

Department of Industrial Engineering and Management (IEM)

| | |
|-----------------------|--|
| Chairperson: | Maddah, Bacel |
| Professors: | Maddah, Bacel; Salameh, Moueen; Yassine, Ali |
| Assistant Professors: | Al-Qaisi, Saif; Azar, Jimmy; Hani, Selim; Moacdieh, Nadine; Noueihed, Maher; Tarhini, Hussein |
| Senior Lecturers: | Abillama, Walid; Charif, Hassan; Nehme, Nabil; Noueihed, Nazim; Saad, Youssef; Trabuhsi, Samir |
| Lecturers: | Bdeir, Fadl; Hamade, Tarek; Itani, Bilal; Kalach, Maysa; Khraibani, Rayan; Rahi, Khalil |
| Instructors: | Gharios, Nadim; Jaafar, Maysaa; Kadi, Samir; Olleik, Majd; Sfeir, Rana |

The Department of Industrial Engineering and Management offers an undergraduate degree program leading to a Bachelor of Engineering in Industrial Engineering and a minor in Engineering Management.

Bachelor of Engineering (BE)

Major: Industrial Engineering (IE)

The Industrial Engineering Program extends over a four-year period and is offered exclusively on a daytime, on-campus basis. The program is offered in eleven terms whereby eight terms are 16-week Fall/Spring terms given over four years, and three terms are eight-week summer terms taken during the first three years of the program. In the summer term of the third year (Term IX), students are required to participate in a practical training program with a local, regional or international organization. The entire program is equivalent to five academic years but is completed in four calendar years with three summer terms.

Program Mission

The mission of the Industrial Engineering program is to graduate students who assume leadership positions in the industrial engineering profession and excel in graduate education. Our graduates are sought to be lifelong learners that contribute to the wellbeing of Lebanon and the region.

Program Educational Objectives

Graduates of the IE program will be able to:

- assume key roles in a range of industries that use industrial engineering, including manufacturing and service.
- effectively participate in, coordinate and manage diverse teams of engineers and analysts, especially in large-scale systems.
- pursue advanced degrees in industrial engineering and other related fields at reputable regional and international universities.
- appreciate the importance of professional ethics and actively use their knowledge and experience to the benefit of the community.

IE Program Learning Outcomes

Upon graduation, IE students will be able to demonstrate:

- an ability to apply knowledge of mathematics, science and engineering to model, optimize and evaluate integrated systems of people, technology and information.
- an ability to design and conduct experiments, as well as to analyze and interpret data.
- an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- an ability to function on multidisciplinary engineering teams.
- an ability to identify, formulate and solve engineering problems and to develop integrated solutions to large-scale, sociotechnical problems through quantitative models.
- an understanding of professional and ethical responsibility.
- an ability to communicate effectively in oral and written form.
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
- recognition of the need for, and ability to engage in, lifelong learning.
- knowledge of contemporary issues.
- an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Program Requirements

The BE curriculum in Industrial Engineering is a four-year program (with three summers) consisting of 143 credit hours of coursework.

The IE curriculum is supported by four pillars:

- a) basic science courses, b) general education courses, c) basic business courses and d) general engineering fundamental courses.

The specific course requirements are as follows:

- Basic Science Courses: MATH 201, MATH 202, MATH 218/219, MATH 251, STAT 230, PHYS 210, PHYS 210L, CHEM 201/202, CHEM 203, BIOL 210
- General Education Requirements: 9 credits in Cultures and Histories (including one History of Ideas), 3 credits in Human Values, 6 credits in Societies and Individuals, 6 credits in Understanding Communication - English: ENGL 203 and ENGL 206, and 3 credits in Understanding Communication - Arabic. Students must also take a course in Community-Engaged Learning. One elective should cover the theme of Social Inequalities
- Basic Business Courses: MNGT 215, ACCT 210, MKTG 210
- Engineering Fundamentals: CIVE 210, MECH 220, MECH 230, EECE 210, EECE 230, MECH 421

The IE courses are distributed in three core areas:

- a) Operations Research, b) Engineering Management and c) Production Systems.

Curriculum

| Term I (Fall) | | Credits |
|--------------------------|--|-----------------|
| FEAA 200 | Introduction to Engineering and Architecture | 3 |
| CIVE 210 | Statics | 3 |
| PHYS 210 | Introductory Physics II | 3 |
| PHYS 210L | Introductory Physics LAB II | 1 |
| MATH 201 | Calculus and Analytic Geometry III | 3 |
| ENGL 203 | Academic English (Understanding Communication) | 3 |
| | | Total 16 |
| Term II (Spring) | | Credits |
| EECE 210 | Electric Circuits | 3 |
| MECH 230 | Dynamics | 3 |
| MECH 220 | Engineering Graphics | 1 |
| MATH 202 | Differential Equations | 3 |
| EECE 230 | Introduction to Programming | 3 |
| ARAB XXX | Arabic Elective (Understanding Communication) | 3 |
| | | Total 16 |
| Term III (Summer) | | Credits |
| MATH 218/219 | Linear Algebra | 3 |
| STAT 230 | Introduction to Probability and Random Variables | 3 |
| ECON 211 | Microeconomic Theory (Societies and Individuals) | 3 |
| | | Total 9 |
| Term IV (Fall) | | Credits |
| MNGT 215 | Fundamentals of Management and Organizational Behavior | 3 |
| BIOL 210 | Human Biology | 3 |
| CHEM 201/202 | Chemistry Course | 3 |
| CHEM 203 | Chemistry Lab | 2 |
| INDE 301 | Engineering Economy | 3 |
| INDE 302 | Operations Research I | 3 |
| | | Total 17 |
| Term V (Spring) | | Credits |
| ACCT 210 | Financial Accounting | 3 |
| MATH 251 | Numerical Computing | 3 |
| INDE 303 | Operations Research II | 3 |
| INDE 320 | Work Measurement and Methods Engineering | 3 |
| ENGL 206 | Technical English (Understanding Communication) | 3 |
| | | Total 15 |

| Term VI (Summer) | | Credits |
|---------------------------|--|-------------------------------|
| MKTG 210 | Principles of Marketing | 3 |
| | Technical Elective I | 3 |
| | Cultures and Histories Elective I | 3 |
| | | Total 9 |
| Term VII (Fall) | | Credits |
| INDE 410 | Engineering Ethics (Human Values) | 3 |
| INDE 412 | Engineering Entrepreneurship | 3 |
| INDE 421 | Human Factors Engineering | 3 |
| INDE 411 | Introduction to Project Management | 3 |
| | Technical Elective II | 3 |
| | | Total 15 |
| Term VIII (Spring) | | Credits |
| INDE 402 | Facilities Planning and Material Handling | 3 |
| INDE 430 | Statistical Quality Control | 3 |
| INDE 431 | Production Planning and Inventory Control | 3 |
| MECH 421 | Manufacturing Processes I | 3 |
| | Community Engaged Learning | 3 |
| | | Total 15 |
| Term IX (Summer) | | Credits |
| INDE 500 | Approved Experience | 0 |
| | | Total 0 |
| Term X (Fall) | | Credits |
| INDE 501 | Final Year Project I | 3 |
| INDE 504 | Discrete Event Simulation | 4 |
| INDE 513 | Information Systems | 3 |
| | Technical Elective III | 3 |
| | Cultures and Histories Elective II | 3 |
| | | Total 15 |
| Term XI (Spring) | | Credits |
| INDE 502 | Final Year Project II | 3 |
| INDE 535 | Data Analytics for Operations Research and Financial Engineering | 3 |
| | Cultures and Histories Elective III | 3 |
| | Societies and Individuals Elective | 3 |
| | Technical Elective IV | 3 |
| | | Total 15 |
| | | Total Credit Hours 143 |

The 12-credit technical electives requirement should consist of (i) 6-9 credits from the graduate courses offered by the IEM Department, (ii) 0-3 credits from outside the IEM Department and (iii) 3 credits from sciences.

Minor in Engineering Management

The Department of Industrial Engineering and Management 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 term of their third year of enrollment. Only students who have a cumulative GPA of 2.3 or more are eligible to apply for the minor. To satisfy the requirements of this minor, a student (GPA:2.3 or more) must earn 18 credits of coursework from the IEM Department course offerings as follows:

- 9 credits from the undergraduate (Industrial Engineering) courses offered by the IEM Department, which must include INDE 301 Engineering Economy.
- 9 credits from either the undergraduate or the graduate (Engineering Management) courses offered by the IEM Department.
- A minimum grade of C+ is required for a course to be counted toward the fulfillment of a minor in Engineering Management. Additionally, a cumulative average of B (GPA 3.0) or above in all minor courses is required.

Course Description

FEAA 200 Introduction to Engineering and Architecture 3 cr.

The course is designed to familiarize first year students with the different disciplines in Engineering and Architecture including: Architecture, Civil, Mechanical, Electrical, Chemical, Industrial and technologies used in the fields. The course takes a unique interdisciplinary approach to the field and introduces the related disciplines in the world of engineering and architecture. One key objective is to promote interdisciplinary interaction and innovative thinking. The course is organized into modules covering the different disciplines within the Maroun Semaan Faculty of Engineering and Architecture (MSFEA). The last module of the class showcases interdisciplinary projects demonstrating interactions among the different fields. The lectures explain as applicable to each discipline, through examples, notions of problem solving, design thinking, process of invention and innovation, environmental and civic responsibility, and measures of success in aesthetics and performance. The course project is a key component of the course. It is interdisciplinary in nature bringing ideas and solutions from all disciplines in engineering and architecture. *Annually.*

INDE 301 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. *Every term. Formerly ENMG 400.*

INDE 302 Operations Research I 3 cr.

A course on operation research modeling concepts with an emphasis on linear programming; topics include: linear programming, network programming and project management. *Prerequisite: MATH 218 or Math 219, or equivalent. Annually. Formerly ENMG 500.*

INDE 303 Operations Research II 3 cr.
 Another course on operation research modeling concepts with an emphasis on probability models and stochastic processes; topics include conditional probability, discrete- and continuous-time Markov chains and their application in modeling queues, inventories and production process behavior. *Prerequisite: STAT 230 or equivalent. Formerly ENMG 501. Annually.*

INDE 320 Work Measurement and Methods Engineering 3 cr.
 A course on system and work design concepts; time studies; performance rating and allowances; standard and pre-determined times; work methods improvement; design of manual work, equipment, tools and work environments; line balancing; manpower determinations, job analysis and incentives; systems analysis, lean and value analysis. *Prerequisite: STAT 230 or equivalent. Annually.*

INDE 402 Facility Planning and Material Handling 3 cr.
 Inter-relationships between facilities, process design, systematic layout procedures, computer aided layout, location analysis models, material handling analysis and concepts, warehousing storage and retrieval systems. *Prerequisites: INDE 302 and INDE 303. Annually.*

INDE 410 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. *Formerly ENMG 504. Every term.*

INDE 411 Introduction to Project Management 3 cr.
 Introduction to project management for engineers. Conception, planning, scheduling, budgeting, leadership, management, tracking and completion of projects. Project management software is introduced and used. *Prerequisites: INDE 302 and INDE 303. Annually.*

INDE 412 Engineering Entrepreneurship 3 cr.
 This course provides students with the tools necessary to create and grow a successful, innovative technology enterprise. Topics include evaluating market opportunities, designing profitable business models, producing a solid business plan, raising capital, addressing legal considerations and developing a winning team. *Prerequisite: INDE 301 or equivalent. Every term. Formerly ENMG 505.*

INDE 421 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. *Prerequisite: INDE 320. Formerly ENMG 614. Annually.*

- INDE 430 Statistical Quality Control 3 cr.**
Design of quality control systems; quality methods for establishing product specifications; process control; variables and attributes charts; acceptance sampling; operating characteristics curves; process capabilities; QC software. *Prerequisite: STAT 230. Annually.*
- INDE 431 Production Planning and Inventory Control 3 cr.**
Methods of production and inventory planning. Single-product replenishment systems. Inventory management for special classes of items and products. Multiple item and multiple location inventories. Production planning and scheduling: aggregate production planning, MRP, JIT, OPT and short-range production scheduling. *Prerequisites: INDE 302 and 303. Annually.*
- INDE 500 Approved Experience 0 cr.**
Practical training program with a local, regional or international organization.
- INDE 501 Final Year Project I 3 cr.**
This is a capstone course where IE students utilize knowledge they acquired from different courses to design and develop an IE-related product or service. This is the first part of the course that spans through the final year of the student's study. *Prerequisite: Completion of third year in IE requirements. Fall. Annually.*
- INDE 502 Final Year Project II 3 cr.**
This is the second part of the IE capstone course. *Prerequisite: INDE 501. Spring.*
- INDE 504 Discrete Event Simulation 4 cr.**
System definition; model formulation, Monte-Carlo method; random number generation; discrete events; system entities and its attributes. Emphasis on analysis of systems and models of real-life problems. Lab experience with a modern discrete-event simulation package (e.g., ARENA). *Prerequisite: INDE 303. Annually.*
- INDE 513 Information System 3 cr.**
This is a course that answers the questions: What is information? How can it best be stored? What to call it? The course also covers the following topics: abstraction, interfaces, barriers, specification, documentation, relational calculus and architectural abstractions, data structures for fast data storage and retrieval, encryption, putting things on the Web, data warehousing and data mining. *Annually. Formerly ENMG 652.*
- INDE 533 Industrial Automation 3 cr.**
A course that introduces students to the field of industrial automation and control. The course covers a wide range of topic covering areas of instrumentation, basic control, electrical actuators and motors, pneumatics, hydraulics, basic mechanical systems and industrial controllers. The course also introduces concepts on numeric control NC and industrial robots, in addition to brief introduction on factory business and lean manufacturing as related to automation. The course consists of a lecture component (2 cr.) and a laboratory component (1 cr.).

INDE 534 Manufacturing Systems Analysis 3 cr.

Introduction which brings together useful models and modeling approaches that address a wide variety of manufacturing system design and operation issues: assembly line, transfer lines, job shops, flexible manufacturing systems and group technology. *Prerequisites: INDE 431 and INDE 402. Formerly ENMG 613. Annually.*

INDE 535 Data Analytics for Operations Research 3 cr.
and Financial Engineering

Students will learn to identify, evaluate and capture analytic opportunities that create value for an organization. Basic descriptive analytics methods are reviewed utilizing specialized software (e.g. R) in analyzing large data sets. Predictive analytics techniques including clustering, classification and regression are covered in detail. Prescriptive analytics applications on utilization simulation and optimization over large data to improve business decisions are presented. *Annually.*