Department Information

Overview - Directions

<table>
<thead>
<tr>
<th>Program/Discipline</th>
<th>Date Submitted to Dean (Deadline by 4/27/18)*</th>
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<tbody>
<tr>
<td>Math Science/Physics</td>
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List of Contributors

Laura Fatuzzo / Physics Instructor

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
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Signature of Area Dean/Director

Please type the name of the area Dean/Director and the date they reviewed the rest of the document. They may also use this space to provide optional comments.
Shannon Bliss
5/7/18

Thanks for all the work on this.
Questions Regarding Degree and Certificate Programs

A.1 Core Outcome I - Completion

Observing the number of students who got Awards in your program(s) using the Program Award Tool, compared to the College historical trends what insights can you share?

Notes: Is your program an awards producer or a “feeder” program? If you have multiple degrees and/or certificates, please analyze and compare the trends among them.

The physics program is a feeder program for engineering, mathematics, biology, chemistry and computer science.

Following is the majors breakdown for students enrolled in calculus-level physics spring 2018: Engineering = 58/132; Computer Science = 22 /132; Biology =16/132; Biochemistry=12/132; ; Chemistry = 6/132; Math = 6/132; Physics = 4/132; Astrophysics = 1/132; ; Other = 4 /132; ; NA (did not respond) = 3 /132

Following are the physics courses required by each major.

• The astronomy program requires College Physics I & II (PHY 2A and PHY 2B), or General Physics /Mechanics (PHY 4A); Electricity & Magnetism (PHY 4B); Waves; Heat, Light and Modern Physics (PHY 4C).
• The biology program for transfer requires College Physics I & II (PHY 2A and PHY 2B), or General Physics /Mechanics (PHY 4A); Electricity & Magnetism (PHY 4B)
• The chemistry program for transfer requires General Physics/Mechanics (PHY 4A); Electricity & Magnetism (PHY 4B)
• The engineering program requires General Physics /Mechanics (PHY 4A); Electricity & Magnetism (PHY 4B); Waves; Heat, Light and Modern Physics (PHY 4C).

As can be seen from the data, engineering is the major with the most students enrolled in physics.

How do you inform potential students about your program? How do students know which courses they should take for your program and in what sequence?

Students meet with the STEM counselor, who has updated information regarding all the STEM programs. The counselor and the students create an Education Plan that guides the students on which classes the students need to take and in which semester. If students have specific questions regarding the physics sequence, they can also meet with the full-time physics instructor.
In addition, the Physics Department has articulated an ASSOCIATE IN SCIENCE IN PHYSICS FOR TRANSFER (AS-T) PROGRAM. The Associate in Science degree in Physics for Transfer provides a clearly articulated curricular track for students who wish to transfer to baccalaureate degree programs at a California State University (CSU) campus. The details are printed in the school catalog.

A.2 Core Outcome II - Time and Units to Completion

Observing the Time & Units data, what insights do you get from the data in general?
When observing the Time and Units to Degree by Program data (5-year Cumulative), we can notice that first-time students (24 students) had a median time to degree of 3.9 years, and the median units to degree was 117.3. We can also notice that transfer students (10 students) also had a median time to degree of 3.9 years, and the median units to degree was 106.8. All the students (34 students) had a median time to degree of 3.9 years, and the median units to degree was 116.5.

The insights we get is that half of our students majoring in physics are taking more than 3.9 years to complete a two-year college degree, and are taking 26.5 extra units beyond the 90 required units. When we look at physics compared to the college as a whole, we see that the median number of units to completion for physics to degree, 106.8 units, while for the college as whole it is 92 units. When we look at physics compared to the college as a whole, we see that the median time to degree is 3.9 years, while for the college as whole it is 4.5 years. This means students majoring physics take more units per year, and complete them in less time.

Two reasons come to mind. First, many of our students take remedial classes in math and English when entering Hartnell College. Physics requires completion of Calculus 1 (Mat 3A), so students may have a lot of catching up to do in order to even take the first physics class (PHY 4A) required in the program. One insight to the solution to the problem is to work closely with high school counselors to guide students into math and English classes so that they are college-ready once enrolled at Hartnell College.

Physics does not have a breakdown by race and gender, and with a count of 34 students, the population is not large enough to come up with statistically significant conclusions.

Observing the Subject Analysis tool, and focusing on the percentage of capacity of your program, is the college offering enough sections or too many sections of the courses in your program?
Here is a summary of the results:
2013-2014: 72% capacity
2014-2015: 84% capacity
2015-2016: 93% capacity
2016-2017: 86% capacity
2017-2018: 94% capacity

The data shows that percent capacity is high, resulting in large classes (greater than 54 students per lecture class). With such large classes, the instructor cannot give as much feedback to students as would be given in smaller classes, and cannot easily or effectively incorporate active learning teaching strategies. The ideal classroom size is 30-32 students.

The Physics Department has experimented with offering night classes in Physics, but enrollments were
less than 15 students. The Physics Department could look into whether offering afternoon classes would be beneficial to students.

Does the way the courses in your degree and certificate program are scheduled enable students to take courses when they need them, plan their lives around their classes from one term to the next, and complete their program on time? If it does not, are there any obvious fixes?

As stated above, the Physics Department has experimented with offering night classes in Physics, but enrollments were less than 15 students. Night classes are difficult for students that live in the Salinas Valley and rely on public transportation, which is limited. The Physics Department could look into whether offering afternoon classes would be beneficial to students. To see if such a need exists, the school could poll incoming students on what times are preferable to them. However, students majoring in Physics also need to take a full load of Math, English and other STEM classes that require labs, filling up the hours in the week.

As far as labs, the physics department has been offering the lab sections at different times during the day, which gives flexibility to students in creating their schedule.

How do you work with underprepared students? How do you share the educational resources that are available on campus with all your students? Please give examples of when these resources have worked well and when they have not.

The college works with underprepared students by offering remedial classes in Math and English. It also offers a Math Academy twice a year, one before the spring semester, and one before the fall semester.

The Physics Department works closely with the Early Support Program in identifying early on in the semester students who are struggling in physics. The Physics department also provides Supplemental Instructors, SIs, when possible, to help students with homework problems and to prepare of exams. In addition, it works closely with the Panther Learning Lab physics tutors to provide optimum service to our physics students. The college works with underprepared students by offering remedial classes in Math and English. It also offers a Math Academy twice a year, one before the spring semester, and one before the fall semester.

A.3 Core Outcome III - Transfer

Observing the number of transfer students from the transfer volume data, what insights do you get from the data in general?

There are very few students who transfer into physics. During the 2017-2018 academic year, only two students in the calculus-level physics classes declared physics as their major.

When looking at transfer data from Hartnell College as a whole, we can clearly see that the number of
students who transferred to a university of California (UC) school was highest during the 2012-2013 academic year (152), and then gradually decreased to 116 transfer students during the 2015-2016 academic year. This is in spite of having greater enrollments every academic year.

On the other hand, with the exception of the 2009-2010 and 2012-2013 academic years, transfers to California state universities (CSUs) increased from 298 in the 2007-2008 academic year to 572 in the 2016-2017 academic year.

It seems as if more students are transferring to CSUs than UCs. I am imagining that one of the reasons for this is that Hartnell College has many Associate Degrees for Transfer, allowing easy pathways to CUS's.

**What interactions do you have with students about transfer options? Please give examples.**
I survey the students in my physics classes and encourage those interested in physics to meet with a STEM counselor. The STEM counselor works closely with our students about possible transfer options. In addition, I guide the students to meet with our a Cal-bridge Liaison. The mission of the Cal-Bridge program is to increase the number of California State University (CSU) students completing their bachelor's degree and successfully entering a PhD program to study physics, astronomy, or a closely related field. The role of the Cal-Bridge liason is not only to help identify students at Harntell College who would like to pursue a PhD in Physics or Astronomy, but also to encourage them to apply for the Cal-bridge program. Students who apply to the program are given mentorship and scholarships during their undergraduate education to help them on their path to a PhD in Physics or Astronomy.

**How are program learning outcomes aligned with the skills and knowledge students will need to succeed in transferring to baccalaureate degree programs?**
The program learning outcomes prepares students in gaining the skills and knowledge needed to continue with their studies. Our courses are in line with the CI-Descriptors found in Curricunet.

**A.4 Core Outcome IV - Employment**

Observing the Employment data, what insights do you get from the data in general?
Observing the Employment data, I notice that there are not many physics jobs in California, and the greater concentration is in the Bay Area. In 2017, there were 1,782 jobs in physics in the Bay Area, compared to 1,653 in 2014, a 7.8% increase. The latest number of annual job openings in physics is 86. The average hourly wage in physics is $56.

Looking at current employment data, one can see from that most Hartnell College students, 76%, are employed at one job. The overall employment in 2017 was 84%, less than the 87% for 2016.

**How and when do you inform students about prospective employment opportunities?**
Again, we have few students who declare physics as a major. Hartnell College physics students transfer to other institutions to earn Bachelors, Masters and PhDs in physics. They need these degrees since
they are required for jobs in physics. However, the American Institution in Physics publishes national employments data in physics. This data is shared with students and the STEM counselor.

Also, any articles regarding employment in physics is shared with students.

Furthermore, the MESA/Internship director and the STEM counselor work closely to inform students about possible internships.

How are program learning outcomes aligned with the skills and knowledge students will need to succeed in their future employment?
We will discuss the program level outcomes one by one:

Program Student Learning Outcomes for the PHY program
Upon successful completion of the a student should be able to:

1. **Demonstrate proficiency in problem solving, especially with regard to basic physics problems involving major concepts, theories, and principles including, but not limited to: conservation of momentum and energy.** This is addressed in the homework, lectures and exams. The physics department does this well, focusing students on major concepts theories and principles.

2. **Comprehend and articulate basic physics terminology.** This is addressed by reading/writing assignments and assessed in exams. Furthermore, in lab, students write reports where they discuss conclusions articulating basic physics terminology.

3. **Collect and analyze data effectively using basic laboratory equipment and present results in formally structured laboratory reports.** This is addressed by introducing students to how to keep a lab notebook, and then introducing the elements of a formal lab report, and giving feedback on student's writing of the reports.

A.5 - Recommendations

Reflecting on your observations and analysis from A.1 through A.4, what recommendations do you have for your program?
The Physics Department recommends hiring a full-time Astronomy/Physics instructor in order to offer more sections of the physics courses and in order to offer smaller classes and labs. This would allow the instructor to give students more individual attention and feedback. This would also allow for to implement more effectively active learning strategies.

The Physics Department also recommends investing in current physics equipment, replacing outdated and unrepairable equipment. It strongly recommends purchasing another set of laptops (32) which are updated and current with today's technology. Also, recommends improving the WIFI in the physics lab.

The Physics Department recommends developing a Physics Academy before each semester in order to get students “physics-ready” by reviewing essential math skills; and by introducing study skills, time
management skills and reading strategies essential to succeeding in physics.

The Physics Department encourages working with the Early Support Program, the Panther Learning Lab, and the STEM counselor and the Supplemental Instructor program to give support to students.

Reflecting on your observations and analysis from A.1 through A.4, what commendations do you have for your program?
SAME as above.

Questions About Previous Activities

Evaluate the success of each completed activity in Section D.1 (Previously Scheduled Activities) from your Spring 2017 PPA. What measurable outcomes were achieved? Did the activities and subsequent dialog lead to significant change in student learning or program success?

<table>
<thead>
<tr>
<th>Activity scheduled</th>
<th>What success has been achieved to date on this activity?</th>
<th>What challenges existed or continue to exist?</th>
<th>When do you expect this activity to be completed?</th>
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<tbody>
<tr>
<td>Activity 1</td>
<td>none</td>
<td>Funding</td>
<td>Feel hiring should be done as soon as possible</td>
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<tr>
<td>Hire Full-Time Physics/Astronomy</td>
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<tr>
<td>Instructor</td>
<td>Activity 2</td>
<td>Fall 2017 two SI’s were hired for PHY 4A. We’re not able to find qualified PHY 4B SI. Spring 2017, two SI’s were hired for PHY 4A. We’re not able to find qualified PHY 4C and one SI.</td>
<td>Funding</td>
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<td>Activity 3</td>
<td>Attend American Association of Physics Teachers (AAPT) meetings or other professional meeting or workshop.</td>
<td>Yes. The full-time physics instructor attends at least one professional meeting or workshop every year.</td>
<td>Finding the time to go to the meetings.</td>
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<td>Activity 4</td>
<td>Participate in the Early Success Program</td>
<td>Yes. Have continued with this program.</td>
<td>Having enough counselors to meet the program’s goals</td>
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<td>Activity 5</td>
<td>Purchase equipment to meet growing enrollments and laboratory needs</td>
<td>We have purchased some of the equipment in the list. Strongly need 32 laptops, and to update broken equipment. Also, need more equipment.</td>
<td>Funding</td>
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<tr>
<td>Activity 6</td>
<td>Continue to develop lab manuals for PHY 2B, 4B and 4C and update physics labs</td>
<td>ONGOING: Have revised/developed the PHY 2A and PHY 4B lab manuals. Need to update, revise and develop the PHY 2B and 4C lab manuals. All</td>
<td>Time</td>
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<td>Activity 7</td>
<td>The activity has been completed. Equipment is very expensive, so a lab has been adapted using PhET Interactive Simulation developed by the University of Boulder, Colorado.</td>
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<td>Activity 8</td>
<td>The activity has been completed with high schools from Salinas, but not the whole Salinas Valley</td>
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<tr>
<td>Activity 8</td>
<td>Time and funding</td>
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- **Activity 7**: Develop a Photoelectric Effect Lab
- **Activity 8**: High school outreach project on physics topics

Completed