

## **2 + 2 + 2 Equals Educational Pathways Without Limitations**

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### **Abstract**

One of the concerns of students entering into an engineering technology program is the possibility of educational limitations due to their choice of major. At the University of Maine, we have developed a pathway that allows for successful transition from an Associates Degree in Electrical and Automation Technology to a Masters Degree in Electrical Engineering.

This paper will discuss the details of the current articulation agreements between the University of Maine Electrical Engineering Technology (EET) program, the University of Maine Electrical and Computer Engineering (ECE) program and the Eastern Maine Technical College Electrical and Automation Technology program. It will also discuss the current process to develop a similar pathway in information technology.

### **Previous Issues**

Traditionally, Maine students had three specific paths to pursue degrees in electrical engineering that weren't related. The path they chose was dependent upon their high school credentials and often upon their socio-economic background. They could pursue an Associates degree in Electrical and Automation Technology at one of the states' technical colleges, a Bachelors Degree in Electrical Engineering Technology at the University of Maine or a Bachelors Degree in Electrical Engineering at the University of Maine. If the student chose wisely, they could find the program best suited to their needs.

Unfortunately, students are forced to make that decision at a very young age. Traditional students are forced to make their decision at roughly seventeen years of age. With so little life experience, students often find themselves in the wrong program.

In the past, this would leave them with years of credits and expenditures that could not be applied to an alternate program. A student who completed a Bachelors Degree in Electrical Engineering Technology would not be able to pursue a Masters Degree in Electrical Engineering. Also, a student who completed an Associates Degree in Electrical and Automation Engineering Technology at Eastern Maine Technical College would have no idea which credits might transfer into a Bachelors Degree program at the University of Maine. This confusion created barriers between the programs that adversely affected students.

## Formal Articulation

The first step to breaking down these barriers was the development of formal relationships between Maine's technical colleges and the University of Maine. The University of Maine is home to the School of Engineering Technology (SET). SET, which is part of the College of Engineering, offers the state's only Bachelors of Science degrees in Electrical Engineering Technology (EET), Mechanical Engineering Technology (MET) and Construction Management Technology (CMT).

SET was founded in 1975. Typical enrollment for the school is 350 which comprises a third of all students in the College of Engineering. The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology accredits all programs in SET. In the mid-1990s, SET phased out its Associate Degree programs. Previously, all programs were established in a 2 + 2 arrangement. Thus, all students in the program since are registered for a Bachelors of Science degree. This change caused a shift for some engineering technology students to pursue their Associates Degrees at a technical college.

While this shift had little effect on the MET and CMT programs it did affect EET enrollment. While there are no competing, in-state programs for CMT and MET, there are four technical colleges that offer Associates degrees related to Electrical Engineering Technology. Thus, members of the EET program decided to reach out to the four technical colleges to develop pathways for their EET graduates to seamlessly transfer to the University of Maine to complete a Bachelors degree in EET. The instrument used to create this agreement was the articulation agreement.

An articulation agreement establishes a formal relationship between the University and the technical college. It clearly details how courses at one institution count for credits at the other institution. While the agreement requires approval through the Board of Trustees at each institution, the practical agreement and implementation is handled at the program level.

Eastern Maine Technical College is the closest technical college to the University of Maine and was the first school to enter into an articulation agreement with the EET program. Though the program is not yet accredited by TAC/ABET, the quality of their graduates has always been excellent. They are currently in the process of obtaining accreditation.

To develop the agreement, all faculty in both programs were involved. Syllabi for all courses were examined and contrasted. Additionally, faculty from the math and physics departments at both schools were consulted. This attention to detail was key to ensuring that students received adequate credit for all work performed.

The final agreement established the successful transfer of up to 64 credits from Eastern Maine Technical College to the University of Maine.<sup>1</sup> This is exactly half of the required 128 credit hours required for the Bachelors degree. The agreement now serves as a living document that is updated on an annual basis. This is necessary due to programmatic changes in each program along with minor changes in course names or numbering. This is also important because it allows for assessment of student performance and course revision based upon that feedback.

Experience has shown that while transfer students can meet the requirements for the Bachelors degree in two years, most take 2-1/2 years. This allows students to take a light load in their first semester at the University of Maine while they adjust to the new environment. It also allows transferring students to pick up any electives of interest beyond the curriculum requirements.

## **Internal Agreement**

The other pathway to be developed was between the EET program and the Electrical and Computer Engineering program at the University of Maine. The EET program is a Bachelors degree program and does not have the resources or sufficient faculty to offer a Masters degree. Thus, exceptional graduates of the EET program did not have an in-state opportunity to pursue graduate work in their field.

In 1993, faculty in both programs began to contrast degree requirements to determine key coursework necessary to adequately prepare exceptional EET graduates to pursue a Masters degree in Electrical Engineering. Obviously, there were significant differences between course emphasis, faculty qualifications, etc. There were similarities in several fundamental areas, though. Both programs offered coursework in digital systems, electronics, control systems, electric machines and power systems. The greatest concerns were topical areas not covered in EET that would hurt a graduate's performance in a Masters program.

A pilot agreement was reached to allow top EET graduates, who maintained a grade point average of 3.0 or better, to enroll in four courses to determine their eligibility for the Masters program. Two of the courses are math courses that cover linear algebra and statistics. The other two courses are offered by the ECE department and cover linear circuits and systems and electromagnetics. These are theoretical courses that are rigorous and are also necessary prerequisites to required graduate courses. Students who earn a B or better in all four courses are admitted to the Masters degree program.

As with any pilot program, success is determined over time. At this point, the agreement has proven to be a success. While only a few EET graduates have pursued their Masters degree, they have been successful in their efforts. We believe the small numbers point more to the fundamental differences between engineering technology and straight engineering students rather than educational capabilities of either group. We value the fact that we have removed a barrier for those few engineering technology students that wished to pursue a Masters degree in Electrical Engineering.

## **Future Agreements**

The success of these agreements has encouraged the University of Maine to pursue additional agreements with other institutions. Currently, we are developing agreements with Southern Maine Technical College and New Hampshire Technical Institute in Electrical Engineering Technology. These agreements should benefit both technical colleges and the University of Maine.

Additionally, we are currently in negotiations with EMTC to establish an additional pathway in Information Technology. The starting point for this agreement is at the high school level while the ending point is a Bachelors degree in Electrical and Information Engineering Technology. We have proposed to partner with EMTC and regional technical high schools to establish the Maine Information Technology Education (MITE) consortium. This agreement will require significant resources and additional coursework in all schools. We are currently pursuing federal funding to assist with this effort. We will continue to pursue an educational process that contains multiple entrance and exit points to better serve student needs.

## **Bibliography**

1. Associate Degree to Baccalaureate Degree Transfer Agreement Between the University of Maine and Eastern Maine Technical College, August 2001

## **Biography**

Dr. Scott Dunning is an Associate Professor and Department Coordinator for the Electrical Engineering Technology program at the University of Maine in Orono, Maine. He teaches undergraduate courses in electrical machinery and power systems. He received his Doctorate in Electrical Engineering from the University of Maine. He is a licensed professional engineer in the state of Maine. He is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE) and a Member of the American Society for Engineering Education (ASEE).