

Cooperative Industry-University Program to Deliver a BSEET Degree

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National Semiconductor Corp. (NSC) is a worldwide manufacturer of integrated circuits for analog and mixed-signal technologies. Its newest and most modern integrated circuit fabrication plant is located in South Portland, Maine. Several years ago NSC identified a need for a career track for valued technicians, a number of who had an associate's degree but were lacking a baccalaureate in an appropriate discipline, a necessity for advancement.

While a BSEE program was available locally through the University of Southern Maine (USM) it was not deemed appropriate for the particular group of technicians targeted for the program. Rather, a BSEET was felt to be more tractable for these individuals for several reasons. Much of the coursework which the technicians had taken was from technical colleges. Credits from these institutions would not transfer into a BSEE program as readily as they would into a BSEET. Also, the particular skill sets projected to be required for these individuals favored the more "hands-on" focus of the BSEET.

There were several challenges that needed to be overcome to serve the needs of the technicians. First, the nearest BSEET program available was at Maine's land grant institution, the University of Maine (UM). UM is located in Orono, Maine which is a two hour drive from South Portland. Second, the company required a program which would allow this selected group of technicians to receive a baccalaureate in two and a half years. Finally, this program was projected to be a one-time-event, rather than a continuing program. To work into UM outreach plans, the effort to develop the off-site classes would have to complement their plans to develop on-line outreach courses. For this unique program to succeed, a cooperative arrangement between UM, USM and NSC would be necessary.

Student cohort

The first step in the process was to garner a cohort of students that were willing to commit the necessary time and effort necessary to succeed in the program. NSC and their affiliate Fairchild Semiconductor, advertised the program to their employees. This resulted in a screening group of approximately twenty-five. UM officials reviewed their transcripts and narrowed the pool to fifteen candidates qualified for the program. Selected candidates had obtained Associates degrees in EET or similar programs. Those applicants lacking an Associates degree were referred to Southern Maine Community College to complete the necessary credentials.

The cohort of students was largely non-traditional. Most students had been out of school for at least eight years with some out for as many as twenty years. Most had families with some

having children already in college. Their biggest concern was their ability to handle the advanced mathematics used in the upper level EET classes. To ease the students into the curriculum, the first course selected was one that was one that did not depend on differential equations. Extra time was scheduled for recitation periods to focus on mathematics skills.

Class Schedule

Next, a schedule had to be planned that would fit with the employees' work schedules and fit with instructor's schedules. NSC desired on-site instruction rather than web-based or teleconference lectures. The EET faculty were consulted to determine their willingness to travel to Portland to offer the classes. This program would require a commitment by instructors to travel to Portland on Thursday afternoons with a return home on Friday evenings. Class schedules at Orono had to be altered for instructors to allow them the freedom to participate in the program.

After several discussions, the program was planned for lectures on Friday mornings and laboratories provided on Friday afternoons. Additionally, recitation sessions were scheduled for Thursday evenings. This would allow employees to still work 40 hours weekly while still participating in classes and recitations. There was significant concern over student burnout from the effort necessary to work full time while participating in classes. To allow students some time to rest, four week breaks were scheduled between class offerings.

Participants' Resources

The UM BSEET program was established in 1975. It maintains a regional focus such that prepares graduates for work in manufacturing sectors that are predominant in New England such as pulp and paper, metal finishing and wood products. Alumni typically take positions as project engineers, electrical equipment engineers, instrumentation engineers, consulting engineers and power engineers.

USM is a comprehensive university with a full range of programs. USM has campuses located in Portland and Gorham that conveniently serve Maine's largest population center. The USM College of Applied Science and Technology offers an electrical engineering program that is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET). USM was happy to provide instructors on-site to support this effort.

NSC has an excellent training facility that was made available for the classes. A computer training room was upgraded to handle simulation software required for the courses. NSC also purchased specific software for use by the students.

Challenges

The UM BSEET program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET). Thus, courses needed to be structured and supervised to ensure that the ABET requirement of equivalency was being met for

a program extended from a remote site. Additionally, UM requires that students complete a minimum of thirty degree hours of coursework with the institution to receive a degree.

To address this requirement, a class schedule was designed that had ten core technical courses taught by UM faculty. USM agreed to teach the additional mathematics, science and liberal arts courses required for the degree to minimize travel costs.

UM agreed to provide technical laboratory equipment as necessary for course support. Examples of this equipment are oscilloscopes, digital multimeters, power supplies and function generators. To support the electric machines and power systems courses, UM purchased Lab-Volt simulation software that successfully simulates the equipment used in the UM laboratories. This removed the necessity of moving large motors and generators down to Portland during those courses. USM also offered use of their electronics laboratories if necessary.

To enhance their future outreach efforts, UM agreed to videotape all lecture sessions. These could then be incorporated into web-based courses in the future. Additionally, it provided a resource for students that might be required to miss a lecture period.

Contract Agreements

A special contract agreement had to be developed that would meet the needs of UM, USM and NSC. A fundamental concern was how to minimize the cost and risk to each organization. A unique agreement was developed that would make use of NSC's current employee educational reimbursement plan and also work with UM's standard course registration process.

UM first estimated the costs associated with delivering the course. These costs were equivalent to the income returned by tuition from a class of fifteen students. Thus, the contract specifies that students will sign up for classes through either UM or USM depending on the instructor. If fifteen or more students register for the course, NSC incurs no direct charges and students are reimbursed for tuition through the employee reimbursement plan. In cases where less than 15 students register for a given course, NSC agrees to make up the revenue shortfall.

Program Status

The program began in January 2003. During the 2003 calendar year, four courses were offered through the program. All four were core technical courses presented by UM faculty. Students report that the first course provided a difficult transition, but their confidence has strengthened considerably with each ensuing course. Current enrollment for the next course is twelve with students scheduled for a morning course in advanced calculus from a USM faculty member and afternoon lectures by a UM faculty member in engineering economics.

Lessons Learned

This program is unique for the University of Maine since it brings the education (which heretofore had only been available at a location far from the company) to the working student at their place of work. Web-based or teleconference courses have been offered previously by other

programs, but the BSEET program had not previously offered alternative course delivery due to restricted resources and the “hands on” nature of engineering technology courses. Typically, on-site courses are cost-prohibitive for companies especially those in advanced technology sectors. The unique contract agreement developed with this program is cost-friendly to the company while also meeting the costs incurred by the universities involved. The resource implications due to the one-time nature of this program are offset by allowing the program to assist with the development of web-based course offerings.

The successful implementation of this program was only realizable through the contributions from many participants at each organization. Everyone involved continually asked the question, “Although this is different from what we have ever done, why can’t we do it?” Top management at NSC and Fairchild Semiconductor along with Deans from UM and USM were involved from the inception. This high-level involvement and commitment was necessary to focus resources located at different sites on the problem, since no mechanism to deliver such a program off-site existed.

The full outcome of this unique program will not be known for 1½ years, when the program is scheduled to be completed. One trend is already apparent. The students in the program, all senior technicians, many of whom have not been in an academic setting for many years, have shown that they are capable and willing to master baccalaureate-level technical coursework. This will allow National Semiconductor Corp. to expand its leadership pool. This model is applicable to many regions in the country which are not served locally with particular desired areas of study but which have some academic resources available.

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