

Engineering Management Program

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General Information

The graduate program leading to the degree of Master of Engineering Management (MEM) caters to the specific needs of management of technical activities and enterprises by providing a professional education in engineering management, with emphasis on technically based organizations and applications to various engineering and related disciplines.

A student may select his/her courses in a way that satisfies one of the four following areas of concentration:

- Financial Engineering
- Industrial Management
- Projects and the Built Environment
- Information and Organizational Management

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

1. 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)
 - three electives from the student's area of concentration (9 credits)
 - two area-related electives (6 credits)
 - two free electives (6 credits)
 - seminar (0 credits)

Note: 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.

2. 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 credits)

A flexible combination of courses not in fulfillment of either option stated above leads to no mention of any area of concentration on the student's transcript.

Requirements

In order to be eligible for admission to the MEM program a student must have a bachelor's degree in one of the engineering disciplines, architecture, or in other related fields, and must satisfy the requirements of the University and the Faculty of Engineering and Architecture for admission to graduate study, as specified in the relevant sections of the university catalogue (refer to the Graduate Studies section).

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 any 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.

Minor in Engineering Management

The Engineering Management Program offers a minor in engineering management that can be pursued by undergraduate engineering and architecture students, as well as by students from related majors, starting as early as the fall semester of their third year of enrollment. To satisfy the requirements of this minor, a student must earn 18 credits of course work from the engineering management course offerings as follows:

- At least nine of the total requirement of 18 credits must be fulfilled from the six undergraduate courses offered by the program, which must include ENMG 400: Engineering Economy.
- The other nine credits can be satisfied by taking courses either from the list of undergraduate courses, or from the elective graduate courses that are unrestricted to undergraduate student registration.

A minimum grade of 70 is required for a course to be counted toward the fulfillment of a minor in engineering management.

Undergraduate Courses

ENMG 400 Engineering Economy 3 cr.

A course that covers principles, basic concepts, and methodology for making rational decisions in the design and implementation of real engineering projects; time value of money, depreciation, comparing alternatives, effect of taxes, inflation, capital financing and allocation, and decision under uncertainty. *Prerequisite: ASST 310 or equivalent. Every semester.*

ENMG 500 Engineering Management I 3 cr.

A course on operations research modeling concepts with emphasis on linear programming; topics include: linear programming, network programming, and project management. *Annually.*

ENMG 501 Engineering Management II 3 cr.

A course outlining basic management models used to optimize operation systems; discrete- and continuous-time Markov chains and their application in modeling queues, inventories, and production process behavior. *Prerequisite: STAT 230 or equivalent. Annually.*

ENMG 502 Construction Management 3 cr.

A course on organizing for construction projects; pre-construction activities; bidding and contracts; fundamentals of construction planning, monitoring, and control; application of construction control tools: CPM, materials management, operations analysis, and quality control. *Annually.*

ENMG 503 Specifications and Cost Estimation 3 cr.

A course on the structure of construction documents and their interrelationships; bidding requirements; general and particular contract conditions; administrative and procedural requirements for construction; technical specifications; construction cost estimation process; and unit rates determination. *Prerequisite: ENMG 502 or CIVE 580. Annually.*

ENMG 504 Engineering Ethics 3 cr.

A course on engineering ethics covering responsibility in engineering; framing the moral problem; organizing principles of ethical theories; computers, individual morality, and social policy; honesty, integrity, and reliability; safety, risk, and liability in engineering; engineers as employees; engineers and the environment; international engineering professionalism; and future challenges. *Annually.*

Graduate Courses

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.

The framing of decision problems. Influence diagrams. Review of probability (random events and variables, probability distribution functions, etc.). Decision Trees. Inverting Decision Trees (Baye's 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 operations 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

Operations and Financial Engineering Sequence

ENMG 611 Supply Chain Design and Management 3 cr.

Introduction to supply chain management and its key issues. 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.

ENMG 612 Production-Inventory Planning and Control 3 cr.

Replenishment systems for individual items. Inventory management for special classes of items. Multiple item and multiple location inventories. Introduction to supply chain management and multiechelon inventories. Production planning and scheduling: aggregate production planning, MRP, JIT, OPT, and short-range production scheduling.

ENMG 613 Manufacturing Systems and Facilities Planning 3 cr.

Assembly lines. Transfer lines. Flexible manufacturing systems. Group technology. Facility layout. Material handling systems. Warehousing storage and retrieval systems. Introduction to general-purpose queuing and simulation models.

ENMG 614 Human Factors Engineering 3 cr.

Designing for human performance effectiveness and productivity. Introducing human factors and ergonomics. Design and evaluation methods. Perception--vision and hearing. Cognition. Displays and controls. Work-space design. Biomechanics of work. Stress and workload. Safety and human error. Human-computer interaction.

ENMG 615 Industrial Scheduling 3 cr.

Deterministic models for single machine, parallel machines, flow shops and flexible flow shops, job shops, open shops. Stochastic models for single machine, parallel machines, flow shops, job shops, open shops. Scheduling in practice: general purpose procedures, modeling scheduling problems, implementation of scheduling systems.

ENMG 616 Network Optimization: Algorithms and Applications 3 cr.

Network flow problems, their practical applications and their solution algorithms. Categories of network flow problems. Shortest path problems. Maximum flow problems. Minimum cost flows. Network Simplex algorithms. Generalized flow models. Constrained networks.

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. Multiple regression. Nonparametric statistics. Introduction to statistical quality control and reliability engineering. Introduction to analyzing and forecasting time-series data. Introduction to queuing theory. Introduction to statistical decision analysis. Introduction to simulation.

ENMG 621 Forecasting Methods and Applications 3 cr.

Principles and applications of forecasting methods in planning and managing activities in organizations. Introduction to business forecasting. Forecasting and data considerations. Simple regression analysis. Multiple regression analysis. Time series regression (decomposition methods). Moving averages and exponential smoothing. Forecasting with Box-Jenkins methodology. Artificial neural networks as forecasting tools. Combining forecasts. Implementing forecasts in organizations.

ENMG 622 Simulation 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, WITNESS).

ENMG 623 Stochastic Models and Applications 3 cr.

Poisson process, renewal theory, queuing models, reliability theory, Markov chains, Brownian motion, random walks and Martingale, stochastic order relations.

ENMG 624 Financial Engineering I 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.*

ENMG 625 Financial Engineering II 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 624.*

Projects and the Built Environment Sequence

ENMG 631 Pre-Project Planning and Feasibility Analysis 3 cr.

Assimilation of client needs. Market assessment studies. Impacts of laws and regulations on the facility program. Surveys of project area infrastructure conditions. Investigation of site conditions. Project scope validation. Project cost and revenues estimation. Project life-cycle analysis. Financial planning. Financial feasibility framework design and analysis.

ENMG 632 Engineering Project Management 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. *Prerequisite: ENMG 632.*

ENMG 634 Design Management for Large Projects 3 cr.

Characteristics of the design phase. Setting out of project design criteria. Design team selection. Design services agreement formation and negotiation. Design sub-consultants coordination issues. Joint ventures for the rendering of design services. Value engineering and management during design development. Constructability analysis of design solutions. Project contingency management during design development.

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 636 Disputes Resolution on Projects 3 cr.

Types of claims and counterclaims. Standard forms of construction contract. Contract conditions governing claims. Claims evolvment and administration: notification and substantiation. The construction schedule: formulation and consent. Types of delay: excusableness, concurrency, compensation. Delay claims and time extension determination. Right for the usage of float: critical versus non-critical activities. Possession of site claims. Unforeseen conditions and obstructions claims. Variations claims. Specifications compliance claims. Damages, payments, withholdings, and reductions. Evolvment of claims into disputes. Dispute resolution methods.

ENMG 637 Logistics, Technologies, and Productivity Concepts 3 cr.

Construction methods and systems. Construction technology classification. Construction team organization, information flow, and complexities. Productivity improvement approaches. On-site construction as a system. Site layout design and analysis. Preplanning for construction operations. Assessing productivity of activities. Data gathering for on-site studies. Analysis of construction operations. Simulation of construction operations. Process of innovation in construction. Automation of construction operations. Safety and environmental health in construction.

ENMG 638 Advanced Topics in Construction Management 3 cr.

Materials procurement and inventory management systems. Job costing and balancing. Cash flow analysis and management. Construction organizational structures. Construction procedural and administrative systems. Labor procurement, retention, and training. Industrial relations.

ENMG 639 Infrastructure and Facility Management 3 cr.

Project life span. Preventive maintenance. Condition assessment. Short-term and long-term repair and upgrade plans. Capital budgeting for sustaining serviceability. Scheduling of service and repair crews. Working around the built facility. Energy conservation strategies. Intelligent building management systems.

ENMG 640 Sustainable Development Management 3 cr.

Introduction to the concept of sustainable development. Pricing the environment, energy, and the marketplace. Innovation process. Technological cooperation. Renewable resources. Leadership for sustainable development in developing countries. Case studies.

ENMG 641 Environmental Strategies for Development Projects 3 cr.

Introduction to global environmental problems including air, water, solid, pesticides, and toxic substances. The impact of such problems on forests, species, coasts, and wetlands. "From cradle to grave" as applied to all types of development projects including industrial, construction, agriculture, and others. Latest techniques and tools available to management such as industrial ecology, environmental impact assessment, etc.

Information and Organizational Management Sequence**ENMG 651 Decision Support Systems 3 cr.**

Major components of decision support systems. Database management system. User interface. Model-based management system. Benefits in relation to improving the decision-making process for managers. Hardware and software limitations of alternative approaches. Anticipated technological improvements. Effective implementation.

ENMG 652 Custom Project Information System 3 cr.

What is information? How to store it and what to call it. Abstraction, interfaces, and barriers. Specification and documentation. Documents needed for project control. Relational calculus and architectural abstractions. Data structures for fast data storage and retrieval. How encryption works. Putting things on the Web. Examples of the system in action. Data warehousing and data mining.

ENMG 653 Knowledge Management 3 cr.

Knowledge management as a new management paradigm. Knowledge creation and capture. Knowledge codification and system implementation. Knowledge management system tools and portals. Ethical, legal, and managerial issues.

ENMG 654 Technology-Based Entrepreneurship 3 cr.

Creation, assessment, development, and operation of new and emerging ventures. Entrepreneurship defined. Initiating and operating concerns. Growth and development of entrepreneurial ventures.

ENMG 655 Management of Technology 3 cr.

Management of technology at both the national and organizational level and its contribution to the national wealth generation. 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 technology-based distinctive competencies and competitive advantages. Technological leadership versus followership in competitive strategy. Institutionalizing innovation. Attracting and keeping corporate entrepreneurs.

ENMG 657 Contemporary Issues in Technological Development 3 cr.

Globalization revisited. Fast growth of information and communication technologies. The growing importance of knowledge-based industries. Changing impact of international rules and regulations concerned with quality standards, environmental constraints, trading generally, etc. Productivity and competitiveness revisited. Framework, factors, and changing conditions: national level, branch level, and firm level. Privatization and participation of the private sector. Clustering and networking of firms. Business development services and incubators. Technology and industry parks.

ENMG 658 Organizational Analysis and Design 3 cr.

Organization aspects such as form, centralization, formalization, differentiation, and culture. The Contingent Organization Design concept: different organizational forms for different situations (e.g., uncertainty, competition, size, strategy). Critiques from contemporary and classical organization science literature. Understanding how an organization can work or fail: from the purely descriptive "process" view to the purely reductionist view of the organization as an information processing mechanism.

ENMG 659 Total Quality Management 3 cr.

Principles of total quality management. Leadership, customer satisfaction, employee involvement, continuous process improvement, supplier management, and performance measures. Tools and techniques including quality management systems (ISO), statistical quality control, quality function deployment, benchmarking, etc.

ENMG 660 Business Process Re-engineering 3 cr.

Introduction to best practices in business process re-engineering. Diagnosis, design, and development of the business processes for firms. Organizational restructuring. Process simplification. Job optimization. Management systems modeling. Performance improvement. Company culture and corporate values reinforcement.

ENMG 661 Strategic Management 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 662 Human Resources Management 3 cr.

Functional areas associated with effective human resources management. Human resource planning, recruitment, and selection. Human resources development. Compensation and benefits. Safety and health. Employee and labor relations. Human resource research. Emphasis on, and case studies applied to, technical industries including manufacturing, engineering consulting, telecommunication, construction, etc.

ENMG 698 Special Topics 3 cr.

Advanced topics in engineering management. May be repeated for credit when topics vary.

ENMG 797 Special Project 3 cr.

A supervised study that may involve special research work in the student's area of concentration.

ENMG 799 Thesis 3 cr.

A thesis whose goal is to demonstrate the candidate's independent ability to apply analytic concepts and accepted methods of research to engineering management problems. Empirical surveys or case studies are acceptable provided that collected data can be manipulated in a fashion that enables the candidate to draw an original conclusion of generalized nature.

ENMG 700 Seminar 0 cr.