# PROGRAM REVIEW REPORT
# June 2017

1. **Reporting Institution** Eastern Illinois University

2. **Program Reviewed** B.S. Engineering Cooperative

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## 5. Overview

The pre-engineering program at EIU has three tracks: (1) a non-degree two year program during which students complete the first two years of engineering curriculum and then transfer to an institution that offers an engineering bachelor's degree, (2) The B.S. Engineering Physics degree (which includes 14 additional hours of physics courses beyond the normal pre-engineering curriculum) and (3) the B.S. Engineering Cooperative Degree. With these latter two degrees students spend three years at EIU followed by two years at UIUC or SIUC where they complete their engineering degree requirements. Once the students receive their bachelor degree in engineering they are awarded a second bachelor degree from EIU. The difference between the B.S. Engineering Physics degree and the B.S. Engineering Cooperative degree is the character of the EIU coursework. This report addresses the B.S. Engineering Cooperative degree, which provides students the equivalent of the first two years of the typical engineering curriculum as well as a solid liberal arts education via the full general education requirements of EIU. The strengths of the EIU general education program give this program a unique structure, one that provides a great liberal arts education to engineers, a characteristic that has been identified as lacking in the typical preparation of engineers.

## 6. Major Findings and Recommendations

6.1 *Description and assessment of any major changes in the program*

(a) *changes in the overall discipline or field*

The engineering field has diversified, has become very interdisciplinary, and has expanded with the introduction of new technologies and their applications in society. The diversification and increasing interdisciplinary nature of engineering has little impact on the curriculum of this program, as the program provides education in a core of instruction common to all engineering disciplines.

(b) *student demand*

Collectively the pre-engineering programs at EIU generate the sixth greatest number of applicants and sixth greatest number of acceptances for enrollment of programs at the University. Although the number of students that complete the programs is not this large, students that leave the program by changing majors contribute strong students to those other majors at EIU. Students typically leave the program for one of two reasons. The first is that the students are unable to develop sufficient mathematical skills to progress through the engineering curriculum. The second reason is some students discover they do not have the desire to perform the quantitative problem solving tasks involved in an engineering career.

(c) *societal need*

The Bureau of Labor Statistics shows moderate to significant job growth in engineering fields through 2024. An increase in the nation-wide number of engineering majors has lagged significantly behind demand, so any increase in the number of well-trained engineers that can be provided is a positive contribution to society.

The *US News and World Report* states that there is high demand in Engineering. In the article, *STEM Roundup: Engineering Jobs in High Demand*, it is pointed out that not only are Engineering jobs currently in high demand and well salaried, they will continue in that way for the foreseeable future. There is a national need for a highly qualified, technically trained workforce and Engineers are generally at or near the top of the list.

(d) *institutional context for offering the degree*

The program specific courses are all courses that are required in the curriculum of other majors at Eastern Illinois University. As the enrollment in the offered sections of these courses has not reached its maximum, there is no increase in cost created by the existence of this program. In fact, the presence of the pre-engineering students in these courses significantly increases the revenue per cost ratio of conducting these courses.

The curriculum of this program is almost identical to the lower division physics major curriculum and significantly overlaps the chemistry major. Students that initially enroll in this program quite frequently switch to either the physics major or the chemistry major without needing to complete an additional year of education, helping to populate these majors.

The majors in this program quite often serve as tutors for either physics or mathematics, supplementing the faculty instruction for many of the introductory courses in both disciplines.

6.2 *Description of major findings and recommendations, including evidence of learning outcomes and identification of opportunities for program improvement*

Basic success for this program can be measured by the acceptance of students into programs that offer bachelor degrees in engineering. Over the period since the previous IBHE program evaluation, 100% of the students that have applied to other institutions to complete their engineering degrees have been accepted into one or more engineering programs.

A measure of the quality of the preparation the program provides can be gained by investigating the academic records of the students after they transfer to other institutions. A significant fraction of our students have one or more semesters during which they earn all "A" grades in their courses at UIUC, SIUC, and other institutions. In addition, we have been given feedback from students such as "I was better prepared for the upper division engineering courses than the students that spent their first two years at UIUC" and "The pre-engineering program has certainly served me well and has prepared me greatly for my engineering courses. I would not have been able to do as well as I have without it."

An opportunity for improvement is in the area of student recruitment. Many of our students make statements such as "I didn't even know about EIU or your program until a family friend told me about it". A faculty member attending a "Discover Engineering" night to at the College of DuPage to which he was invited was shocked to discover a large number of students and parents in attendance claimed to had never even heard of Eastern Illinois University and had no idea of its location.

A possible curriculum improvement that has been identified is the creation of a mechanics of solids course. This is typically a second-year course for students in mechanical engineering and related disciplines. The students in our program that haven't yet taken it before they transfer to an engineering program, are often delayed in taking other courses for which this course serves as a pre-requisite.

6.3 *Description of actions taken since the last review, including instructional resources and practices, and curricular changes*

PHY 1000 Engineering Seminar has evolved from a course in which students heard program descriptions from program heads at UIUC to a course in which students learn about the different disciplines in engineering, developing good study habits to become engineering majors, and program availability at different destination institutions.

6.4 *Description of actions to be taken as a result of this review, including instructional resource and practices, and curricular changes.*

Recruitment actions will be investigated. Ideas must be considered for cost effectiveness and must fit with the current financial limitations of the University.

An increase in the popularity of transfer to several institutions other than UIUC and SIUC for engineering degree completion provides motivation to seek additional formal cooperative degree agreements with institutions such as SIUE, UIC, and other institutions.

There are two courses taught in the curriculum, PHY 3150 and PHY 3270, that cover similar topics in different ways. Both courses together are required for transfer credit for the basic electrical engineering course at UIUC. PHY 3150 is a hands-on course and PHY 3270 is a theoretical course. Consideration is being given to combining the two courses into one to create a course with both lecture and lab components as a cost saving measure, without losing educational value.

Most curricula for mechanical engineering and related engineering disciplines include a second-year course in the mechanics of solids, which our course offerings lack. Adding a course in mechanics of solids to the curriculum would help students by not delaying enrollment in courses for which such a course is a pre-requisite once they transfer. However, at current enrollment levels, it is estimated a once-per-year course offering would only generate an expected enrollment of six to ten students.

PHY 1000 Engineering Seminar will continue to evolve to better serve the needs of the engineering students.

## 7. Responses to Institution-Assigned Issues

7.1 *What strategies has the department implemented that will support the Integrative Learning Experience at EIU?*

The physics department has developed a very structured curriculum for the pre-engineering program that exhibits inherent vertical integration. Daily coursework absolutely requires recalling knowledge gained from previous coursework at each step in problem solution.

The curriculum is structured in a manner that exhibits global integration. The concepts and skills learned in introductory calculus and physics courses are ubiquitous among all succeeding courses in the engineering curriculum. These skills are also brought to general education courses by these students, which allow them to view the materials covered in those courses in a different manner than other students.

The curriculum includes coverage of the basic laws of physics. A knowledge and understanding of these laws gives students a strong foundation for critical evaluation of the world around them. As the laws of physics are developed to describe the entire universe, there is no greater level of cosmic integration that can be provided.

Over the past several semesters, the PHY 1000 Engineering Seminar course has evolved from a "sit and listen" to external presenters course, to a course that provides reflective assignments and class discussions to provide elements of horizontal integration.

The department does provide extracurricular activities through the Society of Physics Students and Astronomy Club organizations, of which many of the pre-engineering students are members. The activities of these organizations provide many outside-the-classroom opportunities for the students that relate their classroom learning to everyday life.

7.2 *What one unique, noteworthy activity is the department involved in that will enable the IBHE to distinguish its program from other similar programs in the state?*

The Physics Department has a personal approach to each and every student. The class size gives faculty integral knowledge of the progress of each Pre-Engineering student. This leads to individualized instruction that helps students better understand the conceptually difficult curriculum. Faculty in the Physics Department are highly accessible to students. Furthermore, students are encouraged to participate in mentored research at the underclass level. Underclass student's participation in research endeavors is not the norm across Engineering programs nationwide so this helps to set EIU apart. Students who have participated in mentored research have won awards at the regional level for their work. All of this personal attention helps guide students through their academics, their professional growth, and the application process for continued study in Engineering. The outcome is that EIU students are highly successful in Engineering programs as discussed elsewhere in this report.

## 8. Outcome

**8.1** Decision:

___X__ Program in Good Standing

_____ Program flagged for Priority Review

_____ Program Enrollment Suspended

**8.2** Explanation

Dean's Comments

Consolidation of PHY 3150 and PHY 3270, along with development of a mechanics of solids course, seem good curricular program improvements with minimal additional resource expenditure. Given the placement success of the program, I strongly concur with the suggestion of developing formal cooperative agreements with other institutions, and encourage the department to work with the admissions staff to assist with this process. Working with admissions in recruitment efforts also is encouraged. The program is a solid path to an engineering degree and helps support other EIU programs. Given the projected job growth, student interest in the program should remain strong. One possible area to emphasize is bioengineering, as the growth in this field is expected to be quite strong and perhaps these students could draw on pre-health areas at EIU.

Provost's Comments

This has been a worthwhile program for Eastern bringing some students to campus who would not otherwise see Eastern as a programmatically viable choice. Moreover, the success rate of these students when they transfer to the University of Illinois or Southern

Illinois University has been very high indicating that their preparation at Eastern was of high quality. As the dean has noted, there maybe some new programmatic directions to consider. This will have to be done, however, in our currently highly constrained fiscal environment.