually. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	09/16/2014 - Additional purchase of Po samples.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		Resource Request: More Po-210 sources should be purchased each year.	
Department - Physics (PHYS) - PHYS 2CM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Optics - The student will be able to interpret phenomena in Waves and Optics with a calculus treatment. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** There should be at least one problem on the final exam that pertains to optics. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% of the class should be able to solve said problem(s).	06/27/2014 - Students solved a difficult Snell's Law problem. More development should go into the online presentation though. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2CM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Modern Physics - The student will be able to solve problems in Modern Physics involving calculus. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** There should be problems on the final that pertain to radioactivity and/or simple quantum mechanics. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% should show a mathematical understanding of the exam problems presented.	06/27/2014 - Students showed a strong success when doing a straightforward Shrodinger's Equation problem. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 2CM - GENERAL PHYSICS - CALCULUS SUPPLEMENT - Thermodynamics - The student will be able to solve problems in Thermodynamics involving calculus. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Inactive			
Department - Physics (PHYS) - PHYS 34H - HONORS INSTITUTE SEMINAR IN PHYSICS - Physical/Conceptual Understanding - Students have a physical/conceptual understanding of a topic investigated in class. (Created By	**Assessment Method:** As this class is a seminar, the students will share their knowledge via in-class discussion, evaluated by the instructor. **Assessment Method Type:** Discussion/Participation	06/27/2014 - This class was not offered this academic year. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Physics (PHYS)) **Course-Level SLO Status:** Active		**Resource Request:** None.	
Department - Physics (PHYS) - PHYS 34H - HONORS INSTITUTE SEMINAR IN PHYSICS - Mathematical Understanding - Students have a mathematical understanding of a topic investigated in class. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** As this class is a seminar, the students will share their knowledge via in-class discussion, evaluated by the instructor. **Assessment Method Type:** Discussion/Participation	06/27/2014 - This class was not offered this academic year. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None.	
Department - Physics (PHYS) - PHYS 4A - GENERAL PHYSICS (CALCULUS) - Kinematics, Newton's Laws, Energy, and Momentum - Students should be able to solve problems involving Kinematics, Newton's Laws, Energy, and Momentum, and know when to use which concept. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Students will be pre- and post-tested with a standardized exam from the Physics Education literature. **Assessment Method Type:** Exam - Standardized **Target for Success:** The class should show an improvement of 0.2 as measured by a normalized gain. This is the national average for physics courses.	07/01/2014 - The class pre-tested at 12 and post-tested at 16, for a Hake gain of 0.27. This was for a class that started near 60. Note that the pre/post raw scores are not as high as they have been when we've tested in the past, indicating that perhaps the incoming quality of student has dropped (or perhaps this is due to testing during Winter). In any case, these gains found, while above the norms for lecture-style classes, are low for peer-interaction classes, which is not surprising given the size of the class. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** At some point there needs to be a frank discussion about the pedagogy of large lectures.	09/16/2014 - There are two areas of concern. One is that students appear to be less prepared than in the past. We wish to address this by modifying Physics 6 and offering it on a regular schedule. We are also concerned about the effects of double-lab lectures. When productivity is not a driving factor in enrollment, we should discuss either single-lab lectures or a cap on the combined total of students across two lab sections.
Department - Physics (PHYS) - PHYS 4A - GENERAL PHYSICS (CALCULUS) - Lab Experiments - Via lab experiments, students will have an understanding of the background science, error analysis, and how to perform experiments.	**Assessment Method:** Instructors will examine a lab for major revision/improvement. **Assessment Method Type:** Class/Lab Project **Target for Success:**	06/27/2014 - This year we introduced a spreadsheet lab that investigated the launch of a V2 rocket. This spiked student interest, it may be of interest to invest in a rocket lab. **Result:** Target Met	06/27/2014 - Before taking too much action, we would need to chat with the fire department to discuss proper permitting. If we get permission, there is a whole

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
(Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	Instructors should be satisfied that implementation of lab revision will lead to improved student understanding in lab. These improvements should also reflect current best practices in pedagogy.	**Year This Assessment Occurred:** 2013-2014 **Resource Request:** It may take several hundred dollars to implement this lab, and there will be recurring quarterly costs. **Resource Request:** It may take several hundred dollars to implement this lab, and there will be recurring quarterly costs.	treasure trove of STEM that could be explored in a way that would excite students at the introductory 4A level.
Department - Physics (PHYS) - PHYS 4B - GENERAL PHYSICS (CALCULUS) - Topics in Electricty and Magnetism - Upon completion of the course, students should be able to solve problems involving forces, fields and potentials created by stationary and moving charges, and basic electrical circuits. (Created By Department - Physics (PHYS))	**Assessment Method:** Students will be pre and post-tested with the Conceptual Survey in Electricity and Magnetism (TYC Physics Workshop Project). **Assessment Method Type:** Exam - Standardized **Target for Success:** The class should show an improvement of 0.2 as measured by a normalized gain. This is the national average for physics courses.	06/30/2014 - We administered the CSEM as planned in Fall. This was a large class, with 42 students taking both the pre and post test. The average pre-test score was 12.4 and the post-test was 19.8. The mean Hake game was 0.39. This is well above the normalized gain seen across physics courses nationally, but does not live up to the very high gains seen a few years prior, but is instead in line with last year's result. Both this year and this year saw large classes where we blended both lecture-style and peer instruction. The move to large lectures across the department has not been to the benefit of the students, although it has helped the productivity of the department. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** At some point there needs to be a frank discussion about the pedagogy of large lectures. **Resource Request:** At some point there needs to be a frank discussion about the pedagogy of large lectures.	07/01/2014 - These are not bad results, but we have done better. The N for this year came from one large-lecture class, as opposed to being spread across more classes. We should strive to include peer-interaction as much as possible.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Physics (PHYS) - PHYS 4B - GENERAL PHYSICS (CALCULUS) - E&M Lab Experiments - Lab experiments should teach students the background science, error analysis, and how to perform experiments. (Created By Department - Physics (PHYS))	**Assessment Method:** Either by review of lab reports, in-class observation, or independent study, instructors should evaluate the lab experiments on an ongoing basis. **Assessment Method Type:** Essay/Journal	06/27/2014 - This year we introduced a discovery lab involving solenoids. Looking over scheduling, we have recognized that our Ohm's Law lab is taking place too early in the quarter. It is our intention to split this lab into two parts, the first a discovery lab earlier in the quarter, followed by one that goes deeper into voltages and currents. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** Class set of Vernier Circuit Boards ($89*16)	06/27/2014 - Vernier sells kits that would work very well for this lab, it would support both 4B and 2B.
Department - Physics (PHYS) - PHYS 4C - GENERAL PHYSICS (CALCULUS) - Wave Concepts - Students should understand the following concepts about waves: 1. wave motion and energy transport by waves, 2. reflection and transmission, interference and standing waves, 3. intensity of sound and interference of sound 4. Doppler effect (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Students will be tested twice, once in midterm, once in final in Mechanical waves. **Assessment Method Type:** Exam - Course Test/Quiz	10/02/2014 - I have increased number of test from two midterms to four midterms. Students seem to do better in final than in individual midterms. There is slight increase for the same topics comparing midterm (65%) with final exam (68%). Based on students performance, students mastered the basic topics covered in 4C. They usually do well on straight forward questions relating one topic only (76%). But when a problem involved multiple steps and multiple concepts, students find it challenging (62% to 68% correct). I will do more practice problems while keep the conceptual discussion as much as possible. Usually students are interested and involved in discussion better. But in general they do not practice as much as they should. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Physics (PHYS) - PHYS 4C - GENERAL PHYSICS (CALCULUS) - Thermal Physics - Students should understand the following concepts Thermal physics: 1. Temperature, internal energy and heat transfer 2. Specific heat and Calorimetry 3. Zeroth, first, and second law of thermodynamics 4. Thermal processes and heat engines Students will articulate how thermodynamic principles affect real-world phenomena or students will be able to identify natural phenomena that are affected by heat and appraise how thermodynamic changes will affect natural systems (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Students will be tested twice, once in midterm, once in final exam. **Assessment Method Type:** Exam - Course Test/Quiz	10/02/2014 - I have increased number of test from two midterms to four midterms. Students seem to do better in final than in individual midterms. There is slight increase for the same topics comparing midterm (65%) with final exam (68%). Based on students performance, students mastered the basic topics covered in 4C. They usually do well on straight forward questions relating one topic only (76%). But when a problem involved multiple steps and multiple concepts, students find it challenging (62% to 68% correct). I will do more practice problems while keep the conceptual discussion as much as possible. Usually students are interested and involved in discussion better. But in general they do not practice as much as they should. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 4C - GENERAL PHYSICS (CALCULUS) - Optics - Students should understand the following concepts about optics: 1. Index of refraction and Snell's law 2. Image formed by reflection and refraction 3. Thin lens and lens maker equation 4. Optical instruments 5. Interference in Young's double slit experiment and thin film 6. Single slit diffraction and limits of resolution (Created By Department - Physics (PHYS)) **Course-Level SLO Status:**	**Assessment Method:** Students will be tested twice, once in midterm, once in final in Mechanical waves. **Assessment Method Type:** Exam - Course Test/Quiz	10/02/2014 - I have increased number of test from two midterms to four midterms. Students seem to do better in final than in individual midterms. There is slight increase for the same topics comparing midterm (65%) with final exam (68%). Based on students performance, students mastered the basic topics covered in 4C. They usually do well on straight forward questions relating one topic only (76%). But when a problem involved multiple steps and multiple concepts, students find it challenging (62% to 68% correct). I will do more practice problems while keep the conceptual discussion as much as possible.	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Active		Usually students are interested and involved in discussion better. But in general they do not practice as much as they should. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Physics (PHYS) - PHYS 4D - GENERAL PHYSICS (CALCULUS) - Einstein's Theory - Students should have both a conceptual and computational understanding of Einstein's theory of special relativity. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** A midterm will be devoted to special relativity, as well a problem on the final. Conclusions will be drawn from students' performance. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** At least 80% of the students should be able to solve simple problems such as length contraction or time dilation, and 80% should be able to solve paradoxes at the level of the Twin Paradox.	06/27/2014 - Students again were able to solve basic problems in relativity and show a conceptual understanding of the common paradoxes. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None.	
Department - Physics (PHYS) - PHYS 4D - GENERAL PHYSICS (CALCULUS) - Schrodinger Equation - Students should have an understanding of the Schrodinger Equation and be able to solve problems with introductory-level potentials. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** A midterm will be devoted to the Schrodinger Equation, as will a problem on the final. Conclusions will be drawn from students' performance. **Assessment Method Type:** Exam - Course Test/Quiz	06/27/2014 - Students did very well on basic problems, but had some difficulty with more advanced challenge problems. The instructor was pleased with the overall performance of the students. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None.	
Department - Physics (PHYS) - PHYS 4D - GENERAL PHYSICS (CALCULUS) - Lab Experiments - The lab experiments should give students deeper understanding into the	**Assessment Method:** The lab reports from one of the experiments will be scrutinized with the goal of revising the experiment.	06/27/2014 - While there is the need to replace one of the labs, it is believed that the lab program will be much better improved by small incremental	06/27/2014 - There are many places for small improvements in equipment. These as purchases of

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
historical experiments that form the basis of modern physics and the science involved. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method Type:** Essay/Journal	purchases to support many of the labs rather than investing in one class set of more fancy equipment. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** See action plan.	gas discharge tubes (these run $40 to $75 each, purchase 10-15), increasing the annual purchases of Po-210 sources ($60 eachx4), wooden offsets($100?), and LEDs and lasers ($25*6?). Rather than breaking things out in program plans every year, the department should simply have a well-supported equipment budget.
Department - Physics (PHYS) - PHYS 6 - INTRODUCTORY PHYSICS - Kinematics, Newton's Laws, Energy, and Momentum - Students should understand the following basic concepts from mechanics: Kinematics, Newton's Laws, Energy, and Momentum (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** Students' midterm and final exam will be compared to analyze their understanding on Newton's second Law. **Assessment Method Type:** Exam - Course Test/Quiz	10/02/2014 - I have increased the number of discussion topics that students need to post. It has very positive effect. From students posts, they have sense of community and they help each other, and debate about topics that they have questions about. The dropping rate is kept at 18%, with overall higher enrollment, 27 people took final exam while the previous year only 18 people took the final. Online test still score better than in person test. One reason could be that they are give longer time margin for taking the test to compensate some technical issues by taking it online which in person test has no such a margin. Also the online test is not proctored, students might relax better, not as much pressure as proctored exam. The final is comprehensive, it is more difficult for most of students. It's true for face to face classes. Students seem to have better grasp on work and energy, but have difficulty when combined with force. Application of Newton's law is still a challenging topic. I will continue use discussion and encouraging students post their own topics. I will focus on more	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		practice problems on Force related topics so students have chance to deal with it under my guidance. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** Due to shifting needs, Physics 6 is due for an overhaul, this should be part of a PDL assignment, if not an entire PDL assignment.	
Department - Physics (PHYS) - PHYS 6 - INTRODUCTORY PHYSICS - Basic Concepts - Students should understand the following basic concepts from Electricity: Charges, electric forces and electric field. (Created By Department - Physics (PHYS)) **Course-Level SLO Status:** Active	**Assessment Method:** The class will be given a pre-lecture test and post lecture test within their final exam to analyze their understanding of electric charges, and electric forces. **Assessment Method Type:** Exam - Course Test/Quiz		

Unit Course Assessment Report - Four Column

Foothill College

Department - Engineering (ENGR)

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Engineering (ENGR) - ENGR 10 - INTRODUCTION TO ENGINEERING - Engineering Commuication - Communicate effectively through written documents and oral presentations (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Oral presentation to the class on the design project. **Assessment Method Type:** Presentation/Performance **Target for Success:** 90% of the class shows improvement in oral communication skills between the first and last oral presentations.	10/10/2014 - The students who were still in the class by the end of the quarter had much improved oral communication skills by the end of the quarter over the beginning of the quarter including their professionalism and confidence. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 10 - INTRODUCTION TO ENGINEERING - Engineering Problem Solving - Identify, formulate and solve problems that have real world constraints (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Formal report from the design project. **Assessment Method Type:** Class/Lab Project **Target for Success:** 75% of the class will receive a B or better on the design project report.	10/10/2014 - 86% of the class received a B or better on the final design project report. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 10 - INTRODUCTION TO ENGINEERING - Engineering Process - Work as a contributing member of a functional team (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Peer survey. Survey completed by team members at the end of the project. **Assessment Method Type:** Survey **Target for Success:** 80% of the class being rated as "Satisfactory" or better by their team members.	10/10/2014 - 86% of the class was rated as Satisfactory or better by their team mates. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 10 - INTRODUCTION TO ENGINEERING - Application of Knowledge - An ability to apply knowledge of mathematics, science and engineering. (Created By Department - Engineering			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
(ENGR)) **Course-Level SLO Status:** Inactive			
Department - Engineering (ENGR) - ENGR 10 - INTRODUCTION TO ENGINEERING - Complex Problem Solving - Collaborative skills to solve complex problems via verbal communication, writing and presentation in a structured format. (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Inactive			
Department - Engineering (ENGR) - ENGR 35 - STATICS - Particles and Rigid Bodies - The student be able to determine the equilibrium of particles and rigid bodies in two and three dimensions (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Final exam **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 70% students can use principle of equilibrium to analyze particles and rigid bodies correctly.	10/10/2014 - 76% of students were able to analyze particles and rigid bodies in equilibrium sufficiently well. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 35 - STATICS - Forces, Centroid and Moments of Inertia - The student will be able to analyze the forces, centroid and moments of inertia on structures, such as: - Trusses - Frames - Beams - Cables (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** End of quarter project **Assessment Method Type:** Class/Lab Project **Target for Success:** 90% of students should apply structure analysis to their end of quarter project by building bridge structure that take specified load.	10/10/2014 - 96% of the students applied structural analysis to their project. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	10/10/2014 - The project was changed this quarter to make it more realistic, and the students became aware of some of the challenges faced in reality through this project. While none of the bridges were built to the correct specifications, the students learned a lot from the process. We should keep the SLO as written, so that we are assessing the application of equations as opposed to the success of the bridges.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Engineering (ENGR) - ENGR 37 - INTRODUCTION TO CIRCUIT ANALYSIS - Direct and Alternating Current - Students will correctly identify the production, characteristics, applications, and voltage change methods of Direct Current and Alternating Current. (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** comparing student exam from quizzes, exams and final exam to monitor student progress. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 75% of student understand and master the concept.	10/10/2014 - The target is met, and my data showed great improvement over the course. The first midterm average is 75%, and the 2nd went up to 85%, the third and fourth goes up to 87 and 89%. Final grade is lower (82%) which is common since final covers broader range of subjects. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	10/10/2014 - The SLO should be more specific as to which quiz or exam (or what combination) will be used to determine success.
Department - Engineering (ENGR) - ENGR 37 - INTRODUCTION TO CIRCUIT ANALYSIS - Quantities of DC and AC Circuits - Students will correctly calculate quantities in DC and AC circuits containing resistive devices,capacitors, and inductors using Ohm?s and Watt?s Laws, Kirchoff?s Laws, and appropriate circuit analysis methods. (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** using exams to monitor student progress and understanding of the concepts mentioned in SLO **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 75% of students should master the ideas stated in SLO.	10/10/2014 - The target is met, and all the midterm exam and final exams covers all the subject listed here. The average is well above 75% **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	10/10/2014 - The SLO, assessments, and target should be rewritten to be more specific.
Department - Engineering (ENGR) - ENGR 37 - INTRODUCTION TO CIRCUIT ANALYSIS - Laboratory Measurements - Students will correctly perform measurements using multimeters, oscilloscopes, and signal generators, perform circuit fabrication using electronic schematic diagrams, and perform simple problem-isolation techniques on laboratory circuits. (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Inactive			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Engineering (ENGR) - ENGR 37L - CIRCUIT ANALYSIS LABORATORY - Circuit Analysis Laboratory - The student will be able to: a) make satisfactory measurements in circuits containing dc, ac and composite signals using equipment commonly found in an electrical engineering laboratory. b) understand the effect of a measuring instrument on a circuit under test. analyze resulting error. (Created By Department - Engineering (ENGR)) **Start Date:** 04/09/2012 **Course-Level SLO Status:** Active	**Assessment Method:** Supervise students' work in lab session and monitor students' progress using equipment and making correct measurement. **Assessment Method Type:** Observation/Critique **Target for Success:** By end of the quarter, 100% of students should be able to know how to use equipment and how to correctly making related measurement.	10/10/2014 - 100% people passed final project in which they need to demonstrate their skills in using the tools introduced in this quarter and in understanding the basic theory of circuitry. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	10/10/2014 - The assessment method and target should be aligned. Possibly just the final project as the assessment for success.
Department - Engineering (ENGR) - ENGR 39 - ENERGY, SOCIETY, & THE ENVIRONMENT - Global Energy Situation - Learn about our global energy situation and relevant economic and environmental issues (Created By Department - Engineering (ENGR)) **Start Date:** 10/01/2012 **End Date:** 12/01/2012 **Course-Level SLO Status:** Active	**Assessment Method:** Written essay and class discussions about how we got into the energy/climate predicament we are in, the types of energy used for types of activities (housing, commerce, industry, and transportation), and the environmental consequences of mining and extraction, processing, and combustion of fossil fuels. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 75% of students will be able to articulate well the linkage between economy => energy => climate, energy intensity of various activities, and projections for world energy demand based on population, wealth, and technology based activities.		
Department - Engineering (ENGR) - ENGR 39 - ENERGY, SOCIETY, & THE ENVIRONMENT - Clean energy technology	**Assessment Method:** A broad overview question that has two parts, first the understanding of specific		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
- Understand clean energy technology, and policies and actions to accelerate positive change (Created By Department - Engineering (ENGR)) **Start Date:** 10/01/2012 **End Date:** 12/31/2012 **Course-Level SLO Status:** Active	clean energy technology (solar, wind, geothermal), electric vehicles and fuel cells, energy efficiency and smart energy management, and policies, actions, and consumer choices (behaviors) and personal energy management to affect positive change. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 90% or more of students should be able to describe the benefits of solar PV technology, wind, geothermal, electric vehicles, fuel cells, energy efficiency, and natural gas as a replacement for coal. 90% or more will be able describe three specific actions (consumer behaviors) and/or policies to accelerate both energy use and GHG emission reduction, such as renewable portfolio standards and low carbon fuel standards. Personal energy management/GHG goals would be a bonus.		
Department - Engineering (ENGR) - ENGR 39 - ENERGY, SOCIETY, & THE ENVIRONMENT - Measure and analyze energy use - Learn how to measure and analyze energy use in buildings, transportation, and apply tools and other behavioral changes to achieve goals in personal energy use and GHG emissions (Created By Department - Engineering (ENGR)) **Start Date:** 10/01/2012 **End Date:** 12/31/2012 **Course-Level SLO Status:** Active	**Assessment Method:** Students will use Kill-a-watt meters, smart meter (online meter data management), utility bills, and commercial interval data (if available) to estimate energy use in buildings, and calculate building energy intensity. Students will track their mileage driving as well as gasoline intake to estimate petroleum emissions. Some students will use personal energy tools (including wattzon etc) to measure and manage their energy use and create personal climate action plans. **Assessment Method Type:** Class/Lab Project **Target for Success:** 75% or more of students will calculate accurate energy intensity of residence based		

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	on utility bills, and conduct a home energy audit of major appliances, correlated to smart meter (or other interval meter data). 75% will accurately know, or reasonable estimate, their use of petroleum and associated GHG emissions. Most students will articulate a personal energy management plan.		
Department - Engineering (ENGR) - ENGR 45 - PROPERTIES OF MATERIALS - Classess of Materials - To ensure that our students are knowledgeable about all classes of materials and their structure, properties, processing, applications and performance; (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Students performance will be scored by answering questions on the final exam. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% of the students taking the exam getting a B or better.	10/10/2014 - Students were assessed for their performance on a comprehensive final exam that covered a broad range of content covered in the course. Topics included classes of materials; structural, mechanical, electrical and chemical properties or materials; phase and transitional diagrams, manufacturing process and material applications. Overall, 80.6% of the class scored a B or better on the final exam in Spring 2014. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 45 - PROPERTIES OF MATERIALS - Real Materials engineering Problems - To ensure that our students can properly relate their hands-on laboratory experiences to solving real materials engineering problems (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Students will be assessed by their average performance on laboratory projects for the quarter. **Assessment Method Type:** Class/Lab Project **Target for Success:** 70% of the class scoring a B or better will be considered success.	10/10/2014 - Students were individually assessed for their performance on a series of laboratory projects in terms of their preparation for each laboratory, active participation in the laboratory experiment and the quality of their laboratory report. Overall, 91% of the class scored a B or better for their laboratory grade in Spring 2014. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 47 - DYNAMICS - Computation - Students should be able to analyze kinematics of rigid bodies in three dimensions. (Created By			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Engineering (ENGR)) **Start Date:** 09/22/2014 **Course-Level SLO Status:** Active			
Department - Engineering (ENGR) - ENGR 47 - DYNAMICS - Modeling - Students should be able to model the relationship between forces and acceleration and energy and momentum. (Created By Department - Engineering (ENGR)) **Start Date:** 09/22/2014 **Course-Level SLO Status:** Active			
Department - Engineering (ENGR) - ENGR 49 - ENGINEERING PROFESSION - Self Analysis and Career Research - Identify one's interest in a engineer field(s) via self analysis and career research. (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** 7-10 page essay on engineering career plan. **Assessment Method Type:** Essay/Journal **Target for Success:** 85% of students receive a grade of B or better.		
Department - Engineering (ENGR) - ENGR 49 - ENGINEERING PROFESSION - Engineering Responsibilities - An understanding of professional, ethical, legal, security, and social issues and responsibilities (Created By Department - Engineering (ENGR)) **Course-Level SLO Status:** Active	**Assessment Method:** Class discussion on ethical issues and responsibilities in engineering. **Assessment Method Type:** Discussion/Participation **Target for Success:** 75% of the class contributing to the discussion.	10/10/2014 - The students in the course actively participated in the discussions about the professional responsibilities in engineering through attending and asking questions throughout the quarter. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	10/10/2014 - This SLO should be rewritten to reflect the nature of the course and how the discussions are spread out over several weeks in the quarter.
Department - Engineering (ENGR) - ENGR 6 - ENGINEERING GRAPHICS - Sketching by hand - Students will be able to sketch orthographic drawings according to industry standards from a given object. (Created By	**Assessment Method:** Assignment to sketch an orthographic drawing from an object. **Assessment Method Type:** Class/Lab Project	10/10/2014 - 100% of the participating students earned a B or better on the drawing. **Result:** Target Met	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Engineering (ENGR))	**Target for Success:** 80% of the participating students will earn a B or better on the assessment	**Year This Assessment Occurred:** 2013-2014	
Department - Engineering (ENGR) - ENGR 6 - ENGINEERING GRAPHICS - Computer Aided Design models - Students will be able to create 3-D models using CAD software that adhere to standards in design and manufacturing. (Created By Department - Engineering (ENGR))	**Assessment Method:** Assignment to create a 3D model of an object following industry standards for design and manufacturing. **Assessment Method Type:** Class/Lab Project **Target for Success:** 80% of participating students will receive a B or better on the 3D prototype created for the project.	10/10/2014 - 88% of the participating students received a B or better on the prototype. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	