

**THE DEVELOPMENT OF A MASTER OF SCIENCE DEGREE IN  
ENGINEERING TECHNOLOGY**

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Abstract

Central Washington University (CWU) offers a Master of Science Degree in Engineering Technology (MSET) at two locations within the State of Washington. The MSET program is multi-disciplinary, having the specific purpose of broadening the technological backgrounds of persons holding bachelor degrees in Engineering Technology (ET), Industrial Technology (IT) or Engineering disciplines. The course offerings are intended to give the graduate student sufficient choices to fit diverse needs. This paper presents the history, the strategy, the problems encountered, and the future development plans for the program. However, despite the fact that the program is only in its second year of operation, expectations for the program are presently being met.

Introduction

Because the practice of engineering and engineering technology is advancing so rapidly, the practitioner is required to possess more knowledge than in years past. A master's degree is an effective means of acquiring that knowledge in a reasonably short time. CWU has responded to the needs of working professionals and graduating students by developing the MSET program.

This paper describes the development of a multi-disciplinary, Master of Science degree in engineering technology with the purpose of broadening the technological background of engineers and engineering technologists. Although the MSET degree is offered at two locations, in Puget Sound and at the main campus in Ellensburg, Washington, this paper focuses on the large population center of Puget Sound. The MSET program is conducted in a traditional manner at the main campus. At the Puget Sound location, the degree is taught in the evening to cohorts of working professionals.

An examination of the literature<sup>1</sup> indicates that institutions offering masters degrees in the engineering technologies is increasing. At present there are approximately 25 institutions offering or planning to offer a masters degree in engineering technology. The objectives of these institutions appear to be divided into two groups; those broadening the technological knowledge base<sup>2</sup> and those offering management related course work<sup>3</sup>.

The Boeing Company has assisted CWU in establishing the MSET Program in the Puget Sound

area. In fact, during the first year, all courses were offered at Boeing’s Puyallup facility. Boeing provided CWU with a grant to financially support moving the MSET program to the campus of Highline Community College in Des Moines, Washington. To date, most of the off campus students are Boeing employees, but we are now admitting some students from other companies and institutions. The potential for a large MSET student population in Puget Sound is great. One of the program’s challenges is to promote an orderly and controlled transition to more cohorts and students. During the Fall of 2003, the program will co-locate at the Edmonds Community College, another CWU satellite campus where we expect a large student population.

CWU’s MSET program is one quarter less than two years old and is on track for meeting student enrollment goals as indicated in the table below. At present, our student population is 38 students after 1-2/3 quarters. To date only 2 students have graduated from the MSET program but at the conclusion of the spring, 2002 quarter, 14 students are anticipated to graduate.

Projected Versus Actual Student Enrollment in Puget Sound

	Year 1	Year 2	Year 3	Year 4
Projected	28	40	55	60
Actual	14	38	-	-

Need for Program

The need for a Master of Science in Engineering Technology (MSET) degree has been identified for the State of Washington. Currently, there are no institutions in the entire Northwest that offer an MSET degree program as described in this document. Central Washington University has filled that gap by utilizing the resources within the Industrial and Engineering Technology (IET) Department.

The Bachelor of Science degree programs in Engineering Technology (ET) or Industrial Technology (IT) provide the graduate with hands-on, practical knowledge, which can be immediately utilized in industry. However, technology is advancing so rapidly that it is necessary to expose engineering technologists to an understanding of some of the latest advances, that is, to update their knowledge base. Corporate downsizing, global market pressures, and rapidly expanding technology require a new type of engineering technologist, one that can function comfortably on a changing career path. This requirement produces the need for the technologist to be a lifelong learner. The tools for life long learning and research are the crux of the MSET program. The MSET program is multi-disciplinary, having the specific purpose of broadening the technological backgrounds of persons holding Bachelor degrees in the ET or IT disciplines.

Four population groups have been identified as benefiting from the proposed master’s program; recent graduates from CWU and other ET or IT degree granting institutions, professionals in the engineering workforce, faculty members in two and four year institutions, and technology education teachers. Recent BS graduates often wish to receive a master’s degree prior to joining the work force in order to secure a job having more responsibility and potential for growth. The professionals working in industry often require additional knowledge for the purpose of advancement or entry into a new field. Many faculty working in two year and four year colleges often require a masters degree to be eligible for tenure and to be considered by TAC/ABET as having “basic credentials.” Finally, technology education teachers at both the middle and high school levels who desire a master’s degree in a technology field for advancement are potential graduate students.

Program Description

Central Washington University (CWU) currently offers the MSET Program in the Puget Sound area at an off-site center for working professionals. All of the course work may be completed in an after work hours program. The courses are taught to cohorts of students that progress through the program in a two-year cycle. To insure quality education, the program limits a cohort to 20 students. Each course is taught once a week from 5:00 p.m. to 9:00 p.m. Two courses are offered during any week, Monday/Wednesday or Tuesday/Thursday. The MSET degree may be completed at the end of two academic years without the student leaving the Puget Sound campus.

Program Requirements

The IET Department offers a Master’s degree that requires a minimum of 45-quarter credit hours of graduate study and a culminating experience. A total of 30 credit hours are required of all students. The student is then required to select at least 15 credit hours from a list of technical electives, which will then total 45 credit hours. The student must take at least 25 credit hours of course work at the 500 level. A maximum of 15-quarter credit hours may be transferred before being admitted into the masters program but only 9-quarter credits or 6 semester credits from another accredited graduated degree granting institution can be transferred. Each graduate student must complete a thesis, project, and/or comprehensive examination on their thesis or project and supporting course work, given by a thesis committee consisting of the Thesis Advisor and two other graduate faculties.

Curriculum

<u>Required Courses</u>		<u>Credits</u>
IET 521	Product Design and Development	4
IET 522	PLC Applications	4
IET 525	Systems Analysis and Simulation	4
IET 530	Fundamentals of Lasers	4
IET 560	Finite Element Analysis	4

IET 577	Robotics	4
IET 700	Thesis or Option*	6
Required Course Total:		30

Department Approved Technical Electives

The student must select 15 credits from the following list to complete a total program of 45 credit hours.

IET 512	Alternative Energy Systems	4
IET 523	Emerging Technologies	4
IET 524	Quality Control	4
IET 526	Engineering Project Cost Analysis	4
IET 532	Generation and Transmission of Electrical Power	4
IET 555	Engineering Project Management	3
IET 582	Plastics and Composites	4
IET 583	Ceramics and Composites	4
IET 585	Ergonomics	4
IET 592	Field Studies	4
IET 596	Individual Studies	3
IET 599	Seminar	1
MET 423	Computer Aided Design and Manufacturing	4
GEOG 443	Energy Policy	5
CMGT 442	Building Service Systems	4
ECON 462	Economics of Energy Resources and Environment	<u>5</u>
Elective Total:		15
Program Total:		45

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Note:

\* Students electing to do a written examination will select 6 credits of approved course work in lieu of IET 700.

Admission Requirements

Incoming students are expected to meet all of the requirements of the Graduate School, have a solid background in science and mathematics, and show evidence of scholarship. All students entering the MSET program are expected to have a background equivalent to that required for the Bachelor of Science Degree in the Engineering Technologies at CWU. This requires that the candidate have a bachelor's degree from a recognized institution and have at least two quarters of calculus and three quarters of a combination of general physics and chemistry. If English is a secondary language, students must score 550 or more on the TOEFL examination. Opportunities exist for the student to complete missing undergraduate training as determined by

the first year of graduate study. Transfer students will be considered using the same criteria, with consideration for equivalent graduate course work completed elsewhere.

### Goals, Objectives and Learning Outcomes

The Master of Science Degree in Engineering Technology has the single goal of broadening the technological background of persons holding Bachelor of Science degrees in the Engineering Technologies (ET), Industrial Technologies (IT), and similar or related degrees.

### Program Objectives

1. Develop advanced competencies associated with the latest innovations in engineering technology.
2. Broaden the career potential of individuals through a program of course work, research, and exposure to new ideas.
3. Develop future engineering technology faculty having the proper academic background to teach in two and four year universities and technical institutions.
4. Promote the notion of life-long learning as a way of professional life.

### Learner Outcomes

Upon completion of the MSET degree program, the graduate student will be able to:

1. Access information databases on details of recent technological innovations in areas such as materials, manufacturing, electronics, design, and instrumentation;
2. Learn how to conduct research in an efficient manner;
3. Present results of research in a clear and concise manner, both verbal and written;
4. Understand how products are designed and developed in the commercial sector with knowledge of design, manufacturing processes, materials, and information transfer;
5. Develop analytical and practical techniques to analyze systems of related components such as manufacturing facilities, machinery, and fluid/thermal systems; and
6. Develop an interdisciplinary approach to problem solving by utilizing knowledge of electronics, mechanics, materials, manufacturing and economics

## Program Assessment Plan

Unlike the BS programs in engineering technology which are evaluated by the Technology Accreditation Commission of the Accreditation Board of Engineering Technology TAC/ABET, Masters Degree programs in engineering technology do not have oversight by any accreditation agency. Therefore, a departmental assessment plan has been devised to evaluate the efficacy of the proposed MSET degree program. Assessment of the three components of the MSET program; students, faculty, and program are addressed below. The program coordinator will initiate the assessment process on a yearly basis. A comprehensive program assessment, as required by the HEC Board, is conducted every fifth year and involves an outside reviewer. A report on the yearly assessment will be submitted to the IET Department Chairman and the Dean of the College of Education and Professional Studies. The results of the five-year assessment will be submitted to the Department Chairman, Deans of the College of Education and Professional Studies and Graduate School, and the Provost.

### Assessment of the Students

Each course in the MSET curriculum contains assessment procedures that evaluate learner outcomes for those specified courses. As a culminating experience, a student may opt to write a thesis, complete a project, or take a four hour written examination plus an oral examination based on material from the written exam. If the student elects to write a thesis, then an oral presentation is given to the student's graduate committee. A project is evaluated in a similar manner to that of a thesis. If the student elects to take a written examination, the graduate committee reads and evaluates the exam report and follows up with an oral examination. In addition to the formal procedures discussed above, the student's committee chairman is involved with the student on a regular basis and is in a position to assess the students overall performance. All of the above assessment data is submitted to the department and filed with the student's records.

### Assessment of the Faculty

Faculty will be assessed in several areas. Since teaching is important in any program, student evaluations of the teaching effectiveness of each graduate faculty member will be obtained for each graduate level course taught. These evaluations will be used for modification of teaching practices in the MSET program. In addition, the departmental personal committee evaluates the faculty by sitting in on select graduate classes and reviewing the faculty member's progress in relation to teaching effectiveness, scholarship, and service. The faculty member is expected to make positive changes as suggested by the personal committee. The action taken by the personal committee and the response of the faculty member to the suggestions for improvement are filed for future use in assessing the overall MSET program.

### Assessment of the Program

1. Every fifth year, an external reviewer from a university having a similar MSET program will be hired to conduct a review of CWU's program. The program coordinator will serve as a principal for this review and will prepare statistical and programmatic data for the reviewer to evaluate.
2. MSET program graduates and their employers will be requested to fill out separate questionnaires in a manner similar to what is required for a TAC/ABET accreditation review. The resulting data will give an indication of the effectiveness and suitability of the graduate's educational experience in relation to their job function.
3. Upon completion of the final oral exam, each graduate will be interviewed by the department chairman and/or by the graduate program coordinator for the purpose of providing feedback regarding perceptions of the programs value, comprehensiveness, and relevance.
4. Internal assessment of the program will include examining data on attrition and time to degree. Data from the student's assessments and the faculty assessments will be compiled to give an overall profile of the program on a five-year basis.

### Conclusion

The Master of Science in Engineering Technology Program is only in its second year and already shows promise of fulfilling the expectations of acceptance by industry, state officials and students. The enrollments are approximately as planned and show that a significant increase will occur next fall.

### References

1. Based upon discussions with faculty attending the Masters Degree Session at the 2001 ETLI, Purdue University, West Lafayette.
2. Qazi, Salahuddin; Hsie, Atlas; and Das, Dibendra K., An Integrated Master of Science Program in Advanced Technology, Session 3448, Proceedings of the ASEE Annual Conference and Exposition, Seattle, WA 1998.
3. Curtis, Kent and Latif, Niaz, Master of Science in Technology: Program Design, Development, and Implementation, Session 3448, Proceedings of the ASEE Annual Conference and Exposition, Seattle, WA 1998.

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