



## Natural Science: Physical Science Instruction

### Vision/Narrative

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, etc.).

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

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

Unique elements of this program are 1) that we only offer transferrable courses that are articulated at CSU and UC four-year schools, and 2) the prerequisite structure required for many of the classes. Many courses have sequential, hierarchical prerequisites that require mastery of the prerequisite material before success is possible, i.e., Inorganic before Organic Chemistry, and many math courses prior to physics courses prior to 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, education plans for students often don't reflect the sequential order of classes or that these are "college level" transferrable classes and 20-unit semesters aren't practical, and faculty are passing 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, for instance, 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 remain cognizant of the fact that the result of these observations depends to a great extent upon the ability of classes and instructors in other disciplines to prepare students for the observed class; engineering classes, because of the prerequisite structure, are frequently only taken by students who have begun to prove their abilities as learners – in contrast to many if not most of the courses offered at Gavilan College.

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. Native Gavilan Engineering students typically come in unprepared for college level math and need to understand they may have several years of prerequisite course work before taking an engineering course.

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 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 half-time lab tech. The lab tech works only during the semester and is being paid with soft money. 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 this semester (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 only goal. Because we are a transfer-oriented 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 insure 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. This is a huge task.

STEM I and STEM II funds have supported all of the equipment acquisition, travel, and half-time Physics lab tech.

Concerns for the Engineering Program is 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 regional program is perfectly located to prepare students that are attractive to so many four-year schools and employers.

## **Feedback from Supervisor / Dean**

The program did not list any objectives, activities, or requests.