

A Collaborative Electrical Engineering Program through Distance Education

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Abstract

This paper describes a Collaborative Electrical Engineering Program that has recently been implemented under a three-way agreement among University of Maryland Eastern Shore (UMES), Salisbury University (SU), and University of Maryland College Park (UMCP). Under this agreement the students at UMES and SU campuses in a relatively remote location on the Eastern Shore of Maryland can obtain an ABET-accredited professional engineering degree from UMCP without having to relocate from the region. All of the first two years sequence of engineering courses is delivered live at UMES and SU by faculty members in the Mathematics, Physics/Natural Sciences, and Engineering Programs at the two campuses. Most of the junior and senior level classes are offered over interactive video network (IVN) by UMCP engineering faculty members to UMES and SU campuses for the students attending the Collaborative Program. All the laboratory courses and capstone designs are taught on-site at UMES.

Introduction

Collaboration between universities across programs is not new. There are several models where the programs are structured such that students receive a degree from each of the participating universities¹. Dillard University in New Orleans Louisiana has a collaborative program with Southern University Baton Rouge Louisiana where the Engineering degree is awarded at Southern while the student attains a Physics degree from Dillard University. Southern University in Baton Rouge has various collaborative degree programs with Louisiana State University Baton Rouge where the aim is to offer the students the opportunity for a dual degree. In some cases, the objective is to develop the necessary experience at the collaborating university to eventually be independent. In most of these collaborations, the delivery system has been traditional on campus classroom lecture, which results in the basic assimilation of the students in their new environment.

The Eastern Shore area of Maryland has traditionally been deprived of access to accredited engineering programs. As a result of this shortfall, the Maryland Eastern Shore

area as part of its objective decided to improve access to engineering programs for students in the Eastern Shore that are geographically tied by economics, family, or jobs; particularly the non-traditional students who cannot avail themselves to access the state universities with engineering programs. The non-existence of an engineering school on the Eastern Shore coupled with the constant demand for skilled workers in the area resulted in the collaborative program between UMES, SU and UMCP. These demands were well documented in the form of the results of the industry survey conducted by UMES/SU. The survey result shows that 95% of the respondents indicated that they would support the development of a cooperative engineering program at UMES/SU. The chosen engineering programs are electrical engineering and mechanical engineering with 65% and 45% need for the respective programs. The premise for the collaborative program is to use technology to access the remote areas while maintaining a means of measuring both quality of service and quality of the resulting product. It requires the participating universities to coordinate schedules as well as validating the curriculum requirements consistent with the degree granting institution's academic standards.

The University of Maryland Eastern Shore has been part of the higher education community since 1886. It is a Land Grant Institution and Historically Black University located in the lower Eastern Shore of Maryland. The student body is about 75% African-American and Black and over 51% are female. There are approximately 125 full-time tenured and tenure track faculty, of which 86% have terminal degrees. The campus occupies over 1000 acres. During the last seven years, the campus has been under heavy construction for expansion and improvement of facilities. The student body is continuously increasing in numbers and in quality. Student enrollment has more than doubled in the last twelve years. The university offers Bachelor of Science degrees in twenty-six, Master degrees in six, and Doctor of Philosophy degrees in four programs.

UMES Engineering Program has been offering and continues to offer the first two years of an engineering sequence. All UMES students were required to transfer to UMCP or other engineering schools to complete their engineering degree in the past. However, four-year Electrical Engineering Degree Program has recently been approved under a three-way collaborative agreement among UMES, SU, and UMCP. Upon successful completion of the Electrical Engineering discipline, the student will receive a Bachelor of Science in Electrical Engineering from College Park. In addition, other engineering programs may be pursued through the five-year UMCP plan for cooperative engineering education which combines classroom theory with career-related work experience.

Collaborative Distance Education Program

This unique program is founded on the premise of sharing resources among the collaborating institutions and builds on the strengths of UMES, SU, and UMCP. The model combines the advantages of distance education and the conventional teaching environment and provides a unique means of offering quality engineering education to remote locations in the eastern shore of the state of Maryland and serves the needs of minority students that attend UMES. Specifically, there is a genuine interest in the Eastern Shore to provide quality engineering education for those who otherwise as a

result of their jobs and other reasons cannot relocate to pursue engineering education elsewhere. This program while not a total solution provides these categories of individuals the opportunity to pursue their desired career objectives.

Under this agreement the students at UMES and SU campuses in a relatively remote location on the eastern shore of Maryland can obtain an ABET-accredited professional engineering degree from the prestigious Clark's School of Engineering at College Park without having to relocate from the region. The students are required to take most of the first two years sequence of engineering courses delivered live at UMES and SU by faculty members in the Mathematics, Physics, Natural Sciences, and Engineering Departments at the two campuses. Most of the junior and senior level classes are offered over interactive video network (IVN) by engineering faculty members at College Park to UMES and SU campuses for the students attending the Collaborative Program. All the laboratory courses are taught on-site at UMES and SU.

The Electrical Engineering Program is founded on the basic sciences and emphasizes the development of a high degree of technical competence. It integrates basic sciences, including mathematics, physics, and chemistry; engineering design which applies the science elements into the creation of systems, components and processes while optimizing resources; and humanities and social sciences as a part of the general education requirements. The program lays a broad base for continued learning after college in professional practice, in business and industry, in public service, or in graduate study and research.

Goals of the Program

The major goals of the collaborative electrical engineering program are:

- To create a unique means of providing quality engineering education to remote locations on the eastern shore of the state of Maryland
- To utilize and share the resources that exist at the Maryland higher education institutions
- To strengthen the collaborative activities of the UMES, SU, and UMCP
- To serve the needs of the minority students that attend UMES
- To provide professional development and continuing education opportunities for engineers working in remote areas of the Maryland
- To help the local industry and government agencies by developing engineering potential in the area

As the collaborative agreement is implemented, there are some obvious and some not so obvious technical difficulties that arise which when resolved, form the basis for further review and improvement of the process.

Facilities

To have a successful new engineering program, it is important to develop a climate that fosters professional development and professional activities consistent with the ongoing efforts for restructuring engineering education for the new millennium through modern technologically-based laboratory and computing facilities.

Thus, the success of any engineering program depends on quick development of the laboratory facilities to support the experimental work and engineering innovation by the students and faculty. While the existing facilities are being discussed further, UMES anticipates improving the quality of the collaboration through the introduction of a new building that will facilitate the implementation of the objectives of the collaborative agreement. It will also allow UMES to develop similar agreements for other engineering disciplines as more experience is acquired through this process.

i. Interactive Video Network (IVN) Classroom

The Interactive Video Network Classroom consists of interactive video and multimedia equipment, which can transmit compressed digital data between UMES and UMCP through dedicated fiber optic lines. The fiber optic delivery provides two-way real time communication with a satisfactory picture quality. The INV classroom is equipped with video cameras, monitors, microphones, a document camera, a system computer, VCR's, and a telephone line.



ii. Circuit and Electronic Lab

The laboratory is mainly used for courses related to analog and digital electronics, logic circuits, and computer interfacing. The circuit and Electronic laboratory can accommodate ten students, with two per stations. Each station has been outfitted with a Hewlett Packard Oscilloscope, Logic Analyzer, DC variable voltage power supply, Multimeter, and Frequency/Function generator. At the heart of the setup is a HP Pavilion

9600 Multimedia PC, equipped with a 15" flat screen monitor, Polk Audio speakers, LaserJet printer, and full integration with the campus's internal network. This allows for Internet access and database sharing with other computers. Although the lab is open to all Electrical engineering students, it is primarily used for Sophomore and Junior level courses.



The circuit and electronic lab is available online and can be access through the following link:

<http://electronicslab.umes.edu/>

iii. Computer Lab

The computer lab is equipped with five SUN workstations and a network of fifteen Personal Computers for programming and design applications. Software on the computers includes ProEngineer, Borland C++, PSpice, MATLAB, AUTOCAD, Electronics Workbench, Macromedia Flash, Dreamweaver, and Fireworks.



iv. Advanced Communication Lab

The advanced communication lab³ is used for junior and senior level laboratory courses in the area of communication and signal processing. There are two stations for performing experiments in digital and analog communication, two stations for Fiber Optics experimentation, two stations for Microwaves, and one station for Telephony. All the stations are equipped for Digital Signal Processing experiments. The stations are equipped with various educational communication modules from LabVolts and measurement and test equipments from HP. The test equipments in the lab consist of Network Analyzers, Oscilloscopes, Logic Analyzers, DC variable voltage power supplies, Multi-meters, Frequency/Function generators, and PCs.



The advanced communication lab is available online and can be access through the following link:

<http://communicationslab.umes.edu/>

Admission Requirements

The Engineering Program limits enrollment through a selective admission procedure. SAT scores, high school or college grades, and preparation in mathematics and science required for admission to the Engineering Program are substantially higher than those required for admission to UMES.

UMES Freshman or transfer applicants who do not meet the direct admission requirements as engineering majors can be admitted to the department as '*conditional*' engineering majors. These students will be subject to two reviews. A student must complete all Math courses with a grade of "C" or higher and have a minimum overall GPA of 2.5 for automatic removal of the conditional status on the first review.

Curriculum

The prerequisites, contents, and syllabus of courses in the collaborative electrical engineering program at UMES are exactly the same as their counterparts at UMCP. The following table shows the recommended course sequence of the program.

FRESHMAN YEAR FIRST SEMESTER			FRESHMAN YEAR SECOND SEMESTER		
CHEM 111H	Chemistry I	4	CHEM 112H	Chemistry II	4
MATH 112	Calculus I	4	MATH 211	Calculus II	4
ENES 100	Intro. to Engg. Design	3	PHYS 161	General Physics	3
ENGL 101	Basic Composition I	3	ENEE 114	Prog. Concepts for Engg.	4
			ENGL 102	Basic Composition II	3
TOTAL		14	TOTAL		18
SOPHOMORE YEAR FIRST SEMESTER			SOPHOMORE YEAR SECOND SEMESTER		
MATH 212	Calculus III	4	MATH 321	Differential Equations	4
PHYS 262	Physics II	4	PHYS 263	Physics III	4
ENEE 241	Numerical Tech. In Engr.	3	ENEE 204	Basic Circuit Theory	3
ENEE 244	Digital Logic Design	3	ENEE 206	Digital & Circuits Lab	2
	General Education	3		General Education	3
TOTAL		17	TOTAL		16
JUNIOR YEAR FIRST SEMESTER			JUNIOR YEAR SECOND SEMESTER		
MATH xxx	Advanced Elective Math	3	ENEE 306	Elect. Circuits Design Lab	2
ENEE 302	Analog Electronics	3	ENEE 312	Digital Electronics	3
ENEE 322	Signal & System Theory	3	ENEE 324	Engineering Probability	3
ENEE 380	Electromagnetic Theory	3	ENEE 350	Computer Organization	3
	General Education	3	ENEE 381	Elect. Wave Propagation	3
				General Education	3
TOTAL		15	TOTAL		17
SENIOR YEAR FIRST SEMESTER			SENIOR YEAR SECOND SEMESTER		
	General Education	6		General Education	3
	Advanced Elective Lab	2		Advanced Elective Lab	2
	Technical Electives	9		Technical Electives	9
TOTAL		17	TOTAL		14

Conclusions

The collaborative distance education electrical engineering program at UMES provides students at a remote campus with the opportunity of having the same educational experience and access to the faculty and facilities of a large university. In this program, class sizes are small and students have more access to faculty and facilities. Also, students have advantage of living in small town and therefore have more time for their education. The success of the students in the program will be measured not only by their graduation rate but also by the success of the day to day operation of the distance education component. The student's ability to access their professors and teaching assistants from the remote site is a key component in the process. UMES is at a learning curve in responding to the challenges that this unique opportunity provides. The collaborative program is an economical solution to extend the educational resources of a flagship university to remote areas.

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