Undergraduate Curriculum Committee Proposal

Creation of a Pre-Engineering Program

The College of Engineering (COE) proposes to create a Pre-Engineering Program for entering University of Arizona (UA) students that typically require additional course selection and professional advising. This creation of the program will enable the College Academic Affairs office to better track students that often need additional help to be successful in completing an engineering degree. We note that "Pre" programs exist at UA in a broad array of fields including business, education, computer science, pharmacy, and nursing. Also, this approach is used at many engineering programs across the country including Purdue, Illinois, and Georgia Tech.

Currently, any student meeting University entrance requirements can sign into the COE as long as they meet the additional math requirements of 1/2 unit of trigonometry. The first two years of COE programs pre-dominantly cover basic math and science (calculus I, II, III and differential equations, chemistry I and II, physics I and II), some basic engineering (one freshman course and up to 4 sophomore engineering science courses), and general education. It should be noted that the majority of the engineering content in the major is in the 3rd and 4th years. The first two years of material is demanding and many students decide to move from engineering to other programs during these first two years. These transfers occur for a variety of reasons including:

- Student’s lack of interest in engineering as a major/career coupled with a gain in interest in another major/career
- Student’s discovery that his/her aptitudes are in other majors
- Mismatch between the student’s learning style and the method(s) that engineering is currently taught (causing poor academic performance)
- Student’s feeling that nobody is interested in their success in engineering

By creating a pre-engineering program we will be able to better mentor students from a central office. Our program will include a 1-unit course to show students the variety of opportunities in engineering, and to guide students having difficulty in areas in the college and university where they can get help (the 1-unit class will be open to all students regardless of whether or not they are in pre-engineering). Students will pass from pre-engineering to an engineering degree major only when they have shown ability and interest that suggest that they will be successful in that major. In this system, we take pressure off of department advisors in that they will not be dealing with as many struggling students as many of these will be handled by the College pre-engineering advisors.

The program will dovetail with the current advanced standing requirements in the COE. The faculty members and administration in the COE believe that this is an excellent strategy for reducing some of the advising load on the departments (AME and ECE in particular - where most students start) and for providing students with a better educational program.
Proposed Program

The faculty members of the COE propose the following entrance structure to the college:

New students can enter the COE in their chosen major immediately upon admission to the UA as long as they meet one or more of the following criteria:

- SAT score greater than 1250
- ACT score greater than 26
- 3.6 unweighted GPA in the 16 required courses (on a 4.0 scale)
- Top 15% class rank

New students can enter the Pre-Engineering program in the COE immediately upon admission to the UA as long as they meet one or more of the following criteria:

- SAT score greater than 1050
- ACT score greater than 23
- 3.0 unweighted GPA in the 16 required courses (on a 4.0 scale)
- Top 25% class rank

We note that the current ENGR admission standards are exactly the standards for admission to the pre-engineering program, hence no student that was currently admitted will be denied. Our research on the impact of this program is that 30% to 40% of entering students will be in the Pre-Engineering program (scanned cohorts back to Fall 2001 to make this estimate. In 2005 39% of the students would have been in pre-engineering).

Students in the Pre-Engineering program will be advised using the College advisors rather than department advisors. These students will be advised to enroll in a 1-unit "engineering fields" course where we will explore the various fields of engineering, "success skills" for studying engineering, and the history of engineering. This course will also be open to students in the traditional majors, however the Pre-Engineering program is the target audience. Since mechanical engineering and electrical/computer engineering currently have the majority of the ENGR students, one of the goals of the course is to show students that there are significant professional and educational opportunities in some of the less popular (less well known) departments.

Students can move to the traditional programs as early as the end of their second semester after demonstrating progress towards their chosen program. We will require that the student be meeting the major advanced standing requirement with the all quantitative based and some of the non-quantitative based first year courses. This list includes the following:
• Math 124/125 (3/5 units)
• Math 129 (3 units)
• Chem 103a (3 units)
• Chem 104a (1 unit)
• Chem 103b (or MSE 110 or MCB 181) (3/4 units)
• Chem 104b (MSE 110 and MCB 181; students do not take) (1 unit)
• Physics 141 (4 units)
• Engineering 102 (3 units)
• Engineering 170 (or ECE 175) (3 units)
• English 101 (or English 103 or English 107 or English 109) (3 units)
• English 102 (or English 104 or Encl 108) (3 units)

**Total** 30/32 units

We note that this is approximately half-way to our advanced standing unit levels (end of the 2nd year). These courses are required in all COE majors with the exception of entry level computing (Engineering 170/ECE 175). For students entering majors that do not require an entry level computing course, we will use the above list with Engineering 170/ECE 175 deleted. The advanced standing requirements of our programs already use a GPA based on a selective set of classes (typically the ones listed above plus sophomore level math, science, and engineering classes). Here are the current advanced standing requirements:

• Aerospace and Mechanical Engineering 2.500 (select set of classes)
• Agricultural and Biosystems Engineering 2.000
• Chemical and Environmental Engineering 2.250
• Civil Engineering and Engineering Mechanics 2.250
• Electrical and Computer Engineering 2.750 (select set of classes)
• Engineering Management 2.000
• Engineering Mathematics 2.250
• Engineering Physics 2.000
• Hydrology and Water Resources 2.200
• Materials Science and Engineering 2.000
• Mining and Geological Engineering 2.000
• Optical Sciences & Engineering 2.500 (select set of classes)
• Systems and Industrial Engineering 2.000

As an example, consider a student that enters Pre-Engineering, takes classes for 1-year and has a 2.4 GPA in the 30 credits listed above. That student will then be qualified to move into all COE majors with the exception of Electrical and Computer Engineering, Optical Sciences and Engineering, and Aerospace and Mechanical Engineering (using present advanced standing GPA requirements). The student will then have the option of moving to a major or continuing in Pre-Engineering (taking sophomore level classes) to try and raise their GPA to the required level. If they choose to stay in Pre-Engineering,
we can monitor progress and give advice about their potential success relative to each COE major.

Students that do not come to the COE ready to take calculus, are at a serious disadvantage. Since they cannot take calculus, they also cannot take Engineering 102 and Engineering 170. Essentially they are delayed entry to even the earliest classes. Since physics follows calculus, they are delayed here as well. There are students that have completed engineering degrees by following the path of starting in Pre-calculus (Math 120) or even College Algebra (Math 110), but they are rare. This is approximately 20% of our students (based on historical numbers). We envision that these students will generally be in pre-engineering. Courses not on the list (for example Math 110) will not be used in the GPA calculations for moving from pre-Engineering to the traditional majors. Also, the credits in these courses will not be counted against the student for determining when a student must leave pre-engineering (see next paragraph).

No student will be permitted to stay in the Pre-Engineering program beyond the end of his/her taking 50 units (not including courses that must be taken before Math 124/125 or any other deficiencies such as English 100 or English as a second language). At this point, students must either move to an ENGR major or move to a major in another college. Historically, students that do not persist in engineering leave by this time so we do not envision this credit limit to be a critical constraint for students. The 50 unit limit will still enable students to enroll in University School as they will be below the 54 unit limit.

We note that Pre-Engineering students will not be given advanced standing; they will simply be admitted to a major. Once accepted to a major, that major will assume the role of the advisor. To achieve advanced standing, the student will still have to meet the above requirements at the end of the 4th semester.

Also, any Pre-Engineering student on probation (GPA less than 2.0) will remain with the College advisors and this will enable us to give this student special attention (academic contract, additional advising help, referral to other programs).

Provisions for Transfer Students

Transfer students that come in with less than 12 credits will be enrolled in majors or pre-engineering based on their high school record and hence will be treated like new students. Students that are beyond 12 credits will be admitted to their chosen major immediately if their transfer work satisfies the advanced standing requirement for the major in the freshman subset as noted above. For example, a transfer student from a community college with a 2.8 GPA overall and a 2.4 GPA in the entire engineering subset of classes described above cannot enter electrical engineering or mechanical engineering, but could enter systems and industrial engineering. If a student has not yet completed the entire engineering subset of classes, then they must enter the College through pre-engineering. These students will also be advised to take the 1-unit exploratory course.
Implications of the Change

Students – There will be no change for students that meet the new criteria. Students that must go through Pre-Engineering will:

- have a College advisor (rather than a Department advisor),
- have the opportunity to sign up for ENGR 195s
- be monitored for moving into degree programs at the end of their first year

Faculty – Faculty will not advise Pre-Engineering students and will not have to deal with many of the pre-advanced standing probation students. This will certainly transfer advising time from the Departments to the College. We will not let unqualified students enter majors, thereby alleviating the Departments of the need to tell extremely persistent students “no.”

Resources – This program will help balance the load between majors in engineering. With a better program for explaining the different fields of engineering, students will have more knowledge and find better fits for their interests. We have a college level advisor now that is dealing with “no major selected” and this plan will expand that student base. We are prepared to teach the 1-unit class and, if it works well, will reduce our needs for other retention strategies.

Other Programs – We see no increase on other programs outside of Engineering and if all goes well, we will retain more of our students. We already graduate students at the UA is the highest percentages (but just not in Engineering!). With special attention and a bit of programming geared towards “high risk” students, we believe that we can improve our retention.
Course Design – Engineering 195s – What is Engineering? (1 credit)

Instructor – Dr. Jeff Goldberg

Grading – P/F based on attendance – 3 or fewer unexcused absences to pass the course

Goal – The goal of this course is to show students what engineers do upon graduation. In particular, we will focus on some of the lesser known engineering disciplines and non-traditional application areas. Classes will be led by instructors from the different engineering programs, professionals in the field (including recent graduates), current upperclass engineering students, and undergraduate advisors. By the end of the class, students should have a clear picture of what engineers do and should be able to choose a particular major within the College or choose another major within the University.

Course Structure – The class will meet weekly in seminar style. Class participation will be encouraged. The topics for each week are:

Week 1. Welcome to the College – What majors do we have – what services does the Dean’s office provide – where can you get help and advice
Week 2. What do engineers do? Engineering in your daily life
Week 3. History of Engineering – Hoover Dam
Week 4. History of Engineering – Space Shuttle
Week 5. Effective “Studenting” – How to be successful at the UA
Week 6. Engineering Majors
Week 7. Engineering Majors
Week 8. Advising – What are you taking next semester? Next year? – Structure of our curricula
Week 9. Engineering Majors
Week 10. Engineering Majors
Week 11. New on the job? – What you can expect in your first 2 years out
Week 12. Diversity in Engineering – Multi-Cultural Engineering Program
Week 13. Professionalism – student professional societies
Week 14. Project Cubs and REU’s – MicroVehicle, Solar Car,
Week 15. Student Projects – Senior Project Presentations