

## Annex 2 Prospectus

### Department of Industrial Engineering and Management

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The Department of Industrial Engineering and Management offers an undergraduate degree program leading to a Bachelor of Science in Industrial Engineering and a graduate degree program leading the Master of Engineering Management degree.

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### Master of Engineering Management (MEM)

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The Master of Engineering Management (MEM) program prepares graduate students to assume the responsibilities of professional engineering management. The EM program provides students from all engineering backgrounds with the necessary leadership abilities, technical expertise, and communication skills to meet the need for both tech-savvy and business-savvy professionals. To achieve this aim, the EM curriculum combines business basics, quantitative methods, and behavioral science in a practical, problem-solving framework. Furthermore, the program is flexible and EM students can tailor their courses to suit their needs and preferences. Students can select from two areas of concentration (1) Financial and Industrial Engineering (FIE) and (2) Project and Program Management (PPM). In addition, students can elect to pursue the thesis or non-thesis option within the program.

## **MEM Program Educational Objectives**

The educational objectives of the MEM program are as follows.

1. Assume managerial and leadership positions in technical and non-technical environments.
2. Maximize efficiency and safety in complex systems.
3. Engage in research in engineering management and closely-related fields.
4. Communicate engineering concepts effectively, both in oral and written form.
5. Engage in lifelong learning, especially, in the context to engineering and management.

## **MEM Program Learning Outcomes**

Upon graduation, MEM graduates will be able to:

1. Describe the general theories, methods, and tools for managing (a) resources, (b) finance, (c) risk, and (d) information for enhanced decision-making in engineering and business environments.
2. Exhibit self-directed learning and critical-thinking skills.
3. Develop scientific managerial skills in fields that promote innovation, such as management of technology, financial engineering, and complex project management.
4. Develop skills that foster interdisciplinary collaboration, teamwork, and leadership, especially in different project and industrial settings.
5. Develop effective verbal and written communication skills.
6. Apply analytical (mathematical, statistical, and computer-based) tools to optimize the performance of socio-technical systems, such as infrastructure, logistics, manufacturing, construction, financial, and healthcare systems.
7. Design tools for complex systems using empirical approaches that optimize user cognitive and physical wellbeing.
8. Develop and defend a thesis topic or a research project in one of the engineering management areas.

## MEM Program Requirements

The requirements for the Master of Engineering Management degree can be fulfilled by pursuing one of the two following options.

### Non-Thesis Option

Under this option, a student is required to complete a total of 96 ECTS, subdivided as follows:

- Four core courses (40 ECTS)
- Two core courses from the student's area of concentration (20 ECTS)
- Two electives from the student's area of concentration (18 ECTS)
- Two free electives (18 ECTS)
- Seminar (0 credit)

### Thesis Option

Under this option, a student is required to complete a total of 96 ECTS, subdivided as follows:

- Four core courses (40 ECTS)
- Two core courses from the student's area of concentration (20 ECTS)
- One elective from the student's area of concentration (9 ECTS)
- One free elective (9 ECTS)
- Thesis (18 ECTS)
- Seminar (0 credit)

## EM Plan of Study According to Different Options Concentrations

### MEM Plan of Study for PPM Concentration, Non-Thesis Option

A/A	Course Type	Course code	Course title	ECTS
<b>Term 1 (Fall)</b>				
6.	Core	ENMG 602	Introduction to Financial Engineering	10
7.	Core	ENMG 661	Strategic Management of Technology	10
8.	Elective	ENMG 635	Project Deliverance and Contracts	10
<b>Term 2 (Spring)</b>				
1.	Core	ENMG603	Probability and Decision Analysis	10
2.	Core	ENMG 698L	Operations Management	10
3.	Elective	ENMG632	Project Planning, Scheduling, and Control	10
<b>Term 3 (Summer)</b>				
1.	Elective		Elective from PPM	9
2.	Elective		Free Elective	9
<b>Term 4 (Fall)</b>				
1.	Elective		Elective from PPM	9
2.	Elective		Free Elective	9

### MEM Plan of Study for PPM Concentration, Thesis Option

A/A	Course Type	Course code	Course title	ECTS
<b>Term 1 (Fall)</b>				
1.	Core	ENMG 602	Introduction to Financial Engineering	10
2.	Core	ENMG 661	Strategic Management of Technology	10
3.	Elective	ENMG 635	Project Deliverance and Contracts	10
<b>Term 2 (Spring)</b>				
1.	Core	ENMG 603	Probability and Decision Analysis	10
2.	Core	ENMG 698L	Operations Management	10
3.	Elective	ENMG 632	Project Planning, Scheduling, and Control	10
<b>Term 3 (Summer)</b>				
1.	Elective		Elective from PPM	9
2.	Elective		Free Elective	9
<b>Term 4 (Fall)</b>				
1.	Core		Thesis	18

### MEM Plan of Study for FIE Concentration, Non-Thesis Option

A/A	Course Type	Course code	Course title	ECTS
<b>Term 1 (Fall)</b>				
9.	Core	ENMG 602	Introduction to Financial Engineering	10
10.	Core	ENMG 661	Strategic Management of Technology	10
11.	Elective	ENMG 604	Deterministic Optimization Models	10
<b>Term 2 (Spring)</b>				
4.	Core	ENMG603	Probability and Decision Analysis	10
5.	Core	ENMG 698L	Operations Management	10
6.	Elective	ENMG 624	Financial Engineering I	10
<b>Term 3 (Summer)</b>				
3.	Elective		Elective from FIE	9
4.	Elective		Free Elective	9
<b>Term 4 (Fall)</b>				
3.	Elective		Elective from FIE	9
4.	Elective		Free Elective	9

### MEM Plan of Study for FIE Concentration, Thesis Option

A/A	Course Type	Course code	Course title	ECTS
<b>Term 1 (Fall)</b>				
1.	Core	ENMG 602	Introduction to Financial Engineering	10
2.	Core	ENMG 661	Strategic Management of Technology	10
3.	Elective	ENMG 604	Deterministic Optimization Models	10
<b>Term 2 (Spring)</b>				
1.	Core	ENMG 603	Probability and Decision Analysis	10
2.	Core	ENMG 698L	Operations Management	10
3.	Elective	ENMG 624	Financial Engineering I	10
<b>Term 3 (Summer)</b>				
1.	Elective		Elective from FIE	9
2.	Elective		Free Elective	9
<b>Term 4 (Fall)</b>				
1.	Core		Thesis	18

### MEM Course Description

#### Core Courses

**ENMG 602 Introduction to Financial Engineering.** Overview of financial statements. Accounting concepts and methods. Measuring and reporting assets and equities. Financial statement models and their use for valuation. Financial feasibility and applied interest analysis. Fixed-income securities and bonds. Term structure of interest rates. Bond portfolio structuring and immunization. Capital budgeting. Dynamic cash flow management.

**ENMG 603 Probability and Decision Analysis.** Framing of decision problems. Influence diagrams. Review of probability (random events and variables, probability distribution functions and so on). Decision Trees. Decision analysis view of assessment (value of information, sensitivity). Multiple attribute decision objective. Mathematical treatment of risk, tolerance and avoidance. Assessing risk using Monte Carlo simulation.

**ENMG 698L Introduction to Operations and Process Management.** This course introduce students to the design and management operations in an organization for a sustainable and competitive advantage. It addresses theoretical and practical insights into service and manufacturing operations, in both the private and public sectors. Topics covered include forecasting, strategic and global operations, facility layout and location, aggregate planning, inventory

management, MRP and short-term scheduling. Case studies and hands-on software tools will be used.

**ENMG 661 Strategic Management of Technology.** The organization as a whole and its interaction with its environment. The corporation as it undergoes the process of a global transformation. Mergers, acquisitions, outsourcing, downsizing and privatization. Framework of analysis for the identification of central issues and problems usually faced in strategic management. Understanding the effect of present and future environments on the corporation's welfare.

### **Project and Program Management Area Courses**

**ENMG 632 Project Planning Scheduling and Control.** Extended overview of project management. Basic planning and scheduling concepts. Project participants and roles. Project management applications and growth. Project team formation. Dealing with time. Project planning and costing. Advanced scheduling techniques. Integrated project cost-time control. Resource and procurement planning.

**ENMG 633 Advanced Topics in Project Management.** Planning and scheduling under constraints. Trade-off analysis in a project environment. Project cost control from a client's perspective. Project risk management. Managing the international project. Determinants of project success. Lessons learned in project management. Strategic planning in project management. Modern developments in project management.

**ENMG 635 Project Deliverance and Contracts.** Overview of project organizations. The design-build project delivery approach. The build-operate-transfer project delivery approach. Innovative delivery approaches, financial schemes and associated contracts. Allocation of risks in contracts. Bidding phase characteristics. Components of the proposal package. Evaluation of the commercial, financial and technical components. Contract formation and agreement closure. Project quality management.

**ENMG 642 Lean Engineering Concepts.** This course focuses on the emerging concept of lean performance in the construction industry. Topics covered include the origin of lean concepts, application to the design process, implementation in construction, contracting for lean performance and value improving practices (e.g., benchmarking, constructability and value management).

**ENMG 645 Program and Portfolio Management.** This course presents a view of managing projects from an organizational perspective. The main areas of discussion will be strategic alignment, the role of effectively managing organizational assets through an enterprise project management office, portfolio and program management. Using specific examples and a case study approach, students will explore the importance of using organizational strategies to align projects and apply practices to create portfolios of programs and projects to efficiently leverage organizational assets.

**ENMG 698K Dispute Resolution on Projects.** The course covers construction contract conditions governing claims and disputes. Focus is on claim involvement and administration (including issues dealing with time barring, notification and substantiation) and ADR methods and amicable settlement.

### **Financial and Industrial Engineering Area Courses**

**ENMG 611 Supply Chain Design and Management.** The course is an introduction to supply chain management and its key issues, such as logistics, network configuration, inventory management, distribution strategies and strategic alliances. The value of information in supply chains, information technology and decision support systems for supply chain management are also covered.

**ENMG 616 Advanced Optimization.** Topics covered include nonlinear, stochastic, dynamic, and nonconvex programming. Optimization in the context of big data, machine learning and prescriptive analytics are discussed. Students will develop skills in modeling complex systems using mathematical programming. Students will also have hands-on experience in using software packages for solving optimization problems.

**ENMG 617 Engineering Management Statistics.** Review of probability and probability distributions. Data description. Random samples and sampling distributions. Parameter estimation. Tests of hypotheses. Design and analysis of single-factor experiments: the analysis of variance. Design of experiments with several factors. Simple linear regression and correlation. Multi-variable regression. Nonparametric statistics.

**ENMG 622 Simulation Modeling and Analysis.** Generating discrete and continuous random variables. Discrete-event simulation. Statistical analysis of simulated data. Variance reduction techniques. Statistical validation techniques. Markov chain and Monte Carlo methods. Experience with a modern discrete-event simulation package (e.g., ARENA, SIMIO).

**ENMG 623 Stochastic Models and Applications.** Review of probability and random variables. Poisson process, renewal theory, queueing models, reliability theory, Markov chains, Brownian motion, random walks and Martingale, stochastic order relations.

**ENMG 625 Financial Engineering II.** Derivative securities: forwards, futures and swaps; models of asset dynamics; options theory; interest rate derivatives. General cash flow streams: optimal portfolio growth, general investment evaluation.

**ENMG 698M Fundamentals of Data Science.** This course provides an introduction to applied data analysis, with an emphasis on providing a conceptual framework for thinking about data from both statistical and machine learning perspectives. Topics covered are based on statistics (frequentist, Bayesian) and machine learning, and include binary classification, regression, bootstrapping, causal inference and experimental design, and multiple hypothesis testing. Data-driven problem sets and a project are also included.