Instructional Program Review

Program Name: **Physics**
Program Contact: **Locke, David**
Academic Year: **2016-2017**
Status: **Submitted for review**
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1. Description of Program

Provide a brief description of the program and how it supports the college's College Mission and Diversity Statements, CSM Strategic Goals 2013/14 to 2015/16, and other Institutional Program Planning as appropriate. What is the program's vision for sustaining and improving student learning and success over the next three years?

The Physics department at CSM offers 4 sequences for students. Which sequence a student will take depends on their educational goal and, in the case of students planning to transfer to a 4-year institution, the institution they plan to transfer to. All four sequences support transfer to a 4 year institution, as well as associate degree requirements. Thus, aligning with the Board of Trustees' Core Value of a Student-Centered Mission, as well as College of San Mateo's Mission Statement.

Physics 100 is a stand-alone one-semester course which satisfies the GE requirement of a Physical Science for transfer or Associate's degree. Physics 101 is a one-semester lab course which can accompany the the Physics 100 course for students completing their science lab requirement for transfer. Physics 101 is being offered for the first time this semester, Fall 2016. It has been designed to be offered online with students ordering a lab kit instead of a textbook.

The Physics 210-220 sequence is designed for students majoring in some field of letters and science. It is required for students planning to enter Medicine, Dentistry, Pharmacy, Optometry, Agriculture, or Forestry.

The Physics 210-211-220-221 sequence is required by some transfer institutions (mainly UC's) for students majoring in fields listed above.

Physics 250-260-270 constitute a three-semester program designed to give students majoring in Engineering, Physics or Chemistry a thorough foundation in the fundamentals of physics.

The department also offers a preparation course, Physics 150, which is designed to get underprepared students ready for the Physics 210-220 and 250-260-270 sequences. That course is now being offered as a hybrid/12-week course with an online lecture and an on-campus lab.

In addition, a three-course sequence, Phys 126-127-128 (cross-listed as BIOL 126-127-128) was added for students interested in careers in science education. These one-unit courses were developed as part of the Aurora project, which in turn is part of the CalTeach project. Each class is limited to a maximum of six students, due to funding for the stipends that students receive. Currently, one physics faculty member and one biology faculty member each get one unit of load for all three courses. These courses are, but probably should not be given the special nature and history of the courses, included in the LOAD calculations for the physics department. They typically carry LOADs well below 100.

In Spring 2017 and Spring 2018, the department will offer an experimental course, PHYS 680 MB (cross-listed as ENGR 680 MB) Rockets and Drones: Science and Engineering. This course will offer students an opportunity to develop and apply science and engineering skills in the emerging technologies of unmanned aircraft.

In the Spring 2014 semester, the department began offering some of its classes online with the goal of achieving further access to students and avoiding conflicts in their class schedules. Courses offered fully online have included Physics 100, 101, 211, and 221.

In the 2015-16 academic year, the department offered two of its lecture/lab courses (Physics 220 and 270) as web-assisted with online lecture and on-campus lab. In both cases, offering the web-assisted course will allow us to increase access to both day and evening students while continuing to increase LOAD. The benefit of this was allowing for an evening section and day section to combine for a double section with higher LOAD than two individual sections. The downside was forcing all students into the hybrid format which may not be the optimal learning mode for all students.

This semester, Fall 2016, we are offering Physics 150 in the hybrid format and plan to do so again in SPring 2017.

2. Student Learning and Program Data

A. Discuss Student Learning Outcomes Assessment

1. Reflect on recent SLO assessment results for courses and degrees and certificates offered by the program. Specify how SLO assessment informs curriculum development and changes to curriculum.

Physics offers two degree options which require the same Physics courses (250-260-270), an AS and an AS-T. Seven students completed the online degree application and the Self-Assessment survey between Summer 2012 and Spring 2014. All seven students agreed or strongly agreed with the first two of the three Likert scale questions they were asked, while 6 out of 7 students agreed or strongly agreed with the third question:

Based on my experiences at CSM, I can...

1. Apply the Laws of Physics to real-world problems
2. Collect and Analyze data to verify physical principles
3. Undertake upper division Physics coursework at a 4-year college

Course level SLO assessment has been useful to the department in identifying what areas students are struggling with in the courses and areas where faculty need to work on time-management in the course. At the course level, many actions have involved further review of topics students struggle with. Since most of our assessments are done by using problems on the course final exam, many topics from the beginning of the course may be forgotten by the end. Review of these throughout the course and at the end of the course has led to improvement. Early on in the department's assessment of SLOs, lack of faculty time management sometimes led to an outcome not being attained by students at all. This has been improved by having faculty more aware of the SLOs for the courses they teach. Some inconclusive results have resulted from the fact that some problems have multiple valid approaches. Students sometimes can correctly solve a problem intended to assess an SLO without demonstrating the outcome. These latter two issues could be remedied by the department drafting common final questions, perhaps three or four per SLO. Faculty could then select which question they would put on their final for SLO assessment. The knowledge of these common questions would help ensure that faculty managed time appropriately. Finding time to develop these questions has been difficult due to lack of full-time faculty in the department. Fortunately, since we have hired a new full-time faculty member who began last year, there is now more time for the department to divide the workload and develop these questions in addition to keeping up with other administrative requirements including curriculum and program review. The physics department hopes to develop these questions in the coming academic year and assess course level SLOs using them in Spring 2017, Fall 2017, and Spring 2018.

2. Comment on the success rates in the program SLOs that are aligned with specific course SLOs. What do the program SLO and course data reveal about students completing the program? Identify trends and discuss areas in need of improvement. Is the alignment between course and program SLOs appropriate and informative? Describe any additional methods used to assess program SLOs and reflect on the results of those assessments. See course-to-program SLO alignment mapping.

The program SLOs for both the AS and the AS-T degree are identical as are the physics course requirements are identical for both degrees. As a result the alignment of the three courses required for the degrees are identical. Since success rates of students attaining the course SLOs has been high in assessments of all but one course SLO, we can conclude that these courses are indeed

supporting students in attaining the three physics program SLOs.

3. For any courses in the program that satisfy a GE requirement, which GE SLOs are supported or reinforced by the course SLOs? What do assessment results for the course SLOs (and for the GE SLOs, if available) reveal about student attainment of the GE SLOs? See GE SLO Alignment Summary Report or All Courses GE SLO Alignment Data.

Both the GE SLO Alignment Summary Report and All Courses GE SLO Alignment Data reports are inaccurate and do not reflect the alignment entered by discipline faculty in tracdat. They are also, sadly, out-of-date, since they contain the Physics 329 course which is no longer in the college catalog.

All of the courses that satisfy a GE requirement have SLOs that are aligned with the "Effective Communication", "Quantitative Skills", and "Critical Thinking" GE SLOs. Since success rates of students attaining the course SLOs has been high in assessments of all but one course SLO, we can conclude that these courses are indeed supporting students in attaining these three GE SLOs.

B. Student Success Indicators

1. Review Student Success and Core Program Indicators and discuss any differences in student success indicators across demographic variables. Also refer to the College Index and other relevant sections of the Educational Master Plan: Update, 2012, e.g., Student Outcomes and Student Outcomes: Transfer. Basic Skills programs should also refer to ARCC data.

Student success and retention in Physics are lower than the college average and are comparable to those in Math. The three years of data provided show both success and retention are fairly constant with only slightly higher success and retention in AY1415 which not surprisingly is when LOAD was smallest.

Percent enrollments in Physics show greater enrollment in Physics by Asian and Filipino students than for the college as a whole and about the same enrollment by White students. All other groups are underrepresented in Physics courses compared to the college as a whole.

Students identifying as Black, Native American and Pacific Islander have 11 or less enrollments per year in Physics. Not much can be said about retention and success for these students, since the enrollment numbers are so small. These three groups do have the lowest success rates in Math and since every Physics course has a Math prerequisite, students in these groups may not be eligible to enroll in Physics courses. The Physics department may want to work together with the division devise strategies to help bring up enrollments by students in these groups.

The four groups with 30 or more enrollments per year (excluding “other” and “unrecorded”) show cumulative success rates of about 66% for White and 65% for Asian and slightly less than 50% for Hispanic and Filipino. These gaps are fairly large; however, in AY1415 success by Filipino students was 61.4% statistically the same as the overall 62.0% success rate by all students in Physics and success by Hispanic students was 58.5% only 3.5% below the overall success rate in Physics. With the exception of Asian students and our few Pacific Islander students, we have had and unfortunate drop in success rates from AY1415 to AY1516.

Success and retention seem to be higher for students 19 and under than students 20-29. This may be due to external factors for working students and students with families.

2. Discuss any differences in student success indicators across modes of delivery (on-campus versus distance education). Refer to Delivery Mode Course Comparison.

For four semesters, the Physics Department has been offering online and web-assisted courses. In Spring 2015, the department began offering courses as online courses with Physics 100 and 211. In Fall 2015, these same two courses were offered as online courses and Physics 270 was offered as a web-assisted course with an online lecture and an on-campus lab. In Spring 2016, Physics 211 and 221 were offered as online courses and Physics 220 was offered as a web-assisted course with an online lecture and an on-campus lab. In Fall 2016, Physics 100, 101 and 211 are being offered online and Physics 150 is being offered as a hybrid

course with an online lecture and an on-campus lab.

A great limitation of the Delivery Mode Comparison Data provided for program review is that it only reports data for Fall offerings. This means there is no data presented for Physics 220 or Physics 221 which were only offered in a distance mode in a spring semester. Also, although Physics 211 has been offered 3 times in the past as an online course, only once was a fall semester. Similarly, Physics 100 has been offered multiple times online, but only in one past fall semester.

Looking at the data, it is clear that the issue that needs to be addressed regarding the distance mode delivery is retention. If we look at success of only the retained students in the two semesters of Fall Physics 270 semesters, the percentages are 84.0% for face-to-face in Fall 2013 and 83.3% for web-assisted in Fall 2015. These two rates may be considered equal. However, the retention rate for the face-to-face class is 89.3%, while the retention rate for the web-assisted class is only 75%.

If we look at the same data for Physics 211, we find a success rate for the retained students to be 94.7% in the online Fall 2015 course higher than the 88.9% for the combined face-to-face classes from Fall 2013 and Fall 2014. However, retention in the online course was only 61.3% while it was 75% in the combined face-to-face classes.

For the Physics 100, success of the retained students in the online sections (55.6%) is significantly lower than for students in face-to-face sections (69.2%). The retention rates are also very significantly different 54.5% for online students and 79.1% for face-to-face students.

So, the major differences (although for each course only one semester with online data is presented) are overall retention in the online sections is significantly lower than in the face-to-face classes and that success of the retained students in Physics 100 is lower in the online sections than the face-to-face sections.

C. Program Efficiency Indicators. Do we deliver programs efficiently given our resources?

Summarize trends in program efficiency as indicated in the Student Success and Core Program Indicators (LOAD, Full-time and Part-time FTEF, etc.)

Enrollments have fluctuated, but show an overall increase from AY1314 to AY1516. WSCH, however show a decrease indicating that we are having more enrollments in our 1-unit courses PHYS 126, 127, 128, 211, and 221. This is expected with Physics 211 and 221 offered as online courses in AY1516.

LOAD cannot be compared year-to-year in any easy way. The college's accounting for HBA/TBA hours was done differently in different years effecting WSCH generated by HBA/TBA hours by as much as 30%. LOAD in physics is limited by the size of some of the course offerings, most notably the Cal-TEACH courses (126-127-128) and in AY1213 the Honors Seminar (329). Due to enrollment limits in these courses. The combined LOAD in 126-127-128 is frequently around 20.

Due to the nature of the course offerings in Physics, LOAD is not expected to reach 500 for the Physics Department. Physics would like to expand its offerings of double lab sections, which can carry much higher LOADs than single lab sections. This is possible to some extent and the program has seen recent growth. However, there is a large constraint on double section offerings due to the lack of lecture rooms in Building 36. In AY1516, we offered two double sections in web-assisted format. This avoids the classroom space issue. Also, the department will need to replace retiring faculty to have healthy growth and increase LOAD.

Fall 2009-Fall 2010 FTEF was all generated by Full-Time faculty. This was due to elimination of some sections for budgetary reasons. Beginning in Spring 2011, Professor Locke became the SLO Coordinator at the college. This allowed for some assignments to be given to the department's two adjunct instructors. For Spring 2011-Spring 2012, Full-time FTEF was 80-90% of the total FTEF. In December 2012, Professor Uchida retired after 22.5 years of service in the district. Effective Spring 2013, Professor Uchida became an adjunct instructor. With this retirement, Regular Full-time FTEF dropped to 1.6 and was only 36.6% of the total FTEF (39% was Adjunct FTEF and 24.3% was Overload FTEF). Fortunately, the department has now hired a full-time instructor, Professor Alex Wong, who began teaching in the department in Fall 2015. However, Professor Janatpour may retire within the next few years and the department will need to hire a replacement or Full-Time FTEF will drop below 50% again.

Part-Time FTEF has decreased from AY1314 to AY1516 as Professor Locke's term as SLO Coordinator ended and Professor Wong began teaching with the department.

3. Additional Factors

Discuss additional factors as applicable that impact the program, including changes in student populations, state-wide initiatives, transfer requirements, advisory committee recommendations, legal mandates, workforce development and employment opportunities, community needs. See Institutional Research as needed.

One external factor effecting student success and retention is the lack of computerized prerequisite checking in the physical science and engineering major's sequence (Physics 250-260-270) and in the first semester of the biological science major's sequence (Physics 210). In 2007, the full-time physics faculty from Canada, CSM, and Skyline met to discuss prerequisites for all physics classes. Although, Canada and CSM came to agreement on prerequisites, the faculty from Skyline asked to consult with the Dean of Science/Mathematics/Technology at Skyline and then follow-up. More than 7 years later, Skyline had neither changed their course numbers nor changed the prerequisites of these courses to agree with what Canada and CSM agreed upon. We hope to be able to work together with district discipline faculty from Canada, College of San Mateo and Skyline to align our courses to best serve students in the district without jeopardizing articulation agreements for our courses with both UC and CSU campuses.

Not having computerized prerequisite checking, not only lowers success and retention rates, but also LOAD. Students who have not met the prerequisites for the course enroll and are not dropped by the system before the semester starts. If these students drop (or are dropped from) the course after the start of the semester, the census enrollment in the classes will be lower. These students will displace eligible students who will look to other colleges to enroll in the course. Thus further impacting the department's LOAD.

In AY1516, Math/Science faculty met to reconsider course scheduling for science majors. A few changes in the Biology and Chemistry classes has caused unexpected conflicts with Physics 210. Thus, the enrollment in double Physics 210 day sections was much lower than expected this semester. For next Fall semester, the faculty plan to change the class time and possibly suggest changes to the Biology and Chemistry schedules to allow greater flexibility for students to enroll in their required classes for transfer, AS degrees and AS-T degrees.

4. Planning

A. Results of Program Plans and Actions

Describe results, including measurable outcomes, from plans and actions in recent program reviews.

An evening section of Physics 250 is now offered and the enrollments for Physics 260 and 270 have increased, resulting in a double section of Physics 260 being offered each semester now.

Offering Physics 211 and 221 as online classes has increased enrollment in those classes by eliminating schedule conflicts with other courses and allowing students from our district and other districts to complete the class(es) after transfer.

Although enrollment and LOAD were increased for the double web-assisted Physics 220 class, the LOAD was still not as high as was hoped for. Although offering the course in this mode did allow to have both an evening option and a day option for students. Ideally, we would like to be able to offer a full day section and a full evening section each year.

Unfortunately, LOAD was not increased in the double web-assisted Physics 270 class. We would as a department still like to explore increased evening offerings for our working students, but it may be that we simply do not have a large enough pool of students to enroll.

B. Future Program Plans and Actions

Prioritize the plans to be carried out to sustain and improve student success. Briefly describe each plan and how it supports the CSM Strategic Goals 2013/14 to 2015/16. For each plan, list actions and measurable outcomes. Plans may extend beyond a single year.

Describe the professional activities and institutional collaborations that would be most effective in carrying out the program's vision to improve student learning and success.

The Physics Program at College of San Mateo would like to continue offering quality education to students preparing to transfer to 4-year institutions pursuing bachelor degrees in the sciences and engineering. This aligns with the statement from the College Mission, "***College of San Mateo fosters a culture of excellence and success that engages and challenges students*** *through a comprehensive curriculum of basic skills, career and technical programs, and* ***transfer preparation.***" (Emphasis added.) This also aligns with the Institutional Priorities 2 and 3.

The Program would like to increase retention and success in its classes. This aligns with Institutional Priority 1. There are multiple actions being pursued. Making sure students enroll in the correct sequence of courses for their educational goals and complete appropriate prerequisite for the courses they enroll in is essential for student success and retention. The department will begin offering Supplemental Instruction this fall in it's first semester science major courses, Physics 210 and 250. Success and retention in the second and third semester courses, Physics 220, 260 and 270 is much higher than the first semester courses. Any assistance we can provide to promote success in the first semester courses will lead to increased enrollments and LOAD in the advanced courses.

The above will require replacing retiring faculty and expanding student supplemental learning resources through an expansion of tutoring, the hiring of a Physics Program Services Coordinator, and Supplemental Instruction.

The Program would also like to expand access to students, by offering more web-assisted, hybrid and online sections of courses. The Program plans to begin offering Physics 270 once a year (in Fall semesters) with an online lecture and an on-campus lab and also Physics 220 in this format (in Spring semesters). The Program would also like to recreate the Conceptual Physics Lab offering it as a science lab option for transfer students.

5. Program Maintenance

A. Course Outline Updates

Review the course outline update record. List the courses that will be updated in the next academic year. For each course that will be updated, provide a faculty contact and the planned submission month. See the Committee on Instruction website for course submission instructions. Contact your division's COI representatives if you have questions about submission deadlines. **Career and Technical Education courses must be updated every two years.**

Courses to be updated	Faculty contact	Submission month
Physics 250	David Locke	November

B. Website Review

Review the program's website(s) annually and update as needed.

Faculty contact(s)	Date of next review/update
David Locke	1 Jan 2017

C. SLO Assessment Contacts

Faculty contact(s)	Date of next review/update
David Locke	1 Jan 2017

6. Dominant Themes Summary for IPC

Briefly summarize the dominant, most important themes or trends contained in this program review, for division deans to collect and forward to the Institutional Planning Committee. What are the key program issues that matter most? (Brief paragraph or bullet points acceptable).

There is a need to increase retention in online courses.

There is a need to increase LOAD in courses. This is best done by increasing success in first semester Physics 210 and 250.

Plans to increase retention and success require:

- Expanding SI
- Expanding Peer Tutoring
- Hiring a Program Services Coordinator

Many of these are now funded by the HSI STEM Grant that was awarded to CSM.