

**German Jordanian University**

**School of Applied Technical Sciences**

**Department of Industrial Engineering**

**Master of Science in Engineering Management**

**Thesis Track**

**Study Plan 2023**

**Master of Science in Engineering Management**

# Overview

Master of Science in Engineering Management (MSEM) is a degree that bridges the gap between the fields of [engineering](https://en.wikipedia.org/wiki/Engineering), [technology](https://en.wikipedia.org/wiki/Technology), business management, and innovation. It is a multidisciplinary field that involves the application of advanced business methods, engineering techniques, and innovation tools to design, manage, and improve complex systems and achieve organizational objectives.

MSEM is aimed at attracting ambitious engineers who aspire to obtain a senior role in their organizations in which they integrate technical and management responsibilities with innovation to support business growth and new organizational trends. It is ideal for recent graduates hoping to make their first move into engineering and innovation management, as well as established professional engineers who aspire for a higher management role and wish to extend their knowledge beyond their specific technical field.

MSEM graduates can work as engineering managers, quality managers, innovation and technology managers, project managers, operations managers, as well as in planning and strategic management to lead their organizations.

# Program Objectives

Graduates of the MEM program will be able to achieve the following objectives:

1. Apply engineering and management knowledge and techniques to analyze complex decisions and design complex engineering systems.
2. Establish successful engineering management careers in public and private sector that will contribute to the development of Jordan and the region.
3. Successfully manage technological innovation through developing the strategies, structures, and systems needed for the effective commercialization of new products and services, business systems and production processes.
4. Develop competitive skills in problem solving techniques, interdisciplinary teamwork, and critical analysis of engineering management problems.
5. Develop profound understanding of global economic and technological aspects to meet the changing needs of a knowledge-based economy by adapting and responding to changes.
6. Engage in service to professional societies and communities through practicing engineering systems management with professionalism and ethics.

# Learning Outcomes

Upon completion of the program, graduates should be able to:

1. Solve industry-related problems by applying advanced engineering management, business, and innovation knowledge.
2. Analyze and design complex systems using both qualitative and quantitative tools and perspectives.
3. Interpret quantitative and subjective data to make sound engineering and managerial decisions.
4. Evaluate possibilities and opportunities through combining creative thinking skills and tools with a thorough understanding of technological development

e. Analyze, design, and manage innovation and product development for maximum effectiveness and value.

f. Develop and lead effective teams and projects and communicate effectively across the entire enterprise

g. Understand the ethical responsibilities of practicing engineering managers and the impact of their decisions within a global and societal context.

h. Appreciate the need for life-long learning and personal development.

# Course Delivery Methods

Courses are in one of the following three methods:

* **Face-to-Face (F2F) Method**

Courses using this method are delivered by faculty in person in regularly scheduled class sessions physically on campus.

* **Blended (BLD) Method**

Courses are delivered in a hybrid mode of physical face-to-face class sessions and asynchronous material including online instructional videos, presentations, projects, and similar learning activities.

* **Online (OL) Method**

Courses are delivered exclusively online. This method consists of a hybrid of synchronous regularly scheduled class sessions delivered via the Internet, and asynchronous material including online instructional videos, presentations, projects, and similar learning activities. Virtual classrooms utilizing different online platforms are used. No physical face-to-face meetings are required.

# German Dimension

School of Applied Technical Sciences has well-established exchange cooperation with over 27 German partner universities. The cooperation includes the following and can be expanded to apply to the current master program:

1. Sending students to Germany for studying or practical purposes.
2. Exchange professors to teach block modules.
3. Capacity building and train the trainings program of staff through EU-funded projects.

# Admission Requirements

To apply for admission, the following minimum requirements must be met:

1. Applicants must hold a B.Sc. degree in any engineering discipline.
2. A minimum professional experience of one year in any field of engineering is required.
3. Additional requirements, including minimum GPA and language skills, are covered by the general graduate studies admission requirements.

# Program Prerequisites

Enrolled students are expected to pass an entry assessment exam on engineering statistics and engineering economics. Students who fail to pass the exam will be required to take a pre-requisite course (IE517 Statistics and Engineering Economics) and will be informed of this in their admission letter.

# 7. Curriculum

The numbering system is structured as follows (from left to right):

1. IE: Industrial Engineering Department
2. Level digit: 7 = Master level
3. The middle digit represents the specialized field of knowledge:

1 = Operations Research

2 = Innovation Management

3 = Statistics & Quality

4 = Management Sciences and Business Management

5 = Technology Management

6 = Research Methods

7 = Special Topics

8 = Comprehensive exam

1. The right digit represents the sequence of the course within the field.

# ECTS Workload

ECTS: European Credit Transfer and Accumulation System (ECTS): One ECTS is equivalent to 25 actual workloads hours.

# Degree Requirements (Credit hours)

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| --- | --- | --- |
| **Classification** | **Credit Hours** | **ECTS** |
| Compulsory Courses | 19 | 50 |
| Elective Courses | 6 | 16 |
| Master Thesis | 9 | 24 |
| **Total** | **34** | **90** |

# Curriculum (Credit hours)

### Compulsory Requirements: (19 credit hours)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE711 | Operations Research & Simulation | 3 | 8 | 3 | - | F2F | - |
| IE732 | Quality Engineering & Management | 3 | 8 | 3 | - | F2F | - |
| IE741 | Operations & Supply Chain Management | 3 | 8 | 3 | - | F2F | IE711 |
| MBA712 | Management and Cost Accounting | 3 | 8 | 3 | - | F2F | - |
| IE761 | Research Methods | 1 | 3 | 1 | - | F2F | - |
| IE790 | IE762 | Applied Research Project I: Innovation Project | 3 | 15 | 3 | - | BLD | - |
| IE763 | Applied Research Project II: Project Management and Entrepreneurship | 3 | 3 | - | IE762 |
|  | **Total** | **19** | **50** | **19** | **0** |  |  |

### Elective Courses: (6 credit hours out of the following)

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| --- | --- | --- | --- | --- | --- | --- |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE733 | Reliability & Maintenance Management | 3 | 8 | 3 | - | BLD | IE732 |
| IE734 | Lean Six Sigma | 3 | 8 | 3 | - | BLD | IE732 |
| IE743 | Facility & Asset Management | 3 | 8 | 3 | - | BLD | IE711 |
| IE744 | Business Law & Engineering Contracts | 3 | 8 | 3 | - | OL | - |
| IE751 | Applied Data Analytics | 3 | 8 | 3 | - | F2F | IE517 |
| IE752 | Sustainability & Energy Management | 3 | 8 | 3 | - | BLD | - |
| IE771 | Special Topics in Engineering Management | 3 | 8 | 3 | - | BLD | - |
| IE772 | Special Topics in Innovation Management | 3 | 8 | 3 | - | BLD | - |
| MBA740 | Organizational Behavior and Human Resources  | 3 | 8 | 3 | - | OL | - |
| MBA743 | Strategic Management and Business Policy | 3 | 8 | 3 | - | BLD | - |
|  | **Minimum required** | **6** | **16** | **6** | **0** |  |  |

### Thesis: (9 credit hours)

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| --- | --- | --- | --- | --- | --- | --- |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE799A-D | Master Thesis | 9 | 24 | 9 | - | BLD | Dept. Approval |
|  | **Minimum required** | **9** | **24** | **9** | **0** |  |  |

1. **Study Plan Guide: Thesis Track**

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| **First Year** |
| **First Semester** |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE711 | Operations Research and Simulation | 3 | 8 | 3 | - | F2F | - |
| IE761 | Research Methods | 1 | 3 | 1 | - | F2F | - |
| MBA712 | Management and Cost Accounting | 3 | 8 | 3 | - | F2F | - |
|  | **Total** | **7** | **19** | **7** | **0** |  |  |

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| **First Year** |
| **Second Semester** |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE732 | Quality Engineering and Management | 3 | 8 | 3 | - | F2F | - |
| IE741 | Operations Supply Chain and Management | 3 | 8 | 3 | - | F2F | IE711 |
| IE762 | Applied Research Project I: Innovation Project | 3 | 7 | 3 | - | BLD | - |
|  | **Total** | **9** | **23** | **9** | **0** |  |  |

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| **Second Year** |
| **First Semester** |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE763 | Applied Research Project II: Project Management and Entrepreneurship | 3 | 8 | 3 | - | BLD | IE762 |
| - | Elective | 3 | 8 | 3 | - | - | - |
| - | Elective | 3 | 8 | 3 | - | - | - |
|  | **Total** | **9** | **24** | **9** | **0** |  |  |

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| **Second Year** |
| **Second Semester** |
| **Course ID** | **Course Name** | **Credit Hours** | **ECTS** | **Contact Hours** | **Type** | **Prerequisites / Corequisites** |
| **Lect** | **Lab** |
| IE799A-D | Master Thesis | 9 | 24 | 9 | - | BLD | - |
|  | **Total** | **9** | **24** | **9** | **0** |  |  |

# Course Descriptions

# Compulsory Courses

|  |  |  |
| --- | --- | --- |
| **IE711 Operations Research & Simulation** | **3 Cr Hr** | **8 ECTS** |
| This course covers basic and advanced Operations Research (OR) methods and applications along with computer simulation of stochastic processes using Monte Carlo and Discrete Event Simulation (DES) software packages. OR is focused on the formulation of mathematical models with linear and integer programming, computer solution, and sensitivity and cost analysis of alternative optimum solutions with applications to production and service systems and logistic networks. The course also covers an overview of queuing systems and decision analyses. The course includes real-world case studies and applications of the learned concepts and methods. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE732 Quality Engineering and Management** | **3 Cr Hr** | **8 ECTS** |
| To familiarize students with fundamentals of quality engineering and management including: quality definitions, quality management principles, total quality management strategy, quality management systems, excellence models, economics of quality, statistical process control, sampling procedures, introduction to ANOVA and DoE, process and measurement system capability, DMAIC methodology and an introduction to Six Sigma. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE741 Operations and Supply Chain Management** | **3 Cr Hr** | **8 ECTS** |
| This course covers the major issues in operations and supply chain management including Sourcing Decisions, Logistics, Demand Forecasting, Capacity Planning, Inventory Control, Production Planning, Lean Production, and Scheduling in different types of organizations. The module emphasizes the utilization of Operations Research methods in designing and optimizing supply chains and logistics networks. It also covers the role of advances in Technologies, Electronic Commerce, and Enterprise Resource Planning (ERP) in coordinating the supply chain of products and services from the point of origin to the point of consumption. The case study requires students to develop the quantitative and analytical skills to analyze, model and solve various supply chain problems. |
| *Prerequisites: IE711* |
| *Corequisites: -* |

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| **IE761 Research Methods** | **1 Cr Hr** | **3 ECTS** |
| This course covers the essential concepts related to research that allow the students to critically analyze published research and/or be able to conduct independent research, starting from developing the research idea up to writing and presenting a scientific paper. Focus is on understanding each component of the research process, qualitative and quantitative research approaches, practical strategies for conducting a literature review, various styles of citations (with an emphasis on APA and IEEE style guidelines), how to read, write effectively, and present technical papers, how to evaluate the effectiveness of research, how to prepare a comprehensive research proposal. Various aspects of research ethics (e.g., professional ethics, intellectual property, plagiarism) will also be addressed in this course. The course includes a number of lectures given by faculty and invited speakers where models of research and case studies in engineering are presented.  |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE762 Applied Research Project I: Innovation Project** | **3 Cr Hr** | **7 ECTS** |
| This course focuses on introducing innovation and entrepreneurship from multiple angles and by exposing the students to real world examples and case studies. It transforms the student from observing innovations to transferring their own innovation from an idea to a research project and a business plan. The module covers the innovation imperative, sources of innovation, tools and methods of innovation, and the development of innovation research projects. This part focuses on developing new products and services and how to write a research methodology to develop these products and a business plan for their adoption. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE763** **Applied Research Project II: Project Management and Entrepreneurship** | **3 Cr Hr** | **8 ECTS** |
| This course examines the organization, planning, and controlling of innovation and research projects and provides theoretical and practical knowledge on managing project scope, schedule and resources. Topics include project life cycle, work breakdown structure, Gantt charts, network diagrams (CPM and PERT), and resource allocation decisions. Concepts and methods are applied through team innovation and applied research projects using project management software competence with a set of tools and methods for entrepreneurship in product/service design and development. The main topics of this part of the module are as follows:* + The process of scoping and planning R&D projects;
	+ Project cost estimation and the budgeting;
	+ Project scheduling and allocating resources;
	+ Research and innovation project risk management;
	+ Managing projects through information systems: planning-monitoring-controlling cycle, information needs and the reporting process, and earned value analysis.
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| *Prerequisites: IE762* |
| *Corequisites: -* |

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| **MBA712 Management and Cost Accounting** | **3 Cr Hr** | **8 ECTS** |
| This course focuses on understanding the usefulness of management accounting information to businesses and managers to drive effective and efficient decisions. This course provides students with vital information on relevant costs, qualitative factors in the dynamic interaction of cost, volume and profit analysis. This course includes studying costing systems to make operational decisions such as costing and pricing in today’s competitive environments. Also, discussed is the profit planning and the impact of budgets on strategic plans and objectives, moreover, accounting for control, performance evaluation and appraisal is presented. Strategic management accounting including competitor analysis and customer profitability analysis are explained to evaluate decision making outcomes. Finally, Ethical practices of management accounting are essential components of this course as a mean of following the new trends of strategic management accounting. |
| *Prerequisites: -* |
| *Corequisites: -* |

# Elective Courses

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| **IE733 Reliability & Maintenance Management** | **3 Cr Hr** | **8 ECTS** |
| Reliability, Availability, Maintainability, and Safety (RAMS) are the most important technical characteristics of systems, structures, and components. The scope of this course is to provide the students with the fundamental concepts and the necessary knowledge and skills related to reliability engineering and maintenance management of industrial systems, structures, and components. Specifically, this course is divided into TWO main parts: Part 1 (dedicated to cover the aspects of reliability engineering) contains an introduction to reliability (reliability definitions, importance, life model distributions, the estimation of the reliability of an industrial component, the typical behavior of failure rate of a component (bathtub curve), reliability models and reliability measures and statistics), system’s reliability (the estimation of the reliability of a system composed by several components connected in different design configurations (series, parallel, mixed series and parallel, complex, stand-by)), reliability engineering (why do systems fail, how to develop reliable systems, how to improve reliability, how to measure/test reliability, and how to maintain systems reliable), reliability applications, failure prevention techniques with an emphasis on Design For Reliability (DFR) approach for improving the overall system reliability. Whereas Part 2 (dedicated to cover the aspects of maintenance management) contains maintenance management objectives, maintenance intervention approaches (i.e., corrective, scheduled, condition-based and predictive) and maintenance strategic planning (i.e., Reliability-Centered Maintenance [RCM] and Risk-Based Maintenance [RBM]) commonly used in the industry, maintenance planning & scheduling, work order systems, maintenance cost control, performance keys indicators, designing a Maintenance Management System (MMS), and Computerized Maintenance Management System (CMMS) and software applications. The course will be supported with examples taken from real-industrial applications, e.g., oil and gas, nuclear, automotive, etc. Besides, hands-on exercise sessions for some topics will be performed to allow the students to develop their skills. |
| *Prerequisites: IE732* |
| *Corequisites: -* |

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| **IE734 Lean Six Sigma** | **3 Cr Hr** | **8 ECTS** |
| The course focuses on all aspects of the Body of Knowledge (BOK) of Six Sigma. Students who pass the class will have the knowledge of Six Sigma Green Belts (SSGB) and should be able to pass SSGB certification exams almost anywhere in the world. Six Sigma’s BOK covers four major areas: project management, problem-solving techniques, decision-making and statistical analysis. Students will learn all project management and statistical tools used in any Six Sigma project |
| *Prerequisites: IE732* |
| *Corequisites: -* |

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| **IE743 Facility & Asset Management** | **3 Cr Hr** | **8 ECTS** |
| Provides students with the skills and knowledge to determine tools and techniques required for facility management. Students learn the concepts and methodology of facilities planning, in addition to layout planning, line balancing, selection of material handling systems, and assessment of labor performance. Students acquire knowledge and skills in the areas of strategic facilities planning and manufacturing facilities design. |
| *Prerequisites: IE711* |
| *Corequisites: -* |

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| **IE744 Business Law & Engineering Contracts** | **3 Cr Hr** | **8 ECTS** |
| This course explains the working of business law in engineering practice by dealing with legal aspects of external large-scale projects such as plant & process engineering, IT, civil engineering, and infrastructure projects. It places special emphasis on a reliable safeguarding of project risks through contractual instruments. It will be demonstrated from a legal point of view, how risk situations are determined by project structures, procurement methods, contracts, and law. Additionally, the course will expose students to important theories applications related to the following acts: the contract act, sale of goods act, the negotiable instrument act, the companies (amendment) act, the consumer protection act, and information technology act. |
| *Prerequisites: -* |
| *Corequisites: -* |
| **IE751 Applied Data Analytics** | **3 Cr Hr** | **8 ECTS** |
| At the present time, there is a growing need for specialists with background in Python who can apply data analytics methods to practical problems at their workplace. Working in data analytics requires an understanding of many interdisciplinary concepts, involves data mining and application of various methods. The proposed course is designed to fill this need. Students will learn major Python tools, machine learning classifiers and techniques for data analytics. There are weekly in-class assignments and mini projects on topics covered in class. These assignments will help build necessary statistical, visualization and other data analytics skills in a variety of applications including finance, time series analysis and recommendation systems. In addition, students will choose a topic for a term project and present it on the last day of class. |
| *Prerequisites: IE517* |
| *Corequisites: -* |

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| **IE752 Sustainability & Energy Management** | **3 Cr Hr** | **8 ECTS** |
| Students will learn about the principle of sustainability and sustainable development in a broader context, sustainability metrics, energy efficiency, conventional and nonconventional energy resources, economics of energy generation and consumption. They will analyze available data related to energy demand, climate change, and sustainability indicators. They will learn how to perform energy analysis and conduct energy audits in building and industrial facilities. Topics including electricity supply systems, heating, lighting, insulation, and other energy related systems will be reviewed in addition to energy systems maintenance. Students will learn various energy storage technologies like mechanical, electrical, chemical, and thermal technologies. Concepts related to energy in transportation, green buildings, energy management standards will be also covered. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **MBA740 Organizational Behavior and Human Resources** | **3 Cr Hr** | **8 ECTS** |
| This course is designed to expose students to important theories and conceptual models for analyzing, understanding, and managing human behavior within organizations. Organizational behavior encompasses a wide range of topics, such as motivation, attitudes, change, leadership, teams, etc. Some of the topics we will cover during this course are vital in the world of business. Organizational behavior studies cover the study of organizations from multiple viewpoints, methods, and levels of analysis. It examines and analyzes the application of knowledge about how people, individuals, and groups act in organizations. It does this by taking a system approach. That is, it interprets people-organization relationships in terms of the whole person, whole group, whole organization, and whole social system. Its purpose is to build better relationships by achieving human objectives, organizational objectives, and social objectives. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **MBA743 Strategic Management and Business Policy**  | **3 Cr Hr** | **8 ECTS** |
| Strategic management and business policy course is designed to unify the students learning experience at the program. This module builds on students learning experience and acts as a corner-step to the real world of business and success. It integrates the various areas of the business disciplines into strategy to achieve a sustainable competitive advantage through energetic discussions of strategy formulation, selection and implementation. It relies heavily on interactive and case analysis learning methods. This course teaches students the science and art of business strategy in modern organizations to achieve long-term strategic objectives in today’s turbulent business environment. It teaches students the process of strategic management and business policy as a usual business practice, which is embedded in the organization’s culture on the top levels of management. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE771 Special Topics in Engineering Management** | **3 Cr Hr** | **8 ECTS** |
| Selected topics of current interest in Engineering Management. The course is designed to give the students an opportunity to pursue special studies not offered in other courses. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE772 Special Topics in Innovation Management** | **3 Cr Hr** | **8 ECTS** |
| Selected topics of current interest in Innovation Management. The course is designed to give the students an opportunity to pursue special studies not offered in other courses. |
| *Prerequisites: -* |
| *Corequisites: -* |

# Thesis/Other

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| --- | --- | --- |
| **IE517 Statistics and Engineering Economics**  | **0 Cr Hr** | **0 ECTS** |
| This course intends to familiarize students with basic concepts in statistics and engineering economics. Students get acquainted with the fundamentals of probability and probability distributions, descriptive statistics, statistical inference and linear regression. Students learn concepts of the of time value of money and equivalence. Students learn economic-based decision making among alternatives including inflation, depreciation, taxes, and replacement decisions. |
| *Prerequisites: -* |
| *Corequisites: -* |

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| **IE799A-D Master Thesis** | **9 Cr Hr** | **24 ECTS** |
| The master thesis concludes the program, and it is the ending measure to the students’ ability to conduct research and complete original work that pertains to engineering management. Students must demonstrate the ability to integrate the information and the skills accumulated in their study plan through rigorous written and oral communications. Advisors and students select a thesis topic, and students complete the project under the supervision of the advisors by searching relevant literature, collecting and analyzing data, preparing and presenting results, and writing research papers. The thesis is completed with a thesis report and a final defense to an examining committee. |
| *Prerequisites: Department Approval* |
| *Corequisites: -* |