

Department of Industrial Engineering and Management

Chairperson:	Maddah, Bacel
Professors:	Maddah, Bacel; Salameh, Moueen; Yassine, Ali
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Senior Lecturers:	Abillama, Walid; Charif, Hassan; Nehme, Nabil; Noueihed, Nazim; Saad, Youssef; Trabulsi, Samir
Lecturers:	Bdeir, Fadl; Hamade, Tarek; Khraibani, Rayan; Shalhoub, Kathy
Instructors:	Jaafar, Maysaa; Kadi, Samir; Olleik, Majd; Sarieddine, Mouna

General Information

The Department of Industrial Engineering and Management offers a graduate program in Engineering Management. The graduate program leading to the degree of Master of Engineering Management (MEM) provides professional training in engineering management, with emphasis on technically based organizations and applications to various engineering and related disciplines. This program addresses the specific area of management of technical activities and enterprises.

A student may pursue courses to satisfy one of the three following areas of concentration:

- Financial and Industrial Engineering (FIE)
- Project and Program Management (PPM)
- Management of Technology and Entrepreneurship (MTE)

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

Non-Thesis Option

Under this option, a student is required to complete a total of 33 credits, subdivided as follows:

- Four core courses (12 credits)
- Four electives from the student's area of concentration (12 credits)
- Three free electives (9 credits)
- Seminar (0 credit)

Thesis Option

Under this option, a student is required to complete a total of 30 credits, subdivided as follows:

- Four core courses (12 credits)
- Three electives from the student's area of concentration (9 credits)
- One free elective (3 credits)
- Thesis (6 credits)
- Seminar (0 credit)

Free electives should be graduate courses (within IEM, MSFEA or any AUB program), which relate to engineering management. All free electives must be approved by the student's academic advisor. All students pursuing the FIE concentration are required to take ENMG 623 Stochastic Models and Applications. All students pursuing the PPM concentration are required to take ENMG 632 Project Planning Scheduling and Control. The ENMG 797 Special Project course can be used to satisfy the 3-credit requirement of any elective depending on the nature of the topic addressed. A flexible combination of courses not in fulfillment of either option stated above leads to no mention of an area of concentration on the student's transcript.

Requirements for Admission

In order to be eligible for admission to the MEM program, a student must have a bachelor's degree in engineering, architecture or a related field. The student must also satisfy the requirements of the university and the Maroun Semaan Faculty of Engineering and Architecture for admission to graduate study, as specified in the relevant sections of this catalogue.

Graduates of universities other than AUB or from majors other than engineering or architecture may be required to take undergraduate prerequisite courses to make up for deficiencies.

A student is not allowed to register in the program for more than four calendar years beyond the date of his/her first registration, except with the approval of the Graduate Studies Committee of the faculty.

Dual Master Degree – Master of Engineering in Engineering Management and Energy Studies (thesis option only)

The dual master's degree – Master of Engineering in Engineering Management and Energy Studies – program is primarily intended for individuals with a bachelor's degree in engineering who seek to deepen their knowledge in advanced energy studies and engineering management subjects.

Applicants must be accepted into both programs (Master of Engineering Management and Master of Science in Energy Studies) and in accordance with the policies of each program, and with AUB policies regarding dual graduate degrees.

A student wishing to apply for the dual degree may submit a single dual-degree application that will be sent to each program simultaneously when first applying for graduate admissions. If the student is already registered in one degree, the student may apply for the second degree no later than the end of the second term at AUB.

The program permits full-time or part-time enrollments. To fulfill the basic requirements for the dual degree, a student must complete a minimum of 18 credit hours of graduate course work in each degree program. The remaining credits include additional course work and a thesis that are credited to the dual degree. The program requires a minimum of 42 credit hours of graduate course work and 6 credits of thesis work. The coursework is distributed as follows:

- 9 credits of core Engineering Studies (ENST) courses
- 6 credits of core Engineering Management (ENMG) courses
- 6 credits of common courses: Required core ENMG (ENST List A Electives)
- 12 credits of ENMG elective courses
- 6 credits of elective courses from ENST List B on energy science and technology
- 3-credit elective course as approved by thesis advisor/s (ENST)

The courses that are counted toward both degrees are:

ENMG 603	Probability and Decision Analysis	3 cr.
ENMG 604	Deterministic Optimization Model	3 cr.
Comprehensive Exam		0 cr.
Thesis		6 cr.

Course Descriptions

Core Courses

ENMG 601 Management Theory 3 cr.
 Nature of managerial work and the roles of the executive (informational, decisional and symbolic). Organizational configurations. Ethics in business and organizational behavior. Business strategy. Principles and practice of worker motivation. Project management and performance assessment. Effective communications in organizations. Negotiation. Power and leadership.

ENMG 602 Introduction to Financial Engineering 3 cr.
 Overview of financial statements. Accounting concepts and methods. Measuring and reporting assets and equities. Alternative accounting principles. Basic financial calculations. Cost of capital calculation. Financial statement models and their use for valuation. Financial analysis of leasing.

ENMG 603 Probability and Decision Analysis 3 cr.
 Framing of decision problems. Influence diagrams. Review of probability (random events and variables, probability distribution functions and so on). Decision Trees. Inverting Decision Trees (Bayes' Law). Traditional approach to assessment of error (confidences level). Decision analysis view of assessment (value of information, sensitivity). Multiple attribute decision objective. Mathematical treatment of risk, tolerance and avoidance.

ENMG 604 Deterministic Optimization Models 3 cr.
 Mathematical modeling and the operation research approach. Formulation and classification of optimization models. Improving search. Formulation of linear programs (LPs). Simplex algorithms for solving LPs. Duality and sensitivity in linear programming. Multi-objective optimization and goal programming. Introduction to network flow models. Formulation of integer programs. Solution methods for integer programs. Unconstrained nonlinear programming. Introduction to constrained nonlinear programming and quadratic programming.

Elective Courses

Financial and Industrial Engineering Sequence

ENMG 611 Supply Chain Design and Management 3 cr.
 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 612 Advanced Supply Chain Design and Management 3 cr.
 This course concentrates on the advanced quantitative and qualitative techniques used in supply chain management to achieve competitive advantage. The focus is on planning models for production, inventory and distribution in general multi-echelon multi-item systems. This course also deals with models for planning, information sharing, transportation, distribution and site selection. The interactions with other functional areas, such as information systems, marketing and finance, are also illustrated.

ENMG 616 Advanced Optimization Techniques 3 cr.
 The course is divided into four parts covering integer programming, nonlinear programming, stochastic programming and heuristic methods. Students will develop skills in modeling complex systems using mathematical programming, analyzing the structure of mathematical programs, and developing and applying the correct solution techniques. Students will also have hands-on experience in using software packages for solving optimization problems.

ENMG 617 Engineering Management Statistics 3 cr.
 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 3 cr.
 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 3 cr.
 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 624 Financial Engineering I: Portfolios and Risk Management 3 cr.
 Basic theory of interest. Fixed-income securities yield, duration convexity and immunization. Term structure of interest rates. Expectation, liquidity and market segmentation explanations of the term structure. Applied interest rate analysis: capital budgeting, optimal portfolios, dynamic cash flow processes, optimal management, the Harmony Theorem, valuation of a firm. Mean-variance portfolio theory. Introduction to expected utility theory. Introduction to general pricing theory. *Prerequisite: ENMG 602 or INDE 301, or consent of instructor.*

ENMG 625 Financial Engineering II: Derivatives 3 cr.
 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. *Prerequisite: ENMG 602 or INDE 301, or consent of instructor.*

Project and Program Management Sequence

ENMG 631 Pre-Project Planning and Feasibility Analysis 3 cr.
 Assimilation of client needs. Market assessment studies. Impact of laws and regulations on the facility program. Surveys of project area infrastructure conditions. Investigation of site conditions. Project scope validation. Project cost and revenue estimation. Project life-cycle analysis. Financial planning. Financial feasibility framework design and analysis.

ENMG 632 Project Planning Scheduling and Control 3 cr.
 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.

ENMG 633 Advanced Topics in Project Management 3 cr.
 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 3 cr.
 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.

ENMG 642 Lean Engineering Concepts 3 cr.
 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 644 Agile Software Project Management 3 cr.
 The main objectives of this course are to enable the student to understand the fundamental principles underlying software management and economics. The course provides a quick overview of traditional software development and management strategies such as Waterfall, PMI/PMBOK and RUP. This will be contrasted with iterative and incremental development techniques covering the full spectrum of agile methods, including Scrum, extreme programming, lean and feature-driven development.

ENMG 645 Program and Portfolio Management 3 cr.
 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 management 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.

Management of Technology and Entrepreneurship Sequence

ENMG 654 Technology-Based Entrepreneurship 3 cr.
 An introduction to general theories, principles, concepts and practices of entrepreneurship and intrapreneurship. The entrepreneurial perspective, developing the entrepreneurial plan, initiating entrepreneurial ventures, growth and development of entrepreneurial ventures and contemporary challenges in entrepreneurship are discussed. The course includes case study analysis and group projects.

- ENMG 655 Management of Technology 3 cr.**
 Management of technology at both the national and organizational level and its contribution to the generation of national wealth. Engineering, science and management principles contributing to the development of a successful framework for managing technology within an organization, nationally or internationally. Introduction to technological innovations. Planning and forecasting. Socio-economic changes.
- ENMG 656 Management of Technological Innovations 3 cr.**
 Strategic management of technology-based innovation within the firm. Assessing the innovative capabilities of the firm. Managing the corporate R&D function. Managing the interfaces between functional groups in the development process. Managing the new business development function in the firm. Building distinctive technology-based competencies and competitive advantages. Technological leadership versus followership in competitive strategy. Institutionalizing innovation. Attracting and keeping corporate entrepreneurs.
- ENMG 659 Introduction to System Dynamics 3 cr.**
 An introduction to the field of system dynamics as a discipline and a set of tools for understanding and dealing with complexity in systems. Students will learn how to collaboratively translate knowledge about a system or problem into a conceptual model, and to simulate the model in order to test hypotheses about system behavior.
- ENMG 661 Strategic Management of Technology 3 cr.**
 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.
- ENMG 663 Product Design and Development 3 cr.**
 This class provides students with a holistic perspective that includes the design, analysis and management of complex engineered systems/products. Topics covered include marketing research, integrated system/subsystem/component design, production planning, manufacturing strategy, supply chain management, innovation and entrepreneurship.
- ENMG 698 Special Topics in Engineering Management 3 cr.**
- ENMG 700 Seminar 0 cr.**
 All students are required to register for the seminar during each fall term.
- ENMG 797 Special Project in Engineering Management 3 cr.**
 A supervised study that may involve special research in the student's area of concentration.
- ENMG 800 Comprehensive Exam 0 cr.**
 A capstone exam covering core engineering management concepts.
- ENMG 798 Thesis 6 cr.**