

**Master of Science in Engineering Management  
University of Tennessee Chattanooga**

**External Reviewer Report**

by

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## PART 1 – Learning Outcomes

*How would you rank this program with similar ones in the state, region, and nation?*

I would rank Master of Science in Engineering management at UTC in the top 10 – 15% of graduate engineering management programs in terms of its curriculum.

*Are the intended program and learning outcomes clearly identified?*

- *Has the department specified program mission, vision, and goal statements? Do these statements clearly identify intended program and student learning outcomes? Are they appropriate for the program level (graduate) and for UTC?*

The department has a specified mission, vision and goal statements aligned directly with UTC. These are stated in the self-study report. They are appropriate for a graduate program.

- *What goals should the department establish regarding its curriculum? In particular, what advice should be offered to the department developing goals regarding the following aspects.*
  - *Student opportunities for research/involvement in faculty research*

The department offers a one-hour Research Methodology course to inform graduate students of the research expectations for this degree and to teach the fundamental skills needed to conduct a research project. Graduate students' involvement in faculty research is through the capstone projects. A thesis option may increase student involvement in research.

- *Student opportunities for practical/field experiences*

The capstone projects and certificate programs offered create opportunities for practical/field experiences. The MSEM program engages students in professional practices and training experiences by offering a variety of seminars, local internship opportunities, and job fairs throughout the year.

- *Student placement in the workforce related to the field of study*

The Center for Career and Leadership Development provides free resources to assist students in finding employment opportunities in line with their qualifications. The College of Engineering and Computer Science also organizes College-level job fairs twice a year.

***What criteria does the department use to evaluate sufficient achievement of intended program outcomes? Are the criteria appropriate for such evaluation and/or for the program? How?***

The desired learning outcomes of the MS Engineering Management program graduates are stated as follows: Application of Engineering Management Principles and Effective and Professional Communication. The criteria is appropriate.

***Does the department make use of evaluation information and/or information obtained from student, alumni, and employer surveys and/or data from institutional research to strengthen and improve the program?***

The outcomes of the MS Engineering Management program are regularly evaluated using rubrics developed by the department to measure students' mastery of engineering management principles along with communication and technical writing skills. The department has a Graduate Curriculum Committee which reviews and makes necessary changes in the graduate curriculum every year based on student evaluations and assessment results.

***Does the program fit/align within the institutional mission?***

The MSEM program aligns with UTC mission.

## **PART 2 – Curriculum**

***Is the current curriculum appropriate to the level and purpose of a graduate program? Is the program more advanced in academic content when compared to related undergraduate programs?***

The curriculum of the MSEM currently has two concentrations: engineering management and construction management. The requirement of 18 hours core courses and 15 hours elective course is the same for all concentrations. The current curriculum is similar and appropriate to the level and purpose of a graduate program in engineering management.

***How has the program designed a process by which students can be assured of making timely progress in the degree program? How is it determined that courses are offered? Is there a set schedule for course offerings upon which the student can rely? Does the department clearly outline program requirements and offer courses regularly to ensure timely completion of the program?***

All graduate core courses are offered at least once a year. All elective courses are offered at least once every other year regardless of enrollment levels. The curriculum has been designed so students can finish their master's program in two years. This course offering schedule is popular within students, employers, and collaborators in the Chattanooga areas and surrounding states.

***Does the curriculum align with the program learning outcomes? How is mastery assured through the curriculum? How is the content reviewed on a regular basis with results used to determine actions to take to improve the curriculum? Does the department regularly review and revise curriculum content***

***and organization to ensure that it is appropriate and that it prepares students to meet the specified learning outcomes?***

The curriculum content is reviewed on a regular basis. Curriculum review and proposals take place each year. Curriculum proposals have the purpose of continuously improving the graduate program. The curriculum modification suggestions are initiated by students, faculty, and the Industry Advisory Board. The departmental graduate committee collects all the suggestions and forms them into curriculum proposals. The proposals are then discussed in this committee and action to table or proceed with the proposals is taken. Based on the initiatives taken to increase enrollments and improve industry contacts, curriculum updates and development of new initiatives may be necessary as student and industry needs evolve.

***Will the department need to update the curriculum and/or develop new or alternative offerings in the near future?***

The curriculum has been updated recently and there is a process in place for updates. There is no pressing need for a short-term update.

***Is the curriculum adequate to enable students to develop the skills and attain the outcomes? Does the curriculum include knowledge of the disciplinary literature?***

The core courses provide the students a strong foundation in the following areas of engineering management: human resources, engineering economics, project management, leadership and entrepreneurship, and strategic management of technology. Knowledge in disciplinary literature is covered through elective courses the students choose based on their background and interest. As such, the curriculum is adequate.

***Are opportunities available to students that allow them to engage in research, professional practice or training experiences? How are those opportunities communicated to students?***

The MSEM program engages students in professional practices and training experiences by offering a variety of seminars, local internship opportunities, and job fairs throughout the year. Students are informed of these via email, bulletin boards, and e-boards. In addition, capstone projects also act as professional practice resources.

***Is the program offered through distance education or online? If so, how are those offerings assessed compared to on ground programming?***

The program is offered both online and in live formats. MSEM program was chosen as the pioneer program by the University of Tennessee (UT) System to offer a fully online program by using shared resources among UT campuses that offer similar courses and/or programs. For online offering assessments, Walker Center for Teaching and Learning and UTC Learn are utilized. The Walker Center administers course and support service evaluations each semester to allow for the continuous improvement of UTC's online courses, funded by Online Distance Fees. UTC Learn provides online assessments.

***Are appropriate pedagogical and/or technological innovations included that enhance student learning? Are the department's instructional practices consistent with the standards of the discipline?***

Each course uses Canvas software to display class materials, create discussion boards, and post assignments. Online offerings are supported by Mediasite to record lectures both synchronously and asynchronously. The College of Engineering and Computer Science has internal technical support personnel and one staff member who is fully responsible for maintaining Mediasite. In addition, Graduate Assistants are trained to assist faculty in administrating online graduate-level courses. These are appropriate and similar to tools generally used for online course offerings,

- *Do the instructional practices provide adequate opportunities for student interactions with one another, faculty, and professionals?*

Discussion boards created using the Canvas software provide adequate opportunities for student interactions with one another and faculty.

- *Does the department make adequate efforts to include students in the life of the program (e.g., seeking student advice in reviewing the curriculum/course schedules/teaching methods, etc.)?*

The Engineering Management has a Graduate Curriculum Committee which reviews and makes necessary changes in the graduate curriculum every year based on student evaluations and assessment results. The curriculum modification suggestions are initiated by students, faculty, and the Industry Advisory Board. The departmental graduate committee collects all the suggestions and forms them into curriculum proposals. The proposals are then discussed in this committee and action to table or proceed with the proposals is taken. The department makes adequate efforts to include students in reviewing the curriculum.

### **PART 3 – Student Experience**

***Does the program have enough students to allow an appropriate group of peers as they participate in the program?***

The program has enough students to sustain a graduate program in engineering management. Enrollments have declined over the past few years mostly due to the decrease in enrollment in Construction Management concentration. Enrollment in MSEM has been in a downward trend since 2014 to 2018. However, there is indication that this trend may be reversing as the department is taking measures to address this issue. Enrollments increased slightly in 2019. The department is currently forming a task force made of active members of the commercial construction industry representatives to find ways to promote the program.

***Are students offered the opportunity to evaluate both the curriculum and the faculty? How? Are these methods effective in getting feedback about the program and teaching effectiveness?***

Students provide feedback on the program and evaluate faculty's teaching effectiveness through surveys conducted online prior to final exams each semester. Students are routinely notified through e-mail and by the instructors in class to login and complete the survey. This method is commonly used and appears effective especially when supplemented by in-class visits and class portfolio reviews.

***Are there appropriate curricular and co-curricular offerings to enhance student experiences?***

As indicated in the self-study report, the MS Engineering Management program provides professional development opportunities through membership in professional associations such as Tau Beta Pi, Associated General Contractors (AGC), Graduate Student Association (GSA), National Society for Black Engineers (NSBE), the Society of Woman Engineers (SWE). These organizations encourage students to attend conferences and workshops, help them network, and provide job opportunities.

To provide adequate enrichment opportunities, the MS Engineering Management program hosts a variety of seminars conducted by local professional speakers from the Tennessee Valley Authority (TVA), Volkswagen (VW), Coca Cola. These seminars are offered at no cost to students. They are also videotaped and made available to online students.

***Are diverse perspectives and experiences provided for the students both through the curriculum and through extracurricular activities?***

The self-study report and interviews with faculty and students reveal that MSEM program makes efforts to expose students to various perspectives and experiences throughout the program. Field trips to TVA, VW, Electric Power Board (EPB), Amazon, Miller Industries, McKee Foods Corp. and others are held regularly to introduce students to various work environments. Guest speakers from these companies and others are brought into classrooms as guest speakers by professors to provide opportunities for diverse perspectives, experiences and approaches to problem solutions.

***Are students provided with appropriate academic support services? What services are offered? Do students use the services? How well do they meet the needs of the students?***

The availability of instructional resources has improved with the opening of the new library building in 2015. The program's instructional equipment and facilities within the College of Engineering seem to be adequate. Graduate students are offered a quiet study room. Technical support is provided by technical personnel staffed by the College of Engineering and Computer Science, along with graduate assistants.

## **PART 4 – Graduate Faculty Quality**

***Are the faculty competencies/qualifications those needed by the program and by UTC? Do all graduate faculty meet the standards set by the program and expected SACSCOC faculty credentials?***

- *Do faculty hold terminal degrees in the appropriate discipline?*

The full-time faculty members in the program all hold terminal degrees in appropriate disciplines.

- *Do faculty specialties correspond to program needs and to the concentrations in which they teach?*

All full-time faculty members have different specialties both in education and experience that complement each other in the concentrations offered.

- *If faculty need additional/different competencies/qualifications, how might these needs be addressed?*

Some additional/different competencies/qualifications are covered by hiring adjunct faculty with the needed education and/or experience. This is appropriate and common practice for professional master's degree programs in engineering management.

***Are faculty teaching loads sufficiently reasonable and equitable to accommodate the highly individualized nature of a graduate program, especially the direction of theses or dissertations?***

Based on the information provided in the self-study report, MSEM program faculty teaching loads appear to be aligned with the highly individualized nature of graduate instruction. In the case of capstone projects, professors with certain specialties are assigned to guide the students on an individual basis. More details provided on this in summary recommendations section.

***With respect to ethnicity, gender, and academic background, is faculty diversity appropriate for the program? Does the program student and faculty diversity mirror the demographics of the discipline?***

Students enrolled in the MSEM Program appear to be diverse, with students from multiple groups of minorities and genders. The faculty have a diverse mix that include Asian, Hispanic African American and white faculty. The program student and faculty diversity does mirror the demographics of the discipline. Currently the faculty is all male. An addition of a female faculty in the near future would be appropriate.

***Do the faculty have regular opportunities for professional development such as travel and participation in professional organizations, workshops, and other learning experiences? Do faculty take advantage of the opportunities provided?***

Conversations with the department chair and the Dean indicate that the faculty have regular opportunities for professional development such as travel and participation in professional organizations, workshops, and other learning experiences. Funds for these are available to every faculty who wants to participate. Most faculty seem to take advantage of these opportunities. In cases of unused funds, the department chair reallocates to those faculty who request them.

***Are faculty engaged in the planning, assessment, and improvement processes that measure and advance student success?***

The faculty actively engages in regular planning, evaluation, and improvement activities that measure and advance student success. To enrich and improve the curriculum, which is maintained at the department level, faculty members may propose changes including curriculum, program goals, and an overall assessment process based on feedback from students and inputs during departmental meetings. The department reviews the proposal and, if approved, submits it to the graduate committee. Once approved, the university implements the changes in the following academic year.

***Does the program use assessment data, etc. to improve teaching, scholarship and creative activity and service? How does this work? Are the processes effective?***

The program uses an appropriate process and data to incorporate UTC's faculty evaluation system. Generally, supervisors score their faculty based on overall performance. The annual Evaluation and Development by Objectives (EDO) process is the main tool used to assess faculty at UTC. The process

measures quality of teaching, research, and service. The annual EDO evaluation consists of objectives, reports and evaluation.

## **PART 5 – Learning Resources**

***Does the program regularly evaluate its equipment and facilities and pursue necessary improvements?***

- *Has the program requested/encouraged necessary improvements of its equipment and facilities through appropriate internal mechanisms? Through appropriate external mechanisms?*

The MSEM program has recently made some improvements of its facilities and equipment both through internal mechanisms and external mechanisms. A room has been designated as a ‘study’ room for engineering management students. Students can plan group studies, work on their capstone projects, or use the computer facilities which have engineering management related software loaded on them. The department has also recently spent close to \$30,000 to remodel a laboratory so that it can be used for projects related to logistics and order processing. A Flexible Manufacturing System (FMS) worth \$350,000 is purchased to help with studies in process optimization, queuing, order processing and time studies.

- *Does it appear that the program’s resources are appropriate within the context of overall college resources?*

The program does appear to have appropriate resources, more so than may be found in similar programs throughout the country. Resource request made by the department chair to improve learning resources in MSEM seem to have been supported by the College. Students and faculty have access to information resources to support teaching and learning primarily through the newly constructed UTC Library. Additionally, The Walker Center for Teaching and Learning supports faculty by offering development sessions and other teaching resources.

- *How should needs of the program be prioritized? Could savings be realized from current program operations to fund any new budgetary needs?*

The program needs and requests for learning resources would normally be prioritized by the department chair and the Dean based on improving learning, increasing enrollments, research opportunities created and overall contribution to the department, College and University mission within the available resource constraints.

***Are library holdings and other learning and information resources current and adequate to support the teaching and learning needs of the discipline? Are there resources adequate to support the research and publication needs of the faculty and staff?***

The mission of the UTC Library is to support the teaching and research of faculty and students. The UTC Library in its impressive new building, is well staffed with a total library budget of over \$4 million. The Library makes available 103,530 serial titles, including open access titles, through subscriptions to full-text resources, databases, journal packages, and individual journals. A conversation with the Dean of the Library indicated that departments are allocated a budget for requested resources that are reviewed frequently. The

library resources seem adequate to support the research and publication needs of the faculty and staff. There have been no issues raised by faculty and the chair related to library resources.

## **PART 6 – Support**

### ***Is the program’s operating budget consistent with the needs of the program?***

The MS Engineering Management program’s internal and external support are consistent with the budget needs of the program. Expenditures stayed roughly the same during the last four years per SCH. Internal external grants received by the department increased significantly from about \$22K in 2017 to about \$1.2M in 2019. This significant growth if sustained can provide additional resources and recognition for the department.

- *Considering current budget constraints, what are the most pressing resource needs of the program? How should the needs of the program be prioritized? Could savings be realized from current program operations in order to fund any new budgetary needs?*

It seems that the most pressing resource need for the department is addition of new faculty in areas of dictated by the local industry and student needs. Hiring of a new faculty who would be able to participate in funded research would be a pressing need. Investments needed to increase enrollments by new program offerings and technology would be another. There are ongoing efforts in this area, like hiring of a company that would increase online offerings.

- *Could these needs be met in ways without requiring additional budgetary resources, such as savings from current program operations?*

The suggested needs above would require some additional resources. However, there is indication that available budget resources are being utilized by the department chair effectively.

### ***Does the program have a history of enrollment and graduation rates sufficient to sustain high quality and cost effectiveness?***

Even though enrollments and graduation rates have declined in the past few years, the number of students in the program is still sufficient to sustain a high quality and cost-effective graduate program. In addition, there is indication that this trend may be reversing as the department takes measures increase enrollments. Enrollments increased slightly in 2019.

### ***Is the program responsive to local, state, regional and national needs of the discipline?***

The MS Engineering Management program is responsive to changing local, state, regional and national needs. The curriculum contents are reviewed regularly, partly to respond to changing regional needs. Since the last program review, a strategic plan for the College of Engineering and Computer Science has been under development to further propel the responsiveness of programs it contains, including the MS Engineering Management Program. Even though it is at an undergraduate level, the addition of a mechatronics concentration is an indication of responsiveness to industry needs.

***Does the program regularly and systematically collect data related to the success of its graduates, including placement? Do they also incorporate the results of that data to inform program improvements?***

The program regularly and systematically collects data related to the success of its graduates. Graduate students are connected to the College's LinkedIn page upon graduation. The LinkedIn page helps the College stay connected with alumni and where they currently work. Since 2015, the College has completed an Annual Review, which is distributed to all alumni in addition to the local and regional businesses.

***Are the program policies reviewed on a regular basis to ensure alignment with institutional policies and mission?***

The MS Engineering Management program's policies and procedures are regularly reviewed to ensure alignment to institutional policies and mission. This is done every year to comply with and maintain the standards contained in the guidelines of the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC), the recognized regional accrediting body in the eleven U.S. southern states.

***Does the program have acceptable completion rates? If unacceptable, what are possible contributing factors? How is this information used toward program revision?***

Enrollment in MSEM has been in a downward trend since 2014 to 2018, mostly due to the decrease in enrollment in Construction Management concentration. Graduation rates have also decreased keeping track with enrollments. As mentioned earlier, the department has been taking measures to reverse this trend and enrollments have increased slightly in 2019. If the upward trend can be maintained, graduation rates will follow and increase. The completion rates provide important data toward program revisions and taking appropriate measures. Recent addition of new programs, learning resources and recruitment efforts indicate the use of such data for revisions.

## **PART 7 – Summary Recommendations**

***Overall, what are your impressions of the program?***

- *What are the major strengths of the program?*

The program in M.S. in Engineering Management fulfills a critical need by providing skills required by the employers in the area. A major strength is the department chair who understands the field of engineering management and seems to work in harmony with the faculty and with a supportive administration to make it a success. The curriculum is well developed and continuously evaluated using input from the students and from the industry. The faculty are qualified, motivated and in touch with the local industries. The program has a potential to grow significantly through the online program and certificate offerings. UTC support for online program development is commendable as evidenced by hiring of a dedicated online program director and a company to assist on developing the courses.

- *What are the major weaknesses of the program?*

The program is currently healthy and doing well. If there is a weakness, the potential to grow significantly and student/industry needs will be better served by additional resources in two areas. The size of the full-time

faculty is barely adequate to offer both the undergraduate and graduate programs online and in live formats. The workload in teaching, advising and online course development is heavy for fulltime faculty, not leaving much time for scholarly publications and research. Scholarly publications and research are necessary for the program and faculty to grow and gain nationwide reputation. Also, one of the faculty positions is currently a visiting position, creating some uncertainty and potential commitment issues.

***What goals would you suggest the program set for the next five years? Please list goals in order of priority (i.e., the most important goal first, followed by the second most important goal, etc.)***

Below are some suggestions based on my observations during the visit. Some of these are easy to implement and some will require additional resources. I will leave the priority assessment to the department chair and the Dean.

1. Suggest a new faculty position focusing on graduate program needs. There are two new positions already, but one seems to be more focused on undergraduate programs.
2. Suggest developing an exhaustive plan for the growth of the online program and a justification for requesting additional resources for it from the University. A review of similar online programs in engineering management, how they are funded, and their successes may be helpful. Study the potential for online students both within the local and distant areas and come up with incentives for online course development, and a detailed budget for all resources needed.
3. Suggest seeking graduate program certification from the American Society for Engineering Management. This is a specialized accreditation process for engineering management. It can bring more visibility for the UTC programs and serve as a marketing tool. The time and effort for this one is not much.
4. Suggest turning the visiting position to a fulltime tenure-track position.
5. Recommend requiring a course in engineering statistics for MSEM, at least as a prerequisite course. This request came up during an interview with students employed fulltime.
6. Suggest offering certificate program online, especially one on project management.
7. Suggest developing a plan similar to above in offering a doctoral program, or in Doctor of Engineering Management. Such a program would have a significant potential to attract engineers in management positions from the local industries and enable increased scholarly research participation from faculty. A large percentage of the students who are in search of a doctoral degree in engineering management work full-time and they are likely to stay and advance in industry rather than going into academia. A Doctor of Engineering degree may be ideal for these students.

***How can the program work to achieve these goals over the next five years?***

- *Considering current budget constraints, what are the most realistic strategies the program can use to achieve the highest priority goals?*

A major strength of the program is its location in a rapidly growing industrial region. Most companies need expertise in the engineering management area. Issues in project management, manufacturing, facilities

management, logistics, product/process design and quality are common. The engineering management faculty at UTC is in a unique position to address such problems. Partnerships with the industry in recruiting students, student/faculty projects, internships and research funding can generate additional resources. This assumes an incentive system and a project funded faculty release time system is in place.

- *What goals would require additional resources? What level of resources would these goals require? How might the program secure these resources?*

Significant growth of enrollments for the online program is going to require a commitment and a sizeable investment from the department, faculty and the university. Some of this is already happening. Faculty financial incentives for developing online courses may be helpful. It would be difficult for me to provide a number, but I can give an example from my own institution. Faculty gets about \$3,000 for developing a new online course and full IT support from our Distance Learning organization. I believe, such small investments in the online program can pay for itself by generating substantial increases in additional student credit hours and tuition revenue.