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### Quality Engineering and Management

#### Mission Statement

The mission of the school of Applied Engineering and Technology is to provide value to our stakeholders through innovation in applied engineering education.

Graduate work leading to a Master of Science in Quality Engineering and Management is offered by the School of Applied Engineering and Technology. The objective of the program is to develop quality and management professionals who can plan, coordinate, design, implement, and control the quality function in manufacturing and service companies in order to increase productivity, optimize resources, decrease waste, and improve product quality. Course offerings and research are available in the areas of quality assurance, six sigma, lean manufacturing, project management, and reliability. The program provides advanced education for students with baccalaureate degrees in engineering, engineering technology, technology, and also an excellent continuing education opportunity for individuals with technical degrees who wish to expand their education in the area of quality and management systems.

### Master of Science (M.S.) in Quality Engineering and Management

#### Admission

Candidates for this program must be accepted by the Graduate School and the School of Applied Engineering and Technology. Candidates should possess a bachelor's degree with a major in a technical area and have a GPA of no less than 3.0/4.0. A student whose undergraduate training is deficient may be required to take additional courses to compensate for deficiencies identified by the school's graduate program committee.

This program requires a nonrefundable \$65 application fee that must be submitted with the application for admission to graduate study in Quality Engineering and Management. Applicants must pay this fee by credit card.

#### Program Requirements

Graduate students who have been admitted into the M.S. in Quality Engineering and Management program must complete a total of 30 credit hours of graduate-level credit of which 15 credit hours must be at the 500 level.

Within the 30 credit hour requirement, students must complete the following four core courses:

- QEM 510: Quality Assurance (3 CH)
- QEM 525: Six Sigma Black Belt II (3 CH)
- QEM 530: Lean Manufacturing II (3 CH)
- QEM 540: Reliability Analysis (3 CH)

The remainder of the 30 credit hours must consist of at least 18 credit hours of QEM and/or IMAE graduate elective courses as specified in the student's program of study. Elective courses in QEM are:

- QEM 535: Service Quality (3 CH)
- QEM 545: Project Management II (3 CH)
- QEM 550: Project Leadership (3 CH)

- QEM 555: Human Safety and Risk Management (3 CH)
- QEM 565: Management of Information Technology Resources (3 CH)
- QEM 570: Energy Management and Conservation (3 CH)

Students not meeting specific requirements for the above core courses will be required to complete the following list of courses. These specific 400-level courses will count toward meeting the 30 credit hour acceptable graduate credit requirement:

- IMAE 450/TRM 470: Project Management (3 CH)
- IMAE 465: Lean Manufacturing (3 CH)
- IMAE 470A: Six Sigma Green Belt (3 CH)
- QEM 500: Six Sigma Green Belt II (3 CH)
- QEM 515: Six Sigma Black Belt (3 CH)

**\*Note:** IMAE courses taken for undergraduate credit cannot be applied towards graduate credit hours, unless the student has been accepted into the accelerated program.

In the thesis option a program of study including the above required courses (12 credit hours), the master's thesis (six credit hours), and the remaining 12 credit hours will be selected by the graduate adviser and the student.

### **Additional Information**

Teaching or research assistantships and fellowships are available for qualified applicants. Additional information about programs, courses, assistantships, and fellowships may be obtained from the College of Engineering, Computing, Technology, and Mathematics or from the director of the school.

## **Accelerated Master's Program**

Industrial Management and Applied Engineering (IMAE) students with senior standing and a GPA of 3.5 are eligible for the Accelerated Master's program. Students pursuing their M.S. in Quality Engineering and Management (QEM) after completing their Bachelor's degree in IMAE will be able to apply up to 9 credit hours of approved IMAE coursework towards the QEM degree. This will allow the student to complete the degree requirements in about a year. Students must complete a Graduate School application and work with the graduate advisor on a program of study. The accelerated master's program allows students who have advanced degree aspirations the ability to save money by completing their studies quicker and to enter the job market sooner.

The Quality Engineering and Management accelerated program with the non-thesis option requires satisfactory completion of twelve credit hours in core courses: QEM 510, QEM 525, QEM 530 and QEM 540 and eighteen credit hours of elective graduate credit, which may include up to nine IMAE credit hours at the 400-level taken as an undergraduate.

The Quality Engineering and Management accelerated program with the thesis option requires satisfactory completion of twelve credit hours in core courses: QEM 510, QEM 525, QEM 530, and QEM 540, six credit hours of thesis and twelve credit hours of elective graduate credit, which may include up to nine IMAE credit hours at the 400-level taken as an undergraduate.

## **Quality Engineering and Management Courses**

**QEM500 - Six Sigma Green Belt II** The objective of this course is to provide the student with a complete coverage of the statistical and analytical tools used and applied in the "Six Sigma" methodology at the green-belt level. Topics include: discrete probability distributions, continuous probability distributions, statistical process control tools, quality control charts, process capability analysis, gauge and measurement capability studies, cumulative sum control charts and exponentially-weighted moving average control charts. Prerequisite: IMAE 307 or MATH 140 or MATH 150, IMAE 470A or consent of instructor. Restricted to students with junior, senior or graduate standing in the College of Engineering,

Computing, Technology, and Mathematics except when approved by School of Applied Engineering and Technology. Credit Hours: 3

**QEM505 - Research Methods** The objective of this course is to familiarize the students with the methods needed in research. Emphasis is placed on how these methods can be applied in the quality engineering & management area. Topics include development of research proposals, use of statistics in the analysis and communication of the results. Restricted to enrollment in quality engineering and management program or consent of instructor. Credit Hours: 3

**QEM510 - Quality Assurance** Study of recent advances in quality planning, quality measurement, design assurance, process control, participatory management, supplier quality, customer relations, and improvement concepts. Prerequisites: IMAE 470A; IMAE 470B or QEM 500. Credit Hours: 3

**QEM515 - Six Sigma Black Belt** The purpose of this course is to provide the student with a comprehensive coverage of the knowledge areas and tools of Six Sigma beyond green-belt training, focusing on descriptive and analytical methods to deal with variability including point and interval estimation, hypothesis testing, and design of experiments. Topics include: confidence intervals, hypothesis testing, regression analysis, analysis of variance, single factor experiments, block design of experiments. Prerequisite: IMAE 307 or equivalent; IMAE 470B or QEM 500 with grades of C or better. Restricted to College of Engineering, Computing, Technology, and Mathematics students or school approval required. Students who have taken IMAE 480 are ineligible to enroll. Credit Hours: 3

**QEM525 - Six Sigma Black Belt II** The purpose of this course is to provide the student with knowledge of the most advanced areas of the Six Sigma black-belt training. Advanced fractional factorial experiments, response surface methodology, robust design and process, design for Six Sigma and other advance Six Sigma principles and techniques are covered in this course. Prerequisites: IMAE 470A; IMAE 470B or QEM 500; IMAE 480 or QEM 515. Credit Hours: 3

**QEM530 - Lean Manufacturing II** This course will cover the principles and techniques of lean manufacturing. Major topics covered include value stream mapping, pull system/Kanbans, continuous improvement/Kaizen, lean six sigma, lean simulation, and other modern lean manufacturing techniques and issues. Prerequisite: IMAE 465. Credit Hours: 3

**QEM535 - Service Quality** This course examines how organizational leadership, strategic development and deployment of service management systems are used to achieve service quality. Key service quality management concepts of customer and market focus, employee focus, communication, and service delivery will be taught through the use of case studies, article reviews and team projects. Prerequisite: none. Credit Hours: 3

**QEM540 - Reliability Analysis** The objective of this course is to provide the student with an overview of the basic techniques applied in the field of reliability and failure data analysis in a manufacturing environment. Prerequisite: IMAE 470B or QEM 500. Credit Hours: 3

**QEM545 - Project Management II** This course is an advanced study of the concepts in project management, building on the fundamentals established in prerequisite courses. Using MS Project, students will work individually and in teams to develop appropriate tools and documentation typically utilized to implement, control, and closeout projects. Computerized scheduling and cost control, quality systems, risks management, procurement, and project termination. Prerequisite: IMAE 450. Credit Hours: 3

**QEM546 - Project Management for Supply Chain Engineering** The course is designed to provide students with an introduction to the project management process and an in-depth examination of the activities needed to successfully initiate, plan, schedule, and control the time and cost factors of the project as it relates to developing a supply chain system. Executing successful supply chain projects requires the management of technology, people, culture, stakeholders, and other diverse elements. This course takes an integrated approach to managing projects, merging both technical and managerial challenges. It emphasizes not only individual project execution, but also provides a strategic perspective, demonstrating means to manage supply chain projects at the program and portfolio levels. Credit Hours: 3

**QEM550 - Project Leadership** This course is designed to develop a graduate student's human relationship skills for leading project teams. Through the use of case studies and practical applications, students will learn effective leadership, team development, motivational, organizational planning, and conflict resolution practices. Credit Hours: 3

**QEM555 - Human Safety and Risk Management** Understanding risk and safety issues inevitably involves many disciplines, as does their effective management. Through the combination of scientific evidence, practical examples, and case studies presented in this course, students will be equipped to identify, assess and develop strategies to mitigate occupational and environmental risk. Methods used to effectively communicate and understand risk factors as presented by various agencies. Credit Hours: 3

**QEM560 - Supply Chain Engineering** The objective of this course is to introduce the basic principles and techniques of the Lean methodologies and its application targeting specific needs of the Supply Chain professionals in executive sales and operations planning, forecasting, customer relationships, leveling production, dependent demand materials management, capacity management, shop floor control, inventory management, lot sizing, warehousing, logistics, quality control, and purchasing. Credit Hours: 3

**QEM562 - Transportation and Logistics Systems** The course covers different components of logistics and distribution; in particular, those dealing with material movement, associated moveable and immovable facilities/resources, procurement and material refurbishing, warehousing and distribution network systems, and transportation. The major thrust of the course is to explore the optimal planning, design and coordination of large scale warehousing operations and distribution logistics, supply transportation systems (shipping and materials tracking), multi-modal transportation systems and convoy movements. Credit Hours: 3

**QEM564 - Facilities and Location Planning** The course encompasses the planning, design, development, management and control of production and distribution systems to effectively distribute goods and services from the producer to end user, whether in manufacturing or service systems. Topics include analytical approaches in site location, facility layout, material handling, and storage systems. Aspects of facilities for manufacturing, material handling, packing and distribution, concepts of group technology, and computer aided facility design are covered. Credit Hours: 3

**QEM565 - Management of Information Technology Resources** The use of information and communication technologies (ICT) dominates the world of business. There are ongoing fundamental changes in the way organizations execute their business processes and interact with each other. This course helps students understand the relationship between information systems and business performance. This will enable students to appreciate the importance of strategic implementation and proper manage of ICT resources. Credit Hours: 3

**QEM570 - Energy Management and Conservation** This course covers the principles and policies of energy management and auditing. It covers development, implementation and economic analysis, using simple pay back and life-cycle cost models, of these programs and audits. It focuses on efficient operation of electric motors, lighting, boilers, furnaces, and facilities climate control. It surveys current energy policy with emphasis on LEED design and certification. Prerequisites: MATH 150 or IMAE 307, PHYS 203A,B or equivalents. Credit Hours: 3

**QEM580 - Seminar** Collective and individual study of issues and problems related to quality engineering and management. Graded S/U. Restricted to enrollment in the M.S. degree in quality engineering and management. Credit Hours: 1-4

**QEM583 - Analysis of Statistical Quality Data** Controlling and improving quality has become an important business strategy for many organizations: manufacturers, distributors, transportation companies, financial services organizations, health care providers, and government agencies. Maintaining a high level of product or service quality provides a competitive advantage. A business that can delight customers by improving and controlling quality can dominate its competitors. This course covers the technical methods for achieving success in quality control and improvement, and offers guidance on how to successfully implement these methods. Credit Hours: 3

**QEM585 - Advanced Data Analysis & Design of Experiments** Experimentation plays an important role in product development and process realization and commercialization activities, which consist of new product design and formulation, manufacturing process development, and process improvement. The

objective in many cases may be to develop a robust process, a process affected minimally by external sources of variability. The purpose of this course is to provide the student with a comprehensive coverage of the knowledge areas involved in these studies, focusing on Planning, Designing and Analyzing Experiments (DoE). Credit Hours: 3

**QEM592 - Special Investigations in Quality Engineering and Management** Advanced topics in quality engineering and management. Topics are selected by mutual agreement of the student and the instructor. Special approval needed from the adviser. Credit Hours: 1-4

**QEM599 - Thesis** Credit Hours: 1-6

**QEM601 - Continuing Enrollment** For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only. Credit Hours: 1

## Quality Engineering and Management Faculty

**DeRuntz, Bruce**, Professor, Ph.D., Southern Illinois University Carbondale, 2005.

**Dunston, Julie K.**, Associate Professor and Interim Director, Ph.D., Florida State University, 1995.

**Legier, John Tugaw**, Associate Professor, Ph.D., Southern Illinois University, 2007.

**Spezia, Carl J.**, Associate Professor, Ph.D., Southern Illinois University Carbondale, 2002.

**Velasco, Tomas**, Associate Professor, Ph.D., University of Arkansas, 1991.

### Emeriti Faculty

**Chang, Feng-Chang (Roger)**, Associate Professor, Emeritus, Ph.D., Ohio State University, 1985.

**Marusarz, Ronald K.**, Associate Professor, Emeritus, Ph.D., Southern Illinois University Carbondale, 1999.

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