

An Integrated Master of Science Program in Advanced Technology

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ABSTRACT

A practice- oriented graduate program is needed to keep pace with the technological changes in corporate America, which prepares students for leadership positions in advanced technology in an interdisciplinary format. Such programs are very scarce in general and are virtually non-existent in the Central New York region. The State University of New York (SUNY) Institute of Technology initiated such a program in Fall 1996, which is broad; practice- oriented and integrates diverse areas of engineering and technology. It is a thirty three-credit program and is currently in the second year of its offering. This paper discusses the development and implementation of the program. Outcomes of the implementation of the program are presented and analyzed for further development.

INTRODUCTION

The SUNY Institute of Technology at Utica/Rome is an upper- division transfer college for students who have already completed their first two years of college. It also offers graduate programs in accounting, business, computer science, nursing and telecommunications.

Graduate programs in engineering and technology are generally taken by engineers to update their academic credentials, help improve the productivity of the corporations they are working for, and to seek career advancement. Most existing graduate programs concentrate in one area and prepare students for a specialized field emphasizing more theory and less hands-on. In most cases engineers enroll in a graduate program related to their undergraduate majors unless they are studying for an MBA. The aim of our Master's program in advanced technology (MSAT) is to prepare students in a wide range of engineering and technology practices, in addition to the area of their undergraduate background. In the current environment, industries have become technologically more advanced and have to compete in a global market. This puts extra demands on their employees to be knowledgeable in a wide range of advanced technologies in addition to their areas of expertise. Such a trend is becoming common as the industrial practices continue to change using new technologies. Fewer employees must do more tasks in small businesses, which have emerged in record numbers due to downsizing and closures. A recent survey conducted by the SUNY Institute of Technology shows that there is a pressing need for graduate programs which combine economic and technological perspectives in an interdisciplinary format. Our survey also indicated that both recent graduates of undergraduate degree programs, and technology professionals preparing themselves for leadership positions within their respective fields, require current technological knowledge and planning perspectives in the critical area of advanced technologies in a competitive global environment [1]. The American Society for Engineering Education has endorsed the concept of a practice-oriented master's program.

Another population to be served by this graduate program is faculty members at community and junior colleges. Many of these colleges presently employ entry-level faculty in technical disciplines with only a bachelor's degree. These people are required to obtain a master's degree in engineering or engineering technology in order to be eligible for tenure. With the increase of technology in the high school curriculum, these teachers may also profit from practice-oriented degree.

DEVELOPMENT AND IMPLEMENTATION OF THE PROGRAM

Based on the feedback from industry as reflected in our survey, a practice oriented, interdisciplinary Master of Science program in advanced technology (MSAT) was developed by a committee comprising of the Dean and faculty from electrical, mechanical and industrial engineering technology departments. These three departments are part of the school of information systems and engineering technology (ISET), which also includes the departments of civil engineering technology, computer science and telecommunications. The program has been built upon the institute's successful undergraduate programs and it meets both academic and industrial needs not presently addressed by any other SUNY institution in the central New York area. The program is designed to serve SUNY Institute of Technology graduates, and technical professionals employed within commuting distance of the institute [1].

The Master of Science in Advanced Technology is a thirty three-credit program that provides a seamless path to a Master of Science degree for students who have earned an engineering, engineering technology, physics, mathematics or similar baccalaureate degree. Students who have not earned an academic degree in an appropriate discipline, but who possess significant work experience (3-5 years) in an engineering/manufacturing area also considered for admission on an individual basis. An executive committee consisting of the dean of ISET, chairpersons of each departments and one faculty member from each of the three departments of electrical, mechanical and industrial engineering technologies run the program. The Dean is an ex-officio member; the coordinator of the program chairs the committee.

Although these three departments offer different areas of concentration at the undergraduate level, we selected only the areas which had some commonality and contained an element, which makes the program practice-oriented and integrated. The college supports a practice-oriented learning environment with state-of-the-art laboratories in all primary areas of academic offerings.

The program is currently offered only to part-time students on a cohort basis. Two three-credit courses are offered per semester and there is a project required as the culmination of the program in lieu of a thesis. The three-credit project may be completed concurrently with the course work or may occur after the tenth course is taken. Classes meet on Saturdays for three and half-hours over a 12-week semester. The following courses constitute our current offering [2].

- MAT 500 Topics in Applied Mathematics
- MST 502 Advanced Engineering Economics
- MST 503 Special topics in Advanced Technology
- MST 520 Network and Multimedia Systems

MST 521 Computer and Robotic Vision
MST 622 Intelligent Control Systems
MST 673 Optimization and Simulation
MST 676 Finite Element Theory
MST 680 Reliability and Quality Assurance
MST 682 Advanced Topics in Computer Integrated Manufacturing (CIM)
MST 690 Project

OUTCOMES

The majority of students enrolled in this program are professionals working in small sized industries and faculty teaching at area community college. Most of them in industry hold positions at the mid-level management, are responsible for technical operations in the areas of electrical, mechanical and industrial engineering. Because of the varied background of the students and the broad nature of the program, continuous feed back from the students was obtained to make sure the program is relevant. Feedback was obtained formally through evaluation of the courses, as well as informally by talking to the students in open forums. Input was also obtained from an industrial advisory committee which consists of representatives from local industries and the student representatives. The result is given below:

1. The students overwhelmingly liked the diverse and practice-oriented program. Some students however expressed a need for more prerequisites and more real life- examples.
2. The idea of cohort where all the students take the same courses through the program was very appealing. This gave them an opportunity to work in teams and form networks for solving technical problems from their workplaces.
3. The students made use of some courses at their place of work and were also able to make technical decisions for their companies.
4. The offering of diverse courses makes the student well rounded and helps them to make decision at the managerial level.
5. The students like Saturday offering of the classes for twelve-week duration.

In the present cohort, six courses have been offered so far, up to the end of third semester. Some students want to start their project and have contacted the appropriate faculty for the guidance. Eight members of faculty from three engineering technology departments have shown their willingness to guide the projects. No additional faculty has been hired as the work load was absorbed by the existing faculty. Listed below are some details and comments from the students.

MST 503 Special Topics in Advanced Technology. Two topics namely, industrial application of lasers and industrial applications of optical fibers were presented. The course was team taught by a faculty from electrical engineering technology and a person from the local industry. It also included demonstrations and tours of the Air Force Research lab, Rome, NY, and fiber optics lab at the college. The course was well received by the students for its pace and contents. Some students have been able to use the knowledge gained in this course to their projects at their place of work. Some students however felt that the laser theory could have been covered in more depth.

MST 680 Reliability and Quality Assurance. The course was appreciated for broad introduction to quality systems and an in-depth study of the practical application of reliability and maintainability. The material from this course can be easily implemented in “real life” manufacturing problems. This course also gave enough knowledge for students to pass both CQE and CRE (Certified Reliability Engineer) which is offered by ASQ (American Society for Quality).

MAT 500 Topics in Applied Mathematics. This course introduces range of topics including probability theory and its applications, introduction to statistics, Fourier Analysis, matrix algebra, and Laplace transform. The course was team taught by a faculty from the electrical and industrial engineering technology. The course was rigorous and some students expressed that this course might be better utilized if it was split into three courses and offered strategically prior to specific courses where the respective math skill is utilized.

MST 580 Computer and Robotic Vision. The course deals with theory and practice of computer and robotic vision. It had an well-organized lab component and included a presentation by a senior engineer from a local vision company. The course was appreciated for its contents and real life examples.

MST 622 Intelligent Control Systems. The content of this course is very much pertinent to manufacturing optimization. The students liked the fuzzy concept and its application in control systems. Some non-electrical students found the concept of mathematical modeling of control systems difficult. The course project and individual help by the Instructor made the course more meaningful.

MST 682 Advanced Topics in Computer Integrated Manufacturing (CIM). The course is based on CIM model developed by the computer and automation systems association (CASA) of the society of manufacturing engineers. The model is commonly known as CIM wheel. A well-equipped lab supports the course, where students completed their hands- on assignments. The course was well received by the students. Some students suggested that this course should be offered earlier in the program.

CONCLUSION

The Master of Science program in advanced technology has been successfully implemented, retaining most of its students through the third semester. The diverse nature of the program has received positive feedback from the students, most of whom are professionals working in small businesses or teaching at the community colleges in the area of central New York. Some students have suggested that certain courses should have a prerequisite while others wanted a good introduction of such courses at the start.

The cohort nature of the programs has enabled the students to work in teams and have resulted in useful networking for solving their technical problems at work. The teaching faculty has benefited professionally in teaching graduate level courses by relating their research to the teaching of the courses in advanced technology. The program has also helped the college to increase its numbers of graduate students and enhance its image for being a unique college for transfer and graduate study.

To our knowledge, the Master of Science program in advanced technology is the only program in the North East where graduates from engineering technology programs can continue their studies for Master's degree without taking any additional courses. A new outreach cohort program has already been scheduled to start in spring 1998. The executive committee of MSAT program will continue evaluating the program and fine tune it by incorporating the input taken from the students and industrial advisory committee.

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BIOGRAPHIES

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