# Pre-Engineering Programs: A Seamless Approach to Connecting K-12 to the University

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Abstract

Valencia Community College offers the fundamental engineering classes needed for all engineering programs. In addition to the standard AA in pre-engineering, a more specialized AA is offered in pre-engineering. Credential requirements for engineering professors at Valencia include a minimum of a Master's degree in engineering. Valencia also offers an "Introduction to the Engineering Profession" class centered on the introduction to students of the different engineering fields available to them. This program has been highly successful and the variety of participating speakers has significantly contributed to that success. Valencia is currently exploring the requirements to obtain ABET accreditation to increase the viability of our pre-engineering programs. The college has a broad diversity of students attending our classes reflecting the diversity of the local population at large in the Orlando area. Valencia has been successful in recruiting and helping engineering students by obtaining a variety of grants, scholarships and assisting in internships with industry to assist them in pursuing their ultimate goal of becoming engineers.

It is well known that there still exists a major shortfall in the supply and demand equation for engineers in the American workforce, particularly with software/hardware engineers as part of a nationwide shortage of technical talent in general. Virtually all technical sectors currently have a strong demand for engineers[1]. Valencia Community College is responding to a strong need for graduating engineers by providing the fundamental engineering classes needed for all engineering programs such as Engineering Analysis-Statics, Engineering Analysis-Dynamics, Probability & Statistics for Engineers, Principles of Electrical Engineering. In addition Valencia provides an "Introduction to the Engineering Profession" class, designed to assist students with their career paths through guest speaker presentations. The demand for graduating engineers is as high as ever. One indicator is the increasing hiring of foreign employees to fill the gap in the supply and demand of the engineering workforce. There actually appears to be a decline in the number of graduating engineers while the demand has remained constant or even increased slightly in the last few years.

Yet not all students are ready academically or financially to start in an engineering program at a four year university. Many cannot afford to go to school full time and take engineering classes with less than a full academic load.

Valencia Community College has one of the highest graduation rates in the nation for minorities, ranking 20th in the nation for all minorities, ranking 13th in the nation for Hispanics. This trend is also evident for students who have declared an engineering Associate in Arts degree. Looking at a snapshot picture of the Fall semester of 2000, we see that Valencia had a 23% Hispanic, a 15% African-American, and a 14% women representation among engineering students. It should also

be noted that Valencia ranks second in the nation in Associate in Arts degrees awarded out of more than 1,100 colleges (ten of the top 12 largest producers of Associate in Arts degrees in the nation are Florida community colleges, underscoring the strength of Florida's 2+2 system). With more than 37,000 credit students, Valencia is bigger than neighboring four-year university, UCF. The college has more than 11,000 Continuing Professional Education students.

The principal advantages offered to the pre-engineering student include:

a) Lower tuition costs than a four-year university.
b) High availability of faculty for student assistance with tutoring/mentoring.
c) "Customer-oriented" smaller class sizes (more flexibility offered with day and evening classes).

Two pre-engineering programs are currently offered:

1) A standard AA in pre-engineering with the required Calculus and Calculus-based Physics courses.
2) A specialized AA in pre-engineering designed for students who will transfer to the University of Central Florida (UCF). This AA includes five engineering courses, which are transferable to UCF via a formal articulation agreement. This agreement entitles the engineering student at Valencia to be automatically accepted into the engineering program of their choice at UCF. The requirements worked out between Valencia and UCF include:

    a) ABET course control documents prepared by the UCF College of Engineering must be used for defining these courses.
    b) The current UCF College of Engineering syllabus for each of these courses must be used to describe the contents of that course. Copies must be kept on file of graded exercises.
    c) Qualified Valencia faculty (master's degree and 18 hours within engineering) may teach these courses provided they are certified by the UCF College of Engineering as meeting ABET and SACS requirements for faculty[2].

Valencia is also currently working on an improved articulation agreement with the University of Miami. This agreement should be in place by June 2001. One of the key goals of our pre-engineering program is to achieve our own ABET accreditation. This would ensure our viability in the future by increasing Valencia's credentials and especially expanding the choices of "follow on" four year universities for the engineering student beyond two articulation agreements with local universities. This goal is currently being pursued by Valencia's engineering faculty. This would also potentially give us the opportunity to expand on the current engineering courses offered (such as a "Strength of Materials" course).

Another goal of the pre-engineering program is to increase the already strong connections Valencia Community College has with the local high schools. The purpose of this is two-fold:

1) Increase the opportunity for recruitment.

2) Increase the awareness of high school juniors and seniors to the alternative opportunity we offer to commence their engineering education with us. Valencia currently has several "connection" events with the high schools in the surrounding counties, and we plan on increasing the scope of those events. These include day and night time events where high school students get the opportunity to meet one-on-one with Valencia engineering faculty and faculty in other disciplines to get exposed to what engineering is and what it entails as far as high school and college prerequisites. This also gives the student a vital early focus on what his or her goals are whether in the engineering field or not.

Another tool available to us to help the student in engineering successfully bridge the gap between high school and a four-year institution is our scholarship/grant program through the National Science Foundation. A $109,000 NSF grant is currently available primarily for minority students and is being heavily utilized by those students. This grant is complementary and in addition to the Pell Grant program. The NSF grant helps the student achieve a desired amount of funding in a community college setting. After the NSF funding years, the intent is to have the college foundation raise monies to continue the scholarship program. In order to qualify for this grant, the student must be enrolled full time in the A.A. Pre-Major for Engineering Program and have academic merit (a 2.5 minimum GPA in high school and a 3.0 GPA in engineering-related coursework). This program has been a key ingredient in giving underrepresented minority groups an opportunity to be successful as engineering students.[3]

To cement the student's desire to continue to pursue the engineering field, another final incentive program is offered: the Internship program through Valencia's ties to local industry and the business community. This program allows the student to measure qualitatively what he or she has learned as an engineering student by becoming a part-time employee for a mutually selected company. This provides the student with invaluable practical experience and gives him or her a more concrete idea of what a future career might be like while earning a small compensatory wage in the process. An engineering faculty member monitors the progress of the engineering student both through regular contact with the student and the employer on site.

Bibliography

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