Department of Industrial Engineering and Management

Chairperson:	Maddah, Bacel
Professors:	Maddah, Bacel; Salameh, Moueen; Yassine, Ali
Assistant Professors:	Moacdieh, Nadine; Nehme, Nabil (visiting), Noueihed, Maher; Olleik, Majd; Tarhini, Hussein
Senior Lecturers:	Noueihed, Nazim; Saad, Youssef; Trabulsi, Samir
Lecturers:	Abboud, Jacques; Bdeir, Fadl; Hamade, Tarek; Kalach, Mayssa; Khraibani, Rayan; Youness, Hasan
Instructors:	Basmadjian, Garo; Bdeir, Fadl; Gharios, Nadim; Hosn, Majd; Jaafar, Maysaa; Kadi, Samir; Karam, Mario; Khraibani, Rayan; Mattar, Maurice; Nehme, Nibal; Sfeir, Rana; Traboulsi; Samir

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 (ENMG 602, ENMG 603, ENMG 606, and ENMG 661, 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 (ENMG 602, ENMG 603, ENMG 606, and ENMG 661, 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.

Engineering Management Master's Degree – Online

The Master of Engineering Management - Online program is a graduate program that provides the student with a complete management experience, coupling the analytical and scientific tools with business management skills. The MEM – Online program is designed to have the same learning outcomes as the residential MEM program. Similar to the residential MEM program, it prepares the student for managerial and leadership positions within turnkey projects and organizations.

Eligibility and Admissions Requirements

Following AUB's standards, in order to be eligible for admission to the MEM – Online program, a student must have an undergraduate bachelor's degree in engineering or architecture (BE or its equivalent) with an average of 3.3 or higher GPA on the AUB Scale (or equivalent) in the last two years of study. This requirement may be waived for applicants with strong work experience.

Other admission requirements are similar to those of the residential MEM program on the previous page.

Structure and Program Requirements

The MEM – Online program only admits students in the non-thesis option. A student is required to complete a total of 33 credits, subdivided as follows:

- Four core courses (12 credits): ENMG 602, ENMG 603, ENMG 606, and ENMG 661,Project and Program Management (PPM)
- Seven electives (21 credits): The student chooses from the following electives, which are offered online on a regular basis, ENMG 624, ENMG 627, ENMG 632, ENMG 635, ENMG 642, ENMG 644, ENMG 645, ENMG 646, and ENMG 647.

Dual Master's Degrees: Master of Engineering in Engineering Management and Master of Science in Energy Studies (thesis option only)

The dual master's degrees - Master of Engineering in Engineering Management and Master of Science in 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 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 606 Operations Management
This course aims to present to the students how to design and manage operations in an organization for a sustainable and competitive advantage. The module addresses theoretical and practical insights into service and manufacturing operations, in both the private and public sectors. The module covers topics such as forecasting, strategic operations, aggregate planning; inventory management; MRP and ERP and scheduling.

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.

Elective Courses

Financial and Industrial Engineering Sequence

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.

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.

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.

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.*

ENMG 626 Human-Computer Interaction and Usability 3 cr.
This course provides an overview of human-computer interaction and user-centered design, including human cognition and visual search theories, methods to understand the user and context (e.g., interviews, questionnaires, observations), design principles, prototyping, and a variety of usability testing and evaluation techniques. As part of the course, students will also learn basic design of experiments and statistical analysis.

ENMG 627 Applied Data Science 3 cr.
The purpose of this course is to provide theoretical knowledge and practical skills to analyze, visualize and explore data. The covered material provides an introduction to applied data analysis, with an emphasis on providing conceptual framework for viewing data from both statistical and machine learning perspectives. Topics covered include supervised and unsupervised machine learning models (e.g. regression, classification, clustering, PCA), frequentist estimation, and hypothesis testing.

Project and Program Management Sequence

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. This will be contrasted with iterative and incremental agile methods.

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.

ENMG 646 Project Risk Management 3 cr.
This course is designed for students with shy or no previous knowledge of risk management, with the objective of engaging them in active discovery of risk management principles. In a project environment, students will develop an awareness of the challenges, the tools and the process of designing and implementing a risk management program. The practices covered are consistent with the PMBOK (Project Management Body of Knowledge) of the Project Management Institute (PMI). Application to industry projects will be stressed.

ENMG 647 Dispute Resolution 3 cr.
The course covers construction contract conditions governing claims and disputes. Focus is on claim evolvement and administration (including issues dealing with time barring, notification and substantiation) and ADR methods and amicable settlement.

Management of Technology and Entrepreneurship Sequence

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 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 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.

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 664 Introduction to Human-Centered Design 3 cr.
This course introduces students to human-centered design approaches for innovative problem solving. Human-centered design begins with a deep understanding of people, technology, and social contexts. The course will include fundamental readings in design thinking, interactive design methods and processes, and hands-on projects. Students will learn how user research and prototyping can be integrated into different phases of the design process.

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.

Engineering Management Master's Degree – Online

Coordinator:	Nouiehed, Maher (Industrial Engineering and Management, MSFEA)
Program Teaching Faculty:	Abdul-Malak, Assem (Civil and Environmental Engineering, MSFEA)
	Kalash, Mayssa (Electrical and Computer Engineering, MSFEA)
	Khoury, Hiam (Civil and Environmental Engineering, MSFEA)
	Khraibani, Rayan (Industrial Engineering and Management, MSFEA)
	Maddah, Bacel (Industrial Engineering and Management, MSFEA)
	Moukaddem, Imad ((Industrial and Engineering Management, MSFEA)
	Nasr, Walid (Business, OSB)
	Nouiehed, Maher (Industrial Engineering and Management, MSFEA)
	Tarhini, Hussein (Industrial Engineering and Management, MSFEA)

General Description

The Engineering Management program is a graduate program that provides you with a complete management experience, coupling the analytical and scientific tools with business management skills to prepare you for managerial and leadership positions within turnkey projects and organizations. It leverages the engineer's background and quantitative skills. The program tackles the technical challenges of managing interdisciplinary organizations and multifaceted systems, equipping you with a solid set of skills necessary to thrive within an engineering-focused environment and in a business setting alike.

Eligibility

In order to be eligible for admission to the OEM program, a student must have an undergraduate bachelor's degree in engineering or architecture (BE or its equivalent) with an average of 3.3 or higher GPA on the AUB Scale (or equivalent) in the last two years of study. This requirement may be waived for applicants with strong work experience.

Admissions Requirements

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.

Applicants should have an undergraduate bachelor's degree or its equivalent from AUB or other recognized institutions of higher learning. Applicants to the program, other than AUB and graduates of colleges or universities recognized and located in North America, Great Britain, Australia and New Zealand, must meet the Readiness for University Studies in English (RUSE).

Structure and Program Requirements

A student is required to complete a total of 33 credits, subdivided as follows:

- Four core courses (12 credits)
- Seven electives from the student's area of concentration (21 credits)

Course Requirements

Core Courses

ENMG 661: Strategic Management of Technology – 3 credits

ENMG 602: Introduction to Financial Engineering – 3 credits

ENMG 603: Probability and Decision Analysis – 3 credits

ENMG 605: Introduction to Operations and Process Management – 3 credits

Elective Courses:

ENMG 632: Project Planning Scheduling and Control – 3 credits

ENMG 635: Project Deliverance and Contracts – 3 credits

ENMG 645: Program and Portfolio Management – 3 credits

ENMG 642: Lean Engineering Concepts – 3 credits

EECE 675: Renewable Energy Systems – 3 credits

ENMG 624: Financial Engineering I – 3credits

ENMG 606: Applied Data Science – 3 credits

ENMG 636: Disputes Resolution on Projects – 3 credits

ENMG 698C: Project Risk Management – 3 credits

ENMG 644: Agile Software Project Management – 3 credits

Course Descriptions

Core Courses

ENMG 661 Strategic Management of Technology 3 credits
Learn to formulate and implement major goals and initiatives based on consideration of resources and assessment of the internal and external environments in which the project or organization competes. Equip yourself to deal with issues such as competitive advantages, resources allocation, economy of scale, and role of technology and technological innovation.

ENMG 602 Introduction to Financial Engineering 3 credits
Acquire the basics of financial accounting, the investment process and financial markets, and gain a flavor of Financial Engineering applications such as pricing and portfolio structuring of bonds, capital budgeting, cash matching, dynamic investment management and firm valuation. This course will prepare you to handle more complex financial instruments with uncertain cash flows, such as stocks, options and futures.

ENMG 603 Probability and Decision Analysis 3 credits
Acquire the basics of financial accounting, the investment process and financial markets, and gain a flavor of Financial Engineering applications such as pricing and portfolio structuring of bonds, capital budgeting, cash matching, dynamic investment management and firm valuation. This course will prepare you to handle more complex financial instruments with uncertain cash flows, such as stocks, options and futures.

ENMG 605 Operations Management 3 credits
Learn how to design and manage operations in an organization for a sustainable and competitive advantage. Gather theoretical and practical insights into service and manufacturing operations, in both the private and public sectors. Get introduced to topics such as forecasting, strategic operations, linear programming, aggregate planning, inventory management, MRP and ERP and scheduling.

Elective Courses

ENMG 632 Project Planning Scheduling and Control 3 credits
Explore technical and managerial challenges of project management and address issues related to project selection techniques, project planning, budgeting, risk analysis, resource management, project monitoring and termination. Understand how project management decisions are reached, what tradeoffs are made, and how outcomes depend on the underlying situation.

ENMG 635 Project Deliverance and Contracts 3 credits
Learn to tackle issues related to the various approaches that may be suitable for the delivery of large construction projects. Understand the risks inherent in the undertaking of large projects and comprehend how certain identified risks can be addressed through the proper formation of project contracts.

ENMG 645 Program and Portfolio Management 3 credits
Explore program management from a life cycle approach and understand the differences between project management and program management. Acquire skills in strategic planning in relationship to program management, change management, communications within programs, program initiation, benefits management, stakeholder management, managing expectations, program governance, program risk management, program maturity and closure.

ENMG 642 Lean Engineering Concepts 3 credits
Discover the emerging concept of lean performance in the construction industry. Get introduced to the origin of lean concepts, and learn their application to the design process, implementation in construction, contracting for lean performance, and value improving practices such as benchmarking, constructability, and value management.

EECE 675 Renewable Energy Systems 3 credits
Acquire a sound understanding of renewable energy systems in terms of their design, operation and economic impacts. Learn the technical assessment components of wind, solar, and hybrid energy resources, and become equipped to make informed design and operational decisions. Get introduced to small hydro and geothermal energy systems.

ENMG 624 Financial Engineering, I 3 credits
Get introduced to the investment process and financial markets. Learn about portfolio management, the valuation of financial instruments, the pricing of a basic class of financial derivative securities (forwards, futures and options) Gain insights that can be extended to handle more complex financial instruments. Get exposed to areas such as mathematical modeling, optimization, probability, and, more generally, to finance, and operations research.

ENMG 606 Applied Data Science 3 credits
Gather theoretical knowledge and gain practical skills to analyze, visualize, and explore data. Get introduced to applied data analytics, with an emphasis on viewing data from both statistical and machine learning perspectives.

ENMG 636 Disputes Resolution on Projects 3 credits
Understand construction contract conditions governing claims and disputes, with a focus on claim evolvement and administration, Alternative Dispute Resolution (ADR) methods and amicable settlement.

ENMG 698C Project Risk Management 3 credits
Engage in an active discovery of risk management principles and develop an awareness of the challenges, the tools and the process of designing and implementing a risk management program, with application to industry projects.

ENMG 644 Agile Software Project Management 3 credits
Understand the fundamental principles underlying software management and economics through an overview of traditional software development and management strategies, contrasted with iterative and incremental development techniques covering the full spectrum of agile methods, including Scrum, extreme programming, lean and feature-driven development.