

Articulated Pre-Engineering Programs: How Community Colleges can be Effective Partners with Universities to Deliver Engineering Curriculum to Students

**Dr. Gaby Hawat, Hank Regis
Valencia Community College**

Abstract

Valencia Community College (VCC) offers, in addition to the standard general education pre-engineering Associate of Arts degree, a pre-engineering curriculum including the fundamental engineering classes needed for all engineering majors. Engineering students have the option of pursuing a general degree in pre-engineering or the more specialized articulated AA degree where those fundamental engineering classes (such as Introduction to the Engineering Profession, Statics, Dynamics, Engineering Graphics, Probability and Statistics for Engineers, Principles of Electrical Engineering) will transfer to a four-year university. VCC currently has two articulated agreements in place sanctioning the college's ability to offer engineering courses for transfer credit. One is with the University of Central Florida, the other and most recent is with the University of Miami. In addition, Valencia offers a two-year Associate in Science degree in Electronics Engineering Technology. This program is designed for students who seek immediate appointment in the fields of Electronic Engineering Technology. However, students who decide to continue to a four-year university can transfer those credits (due to articulated agreements) to Florida A & M University, the University of Central Florida or the University of West Florida to complete a bachelor's degree in Electrical Engineering Technology. These agreements detail which courses can be taught by Valencia Community College, the guidelines to teach these courses, including credentialing requirements, and rules governing the transfer of credits. All these programs have been highly successful in giving the opportunity for students, especially disadvantaged students, to pursue an engineering degree. Valencia, due to these articulated agreements, has been successful in recruiting and helping many engineering students. Assistance to students has included the awarding of a National Science Foundation grant to financially struggling students, as well as scholarships specifically offered to Valencia students who transfer to the University of Miami after completing their pre-engineering AA degree. In addition, internships with industry have contributed to giving pre-engineering students an opportunity to achieve their ultimate goal of becoming engineers. Valencia's engineering staff are professionals in their respective fields, and their accessibility to students and educational experience have been a key in making the pre-engineering program at Valencia successful.

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 engineers¹. Valencia Community College is

responding to the 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. Through the use of articulated agreements, Valencia Community College has been able to join in the effort to educate those engineering students in the fundamental courses common to all engineering curriculum. The engineering student attending Valencia has the choice to complete their engineering degree at the University of Central Florida or the University of Miami. The articulated agreements guarantee the transfer of the engineering courses taken at Valencia as long as all conditions of the agreements are met. 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 2001, we see that for the articulated pre-engineering program, Valencia had a 22% Hispanic, an 11% African-American, an 11% Asian-American and a 13% women representation among engineering students. For the general pre-engineering program, the college had a 25% Hispanic, a 13% African-American, a 7% Asian-American and an 18% women representation. 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) and the University of Miami (UM). This AA

includes five engineering courses, which are transferable to UCF/UM via formal articulation agreements. These agreements entitle the engineering student at Valencia to be automatically accepted into the engineering program of their choice at those two institutions. The requirements worked out between Valencia and the universities include:

- a) ABET course control documents prepared by the UCF College of Engineering must be used as a model for defining these courses.
- b) The current UCF and UM College of Engineering syllabi for each of these courses are used as models 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 meet credentialing requirements for faculty².

The articulated programs are also used to:

- 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 at VCC. 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. This increases the students' exposure 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. This year, Valencia has significantly increased our participation with the local high schools, including among other events participation in the Annual Orange County Science and Engineering Fair held February 2002.

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 students³. This program has seen increased student participation this year thanks to increased advertising by faculty and financial aid counselors.

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. This program has suffered this year from the worsening local economy, which has impacted the availability of internships. As the economy improves, Valencia expects this program to bounce back to hiring levels previously reached in 2001.

Bibliography

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Dr. GABY N. HAWAT

Dr. Hawat holds Bachelors and Masters degrees in Electrical Engineering, a Doctorate degree in Higher Education, and is also a graduate of Harvard University's Management Development Program. Dr. Hawat is currently the Dean of Engineering and Technology at Valencia Community College and has extensive experience working with High Tech industries in Central Florida

HANK REGIS, P.E.

Hank Regis is currently a full time Professor of Engineering at Valencia Community College. He received his B.S. in Mechanical Engineering from Auburn University in 1980. He served in the Navy as an Engineering Duty Officer, earned a Master's degree in Mechanical Engineering from the Navy Post Graduate School in Monterey, California. He obtained his Professional Engineering license in that state.