



## IEC PROGRAM SUMMARY

<b>Academic Year</b> 12/13	<b>Program Name:</b> <u>Physical Sciences and Engineering</u>
	<b>Date of Review:</b> <u>2012-2012</u>

### Major Program Goals:

- Ensure the courses taught for general education students are meeting the criteria of quality instruction, at a college level, with appropriate standards of performance.
- Ensure classrooms and laboratory spaces are meeting the needs of the institution and of the student.
- Procure sufficient space to offer the increased number of course offerings by re-evaluation of room allocations in the science cluster.
- Make the campus community aware of the unique position of programs containing only transferable, lower-division university courses that are laden with multiple skill-based prerequisites.
- Increase the Engineering Program's visibility to the community and to Gavilan students not yet at the academic level of engineering courses
- Make sure instructors of prerequisite courses realize the definition of success has changed slightly to include sufficient mastery in the prerequisite course that the skills translate across discipline boundaries.

### Concerns/Trends:

- Lack of appropriate internship opportunities.
- Long pipeline of prerequisite courses in preparation for Engineering.
- Number of students who are prepared to enter the Engineering program.
- Campus awareness about the Engineering program.
- Facility scheduling challenges in science building cluster.

### Plans for Addressing Concerns/Trends:

- Further develop the Engineering Club and other outreach methods.

### IEC Recommendations:

- Since the submitted report was almost entirely focused on the Engineering program, increase involvement of other physical science disciplines in the development of future program plans and reviews.
- Coordinate with STEM, MESA, and Career center to identify appropriate internship opportunities.
- Regularly assess all course and program SLOs.
- Continue efforts to educate campus on the engineering program and the rigors of the corresponding pipeline.
- Develop an outreach plan and materials, utilizing the newly formed Engineering Club.



## PROGRAM EXECUTIVE SUMMARY

<b>Academic Year</b> 2011-2012	<b>Name of Program</b> <b>Date Reviewed</b>	<u>Physical Science/Engineering</u> <u>AY12-13</u>
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### EXECUTIVE SUMMARY

Gavilan College's Engineering Program has always been great for students! Every student who has completed our program in the last 22 years has transferred to a four-year school, graduated from that school, and is working in the field of their choice. Many women have completed the program. Our first student from the current cycle of offering engineering courses has been accepted to Cal Poly SLO to study Biomedical Engineering and will continue this tradition. There are over 20 students in the engineering pipeline at Gavilan College right now (Spring 2013) who are headed for transfer to study engineering. Based upon the size of our service area, the number of students in any one Engineering class will never be huge. However, the pyramid of students attracted to the college because of the engineering program is huge. The young people of southern Santa Clara and San Benito counties deserve high-quality education that will prepare them for transfer and success at a high-quality school so they can get a good job as an engineer in Silicon Valley and create good lives for themselves and their families.

There are two degree programs within the broader heading of Physical Sciences at Gavilan College:

1. Physical Sciences and Engineering. This degree is for students interested in Astronomy, Chemistry, Physics, etc. – any of the areas within the Physical Sciences that require calculus-based physics.
2. Physical Sciences and Engineering – General Engineering option. This degree is for students interested in any of the engineering disciplines (aerospace, chemical, civil, electrical, materials, mechanical).

In addition to these two majors, we offer a number of single courses with and without labs (Astronomy, Geology, Physical Science) to meet general education requirements for non-science majors.

Lastly, courses from this program are used by students to meet the requirements for A.S. degrees and for transfer in the Biological Sciences, pre-med, and nursing disciplines.

Unique elements of this program are 1) we don't offer any non-transferrable courses, 2) we only offer transferrable courses that are articulated at CSU and UC four-year schools, and 3) the majority of the courses we offer have lots of prerequisites that must be taken in order and require mastery of the prerequisite material before success is possible, i.e., many math courses are prerequisites for physics courses, physics courses are prerequisites for engineering courses. This last element has proven difficult for virtually all groups on campus to understand. Students don't understand the ramifications of falling "out of step" within the hierarchical prerequisite structure. Counselors sometimes prepare education plans for students that don't reflect the sequential order of classes based upon the prerequisite pathway, or don't acknowledge that these are "college level" transferrable classes and 18-unit semesters aren't practical. Lastly, faculty sometimes pass

students without demanding mastery of basic ideas and skills that are needed in the subsequent class.

An additional unique element is that before students take an engineering class they have needed to pass at least two semesters of calculus and two semesters of physics. When one looks at the size and/or composition of an engineering class, they must realize that the number of students they see in that class depends upon the ability of instructors of prerequisite courses in other disciplines (math and physics) to prepare students for enrollment in the observed class.

Engineering classes, because of the prerequisite structure, are only taken by students who have made it through a gauntlet of prerequisites and proven their abilities as successful learners – in contrast to many of the courses offered at Gavilan College where any incoming student is qualified.

The heavy prerequisite load for engineering also makes outreach difficult. Most students eligible to take calculus as college freshman are also CSU and/or UC eligible and have proven to be successful learners in high school and therefore go directly to a four-year school. Engineering students at Gavilan typically enroll initially unprepared for college level math courses and may have several years of prerequisite course work before taking an engineering course and being in the Engineering Program.

A final unique element is that many students in these “high-unit majors” do not graduate from Gavilan with an A.S.; their only goal is to receive a Bachelor’s degree from a four-year school. In the past two years there have been many accomplishments in bringing the engineering program back.

Equipment for laboratory classes has been purchased and is being brought online in the classroom with the assistance of a 0.3 FTE lab tech. The lab tech works only during the semester and is being paid with grant funds. All of the curriculum documents for all of the courses associated with the engineering program (physics and engineering) have been updated in accordance with statewide standards for the discipline.

Courses are being offered and we are looking at a cohort of about 28 students in Physics 4A (F 2013) many of whom are planning to become engineering majors at four-year schools. An Engineering Club has been founded at Gavilan and is fairly active. Appropriate advising documents have been provided to counselors, students, and staff describing the Engineering Program, its courses, and suggested pathways to transfer.

Chemistry offerings have grown to meet the needs of more students and new equipment has been integrated into the laboratory experience.

Supporting student achievement is the goal. Because it is a transfer program, it is essential that our students both transfer and be successful at their destination institution. To this end, classes are articulated, faculty are in contact with discipline faculty at typical destination institutions, adjunct faculty are hired based upon their familiarity with, and knowledge of, the demands and rigors of upper-division coursework and what is required from the lower-division to ensure success upon transfer, site-visits are made with students to show them what native lower-division students are doing and what their lower-division coursework at Gavilan is preparing them for. Also supporting student achievement is the implementation and integration of new laboratory equipment that has brought modern equipment and greater student/instructor interactions into the classroom.

STEM funds have supported all of the equipment acquisition, travel, and 0.3 FTE Physics lab technician.

Concerns for the Engineering Program are that the campus will fail to understand the second-order reasons for small classes that are unrelated to the Engineering Program itself and due to the rigorous preparation required before engineering courses are taken.

Trends for the program are hugely optimistic! The need for engineers remains great. Both large and small employers see the need to support the education of non-foreign engineers for both social and economic reasons. Our community base is a target population for many employers for their efforts to support education of their future work forces. With so many community college engineering programs in the Bay Area,

Gavilan's program in South Santa Clara county and San Benito is perfectly located to prepare the underrepresented students that are attractive to so many four-year schools and employers.

A goal for the broader program is to ensure the courses taught for general education students are meeting the criteria of quality instruction, at a college level, with appropriate standards of performance.

A second goal is ensuring classrooms and laboratory spaces are meeting the needs of the institution and of the student.

A third goal is to procure sufficient space to offer the increased number of course offerings by re-evaluation of room allocations in the science cluster.

A fourth goal is to make the campus community aware of the unique position of programs containing only transferable, lower-division university courses that are laden with multiple skill-based prerequisites.

A fifth goal for the program is to increase the Engineering Program's visibility to the community and to Gavilan students not yet at the academic level of engineering courses via the Engineering Club and a multiyear bridge program so they feel connected and also to infuse a greater campus awareness of the program.

A sixth goal is to make sure instructors of prerequisite courses realize the definition of success has changed slightly to include sufficient mastery in the prerequisite course that the skills translate across discipline boundaries.

Lastly, the most important goal is to ensure that we provide top quality instruction.