School of Applied Technical Sciences

Master of Science in Engineering Management

Study Plan - Comprehensive Track

2022

Master of Science in Engineering Management

1. Overview

Master of Science in Engineering Management (MSEM) is a degree that bridges the gap between the fields of engineering, technology, business management, and innovation. It is a multidisciplinary field that involves the application of advanced business methods, engineering techniques, and innovation tools to design, manage, and improve complex systems and achieve organizational objectives.

MSEM is aimed at attracting ambitious engineers who aspire to obtain a senior role in their organizations in which they integrate technical and management responsibilities with innovation to support business growth and new organizational trends. It is ideal for recent graduates hoping to make their first move into engineering and innovation management, as well as established professional engineers who aspire for a higher management role and wish to extend their knowledge beyond their specific technical field.

MSEM graduates can work as engineering managers, quality managers, innovation and technology managers, project managers, operations managers, as well as in planning and strategic management to lead their organizations.

2. Program Objectives:

Graduates of the MEM program will be able to achieve the following objectives:

1. Apply engineering and management knowledge and techniques to analyze complex decisions and design complex engineering systems.
2. Establish successful engineering management careers in public and private sector that will contribute to the development of Jordan and the region.
3. Successfully manage technological innovation through developing the strategies, structures, and systems needed for the effective commercialization of new products and services, business systems and production processes.
4. Develop competitive skills in problem solving techniques, interdisciplinary teamwork, and critical analysis of engineering management problems.
5. Develop profound understanding of global economic and technological aspects to meet the changing needs of a knowledge-based economy by adapting and responding to changes.
6. Engage in service to professional societies and communities through practicing engineering systems management with professionalism and ethics.

3. Program Learning Outcomes

Upon completion of the program, graduates should be able to:

1. Solve industry-related problems by applying advanced engineering management, business, and innovation knowledge.
2. Analyse and design complex systems using both qualitative and quantitative tools and perspectives.
3. Interpret quantitative and subjective data to make sound engineering and managerial decisions.
4. Evaluate possibilities and opportunities through combining creative thinking skills and tools with a thorough understanding of technological development.

5. Analyse, design, and manage innovation and product development for maximum effectiveness and value.
6. Develop and lead effective teams and projects and communicate effectively across the entire enterprise
7. Understand the ethical responsibilities of practicing engineering managers and the impact of their decisions within a global and societal context.
8. Appreciate the need for life-long learning and personal development

4. German Dimension

School of Applied Technical Sciences has well-established exchange cooperation with over 27 German partner universities. The cooperation includes the following and can be expanded to apply to the current master program:

1. Sending students to Germany for studying or practical purposes.
2. Exchange professors to teach block modules.
3. Capacity building and train the trainings program of staff through EU-funded projects.

5. Admission

A B.Sc. degree in any engineering discipline and a minimum professional experience of one year in any field of engineering are required for application. Further requirements, such as minimum GPA and language skills, are covered by the general graduate studies admission requirements.

6. Program Prerequisites

Enrolled students are expected to pass an entry assessment exam on engineering statistics and engineering economics. Students who fail to pass the exam will be required to take a prerequisite module (IE517 Statistics and Engineering Economics) and will be informed of this in their admission letter.

7. Curriculum

The numbering system is structured as follows (from left to right):

1. IE: Industrial Engineering Department
2. Level digit: 7 = Master level
3. The middle digit represents the specialized field of knowledge:
    1 = Operations Research
    2 = Innovation Management
    3 = Statistics & Quality
    4 = Management Sciences and Business Management
    5 = Technology Management
    6 = Research Methods
    7 = Special Topics
    8 = Comprehensive exam
4. The right digit represents the sequence of the module within the field.

8. Study Plan: Non-Thesis Track

Classification	Credit Hours	ECTS
Compulsory Modules	25	66
Elective Modules	9	24
Comprehensive Exam	0	0
Total	**34**	**90**

1. Compulsory Modules (19 Credit hours)

Module No.		Module Title	Credit hours	ECTS[1]	Prerequisite
IE711		Operations Research & Simulation	3	8	-
IE732		Quality Engineering & Management	3	8	-
IE741		Operations & Supply Chain Management	3	8	IE711
IE751		Applied Data Analytics	3	8	IE517
IE761		Research Methods	1	3	-
MBA712		Management and Cost Accounting	3	8	-
MBA743		Strategic Management and Business Policy	3	8	-
IE790	IE762	Applied Research Project I: Innovation Project	3	15	-
	IE763	Applied Research Project II: Project Management and Entrepreneurship	3		IE762
		Total	**25**	**66**	

2. Elective Modules (6 Credit hours) to be chosen from:

Module No.	Module Title	Credit hours	ECTS	Pre-requisite
IE733	Reliability & Maintenance Management	3	8	IE732
IE734	Lean Six Sigma	3	8	IE732
IE743	Facility & Asset Management	3	8	IE711
IE744	Business Law & Engineering Contracts	3	8	-
IE752	Sustainability & Energy Management	3	8	-
IE771	Special Topics in Engineering Management	3	8	-
IE772	Special Topics in Innovation Management	3	8	-
MBA740	Organizational Behavior and Human Resources	3	8	-
	Total	**9**	**24**	

[1] European Credit Transfer and Accumulation System (ECTS): One ECTS is equivalent to 25 actual workload hours

3. Comprehensive Exam (0 Credit hours):

Module No.	Module Title	Credit hours	ECTS	Prerequisite
IE799	Comprehensive Exam	0	0	Dept. Approval
	Total	**0**	**0**	

9. Study Plan Guide: Non-Thesis Track

First Year					
First Semester					
Module No.	**Module Title**	**CH**	**ECTS**	**Prerequisites**	**Corequisites**
IE711	Operations Research and Simulation	3	8	-	-
IE761	Research Methods	1	3	-	-
MBA712	Management and Cost Accounting	3	8	-	-
	Total	**7**	**19**		

First Year					
Second Semester					
Module No.	**Module Title**	**CH**	**ECTS**	**Prerequisites**	**Corequisites**
IE732	Quality Engineering and Management	3	8	-	-
IE741	Operations Supply Chain and Management	3	8	IE711	-
IE762	Applied Research Project I: Innovation Project	3	7	-	-
	Total	**9**	**23**		

Second Year					
First Semester					
Module No.	**Module Title**	**CH**	**ECTS**	**Prerequisites**	**Corequisites**
IE751	Applied Data Analytics	3	8	IE517	-
IE763	Applied Research Project II: Project Management and Entrepreneurship	3	8	IE762	-
-	Elective	3	8	-	-
	Total	**9**	**24**		

Second Year					
Second Semester					
Module No.	**Module Title**	**CH**	**ECTS**	**Prerequisites**	**Corequisites**
MBA740	Organizational Behavior and Human Resources	3	8	-	-
-	Elective	3	8	-	-
-	Elective	3	8		
IE799	Comprehensive Exam	0	0	Dept. Approval	
	Total	**9**	**24**		

10. Module Descriptions

Master

Module Title	Module Code
Statistics and Engineering Economics	IE517

Compulsory Module		**Year of Study**	1	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	0
Pre-university		**Pre-program**	X	**Remedial**	X

Examination

Portfolio:
20% First exam
20% Second exam
10% Assignments
10% Project
40% Final exam

Responsible Lecturer(s)

Dr. Hazem Kaylani
Dr. Rula Allaf
Dr. Saleem Ramadan
Dr. Safwan AlTarazi

Course	Mode of Delivery	Contact Time	Self-Study
Statistics and Engineering Economics	Face-to-face	45	105

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Assignments and self-study at home: 35 hours;
- Preparation and writing of project paper: 20 hours;
- Preparation of first exam: 15 hours;
- Preparation of second exam: 15 hours;
- Preparation of final exam: 20 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Describe data samples graphically and mathematically.
- Make inferential decisions about populations from data involving a single sample or two samples.
- Build models to data using simple linear and multiple linear regression and assess model adequacy.
- Use computer software such as Minitab to perform basic statistical analyses.
- Define and distinguish concepts of time value of money, engineering costs, equivalent worth, rate of return, and depreciation.
- Evaluate projects and compare alternatives using net present worth (NPW), annual worth (AW), future worth (FW) and rate of return (ROR) methods.
- Conduct engineering economic analysis with depreciation, taxes, and inflation consideration.
- Apply replacement/retention analysis.
- Use electronic spreadsheets such as Excel to perform basic economic analyses.

Module Contents:
This module intends to familiarize students with basic concepts in statistics and engineering economics. Students get acquainted with the fundamentals of probability and probability distributions, descriptive statistics, statistical

inference and linear regression. Students learn concepts of the of time value of money and equivalence. Students learn economic-based decision making among alternatives including inflation, depreciation, taxes, and replacement decisions.

Planned Learning Activities and Teaching Methods:

- Lectures, supported by slides to present concepts with through examples and discussions;
- Exercises in class and at home;
- Project, supported by software on “real life” example;
- Writing and presenting projects alone or in group work.

Recommended or Required Reading:

- Montgomery, D. C. and Runger, G. C. (2018). *Applied Statistics and Probability for Engineers* (7th Edition). John Wiley & Sons, ISBN: 978-1-119-40036-3;
- Ross, S. M. (2020). *Introduction to Probability and Statistics for Engineers and Scientists* (6th edition). Academic Press, ISBN 13: 978-0128243466;
- Sullivan, W., Wicks, E. and Koelling, P. (2018). *Engineering Economy* (17th Edition), Pearson, ISBN-13: 978-0134870069.

Usability of the Module:

Students enrolled in the program are expected to pass an entry assessment exam on engineering statistics and engineering economics. Students who fail to pass the exam will be required to take this “pre-requisite” course. The content in this module is required for the program degree to standardize the entry educational level in the subject matters.

Prerequisites and Co-requisites:

None

Language of Instruction:

English

Recommended Optional Program Components:

None

Master

Module Title	Module Code
Operations Research and Simulation	IE711

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
30% Midterm exam
20% Case Study
10% Project
40% Theory final exam

Responsible Lecturer(s)

Dr. Mahmoud El-Banna
Prof. Raid Al-Aomar

Course	Mode of Delivery	Contact Time	Self-Study
Operations Research	Face-to-face	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Preparation of case studies: 45 hours;
- Preparation of projects: 45 hours;
- Preparation for midterm exam: 35 hours;
- Preparation for final exam: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Define and distinguish operations research (OR) model elements: decision variables, objective function, and constraints, and comprehend the linearity, feasibility, and optimality concepts.
- Formulate and solve popular real-world models: Production planning, Blending, Diet and perform sensitivity analysis.
- Formulate and solve real-world transportation model and its variants.
- Formulate and solve real-world scheduling models.
- Formulate and solve logistic network models.
- Formulate and solve multi-objective real-world models.
- Formulate and solve Stochastic models using queuing theory.
- Utilize concepts of computer simulation to model and optimize real-world stochastic processes.
- Assess the role of advanced OR methods and simulation modelling in decision-making and management.

Module Contents:
This module covers basic and advanced Operations Research (OR) methods and applications along with computer simulation of stochastic processes using Monte Carlo and Discrete Event Simulation (DES) software packages. OR is focused on the formulation of mathematical models with linear and integer programming, computer solution, and sensitivity and cost analysis of alternative optimum solutions with applications to production and service systems and logistic networks. The module also covers an overview of queuing systems and decision analyses. The module includes real-world case studies and applications of the learned concepts and methods.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples.
- Famous OR problems as theory and their variations in real world scenarios.
- Real world scenario problem statements discussions in class and left as self-exercise.
- Case studies to show how OR models been applied to solve certain problems in real life.
- Recorded videos for coding component to teach basics of Python and how it can be used to solve a ready linear program (the translation of mathematical models into code).
- Term paper/project that students try to solve/resolve real life problem.

Recommended or Required Reading:

- Taylor, B. (2016). *Introduction to Management Science* (12th Edition). Pearson, ISBN-13: 978-0133825770;
- Kelton, W. D., Sadowski, R. and Zupick, N. (2014). *Simulation with Arena* (6th Edition). McGraw-Hill, ISBN-13: 978-0073401317;
- Taha, H. A. (2016). *Operations Research: An Introduction* (10th Edition). Pearson, ISBN-13: 978-0134444017;
- Hillier, F. and Lieberman, G. (2021). *Introduction to Operations Research* (11th Edition). McGraw Hill, ISBN-13: 978-1260575873.

Usability of the Module:

This module provides part of the theoretical base required for the modules *IE741: Operations and Supply Chain Management* and *IE743: Facility and Asset Management*.

Prerequisites and Co-requisites:

None

Language of Instruction:

English

Recommended Optional Program Components:

None

Master

Module Title	Module Code
Quality Engineering and Management	IE732

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% mid-term exam
30% Project
10% Quizzes
5% Case study presentation
5% Book (extra-reading) summary
30% final exam

Responsible Lecturer(s)

Prof. Safwan Altarazi
Prof. Saleem Ramadan
Prof. Abdallah Abdallah

Module	Mode of Delivery	Contact Time	Self-Study
Quality Engineering and Management	Face-to-face	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 45 hours;
- Preparation for class project: 35 hours;
- Preparation of case study presentation: 10 hours;
- Preparation for quizzes: 15 hours;
- Revision of material and assignments at home: 60 hours;
- Book (extra-reading) summary: 5 hours;
- Preparation of quizzes, mid-term exam, and final exam: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Explain basic knowledge in the fields of quality engineering and management
- Differentiate between different quality management philosophies.
- Understand excellence models role within the quality management environment.
- Justify quality activities economically
- Understand and implement the basic tools of statistical process control.
- Explain the five steps of DMAIC: Define, Measure, Analyze, Improve, and Control.
- Design, implement, and interpret appropriate control charts for variable and attribute quality characteristics to quickly detect the emergence of any quality control problems.
- Apply process capability analysis principles for continuous and attribute quality characteristics.
- Conduct and analyze a measurement systems capability experiment.
- Construct acceptance sampling plans for testing the incoming raw material quality
- Implement DMIAC methodology on a real-life case
- Design and conduct experiments to further understand a process behavior and understand the process variables that contribute to optimizing its performance.

- Communicate quality engineering and management tools findings to individuals who do not share technical and statistical expertise.

Module Contents:
To familiarize students with fundamentals of quality engineering and management including: quality definitions, quality management principles, total quality management strategy, quality management systems, excellence models, economics of quality, statistical process control, sampling procedures, introduction to ANOVA and DoE, process and measurement system capability, DMAIC methodology and an introduction to Six Sigma.

Planned Learning Activities and Teaching Methods:

- Lectures with discussions;
- Exercises in class and at home;
- Presenting real-life case study and project outcomes individually and as teams;
- Practical project work and related group discussions.

Recommended or Required Reading:

- Montgomery, D.C. (2019). *Introduction to Statistical Quality Control* (8th Edition). John Wiley & Sons;
- Goetsch, D. L., & Davis, S. B. (2015). *Quality Management for Organizational Excellence* (8th Edition). Pearson;
- Montgomery, D.C. and George C. Runger (2013). *Applied Statistics and Probability for Engineers* (6th Edition). John Wiley & Sons;
- Tague, Nancy R. (2005). *The Quality Toolbox*. Vol. 600. Milwaukee: ASQ Quality Press;
- Pyzdek, Thomas, and Paul A. Keller. (2014). *The Six Sigma handbook*. McGraw-Hill Education;
- Chowdhury, S. (2005). *The ice cream maker: an inspiring tale about making quality the key ingredient in everything you do*. Currency.

Usability of the Module:
The module can be used as an elective module by other master programs such as MBA and logistics management. This module is a prerequisite module for the modules *IE733: Reliability and Maintenance Engineering* and *IE734: Lean Six Sigma*.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Reliability and Maintenance Management	IE733

Compulsory Module		**Year of Study**	2	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
25% mid-term exam
25% course project (report and presentation)
10% quizzes and homework
40% final exam

Responsible Lecturer(s)

Dr. Sameer Al-Dahidi

Course	Mode of Delivery	Contact Time	Self-Study
Reliability and Maintenance Management	Blended learning	45	155

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures and exercises 15 weeks * 3 hours = 45 hours;
- Preparation of quizzes and homework: 25 hours;
- Preparation of report and presentation: 60 hours;
- Preparation for midterm and final exams: 70 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Outline the importance of reliability and maintenance functions of industrial components and systems across multiple industries.
- Define and evaluate concepts of reliability, availability, maintainability, and safety performance parameters of industrial structures, systems, and components.
- Define the concepts of the common reliability functions, parameters, and methods of their modelling and prediction.
- Demonstrate an understanding of the relationship between the time to failure distribution, the probability density function, the reliability/unreliability function, and the hazard rate and explain the Bathtub curve.
- Define, explain, analyze, and estimate reliability and its performance parameters for industrial components and various systems design configurations using reliability block diagrams and Identify improvement opportunities.
- Inspect different failures across multiple-industries and their impacts on the overall system reliability.
- Illustrate the ways for failure prevention and understand the Design for Reliability process in enhancing the reliability of components & systems.
- Name, compare, apply, assess, and plan various maintenance intervention approaches (corrective, scheduled, condition-based, and predictive) and maintenance strategic planning (reliability-centered maintenance and risk-based maintenance).
- Illustrate and categorize the costs associated with maintenance interventions.
- Explain the significance of maintenance spare parts management and other logistics support systems on the overall plant availability and the maintenance investment costs.

- Design a Maintenance Management System (MMS) and Computerized Maintenance Management System (CMMS) and software applications for planning and budgeting deferred maintenance, capital improvement, equipment repair and replacement, and construction projects.

Module Contents:
Reliability, Availability, Maintainability, and Safety (RAMS) are the most important technical characteristics of systems, structures, and components. The scope of this module is to provide the students with the fundamental concepts and the necessary knowledge and skills related to reliability engineering and maintenance management of industrial systems, structures, and components. Specifically, this module is divided into TWO main parts: **Part 1** (dedicated to cover the aspects of reliability engineering) contains an introduction to reliability (reliability definitions, importance, life model distributions, the estimation of the reliability of an industrial component, the typical behaviour of failure rate of a component (bathtub curve), reliability models and reliability measures and statistics), system's reliability (the estimation of the reliability of a system composed by several components connected in different design configurations (series, parallel, mixed series and parallel, complex, stand-by)), reliability engineering (why do systems fail, how to develop reliable systems, how to improve reliability, how to measure/test reliability, and how to maintain systems reliable), reliability applications, failure prevention techniques with an emphasis on Design For Reliability (DFR) approach for improving the overall system reliability. Whereas **Part 2** (dedicated to cover the aspects of maintenance management) contains maintenance management objectives, maintenance intervention approaches (i.e., corrective, scheduled, condition-based and predictive) and maintenance strategic planning (i.e., Reliability-Centered Maintenance [RCM] and Risk-Based Maintenance [RBM]) commonly used in the industry, maintenance planning & scheduling, work order systems, maintenance cost control, performance keys indicators, designing a Maintenance Management System (MMS), and Computerized Maintenance Management System (CMMS) and software applications. The module will be supported with examples taken from real-industrial applications, e.g., oil and gas, nuclear, automotive, etc. Besides, hands-on exercise sessions for some topics will be performed to allow the students to develop their skills.

Planned Learning Activities and Teaching Methods:

- Lectures with intensive discussions.
- Exercises and case studies from real-industrial applications in class and at home.
- Writing and presenting reports alone or in group work as part of a class project.

Recommended or Required Reading

Reliability Engineering:

- Elsayed, E. A. (2021). *Reliability Engineering* (3rd Edition), Wiley.
- Zio, E. (2007). *An Introduction to the Basics of Reliability and Risk Analysis, Volume 13 of Series on Quality, Reliability & Engineering Statistics*. World Scientific.
- O'Connor, P. and Kleyner, A. (2012). *Practical Reliability Engineering* (5th Edition), Wiley.

Maintenance Management:

- Gopalakrishnan, P. and Banerji, A. K. (2013). *Maintenance and Spare Parts Management* (2nd Edition). PHI Learning Private Limited.
- Levitt, J. (2009). *The Handbook of Maintenance Management* (2nd Edition). Industrial Press Inc.
- Richardson, D. (2014). *Plant Equipment & Maintenance Engineering Handbook* (1st Edition). McGraw-Hill Education.
- US Army Material Command, Engineering Design Handbook: Maintainability Engineering Theory and Practice, U.S. Department of Defense, Department of the Army, Army Materiel Command, Volume 133. 1976.

Usability of the Module:
This module provides the students tools to encorporate reliability and maintenance measures when managing a venture.

Prerequisites and Co-requisites:
IE732: Quality Engineering and Management (prerequisite)

Language of Instruction:
English, Arabic (or if German professors available English with German)

Recommended Optional Programme Components:
None

Master

Module Title	Module Code
Lean Six Sigma	IE734

Compulsory Module		**Year of Study**	3	**Semester Hours**	3
Elective Module	X	**Spring Semester**		**Workload**	200
Optional Module		**Winter Semester**		**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
5% Quizzes
30% Midterm exam
10% Assignments
15% Practical Project
40% Theory final exam

Responsible Lecturer(s)

Dr. Mahmoud El-Banna
Prof. Raid Al-Aomar
Dr. Abdallah Abdallah

Course	Mode of Delivery	Contact Time	Self-Study
Lean Six Sigma	Blended learning	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours: 45 hours;
- Preparation for quizzes: 20 hours;
- Preparation for midterm exam: 35 hours;
- Preparation for final exam: 30 hours;
- Preparation of the semester project: 40 hours;
- Preparation of assignments: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Define all quality improvement activities using Six Sigma concepts.
- Explain the Six Sigma five phases in depth.
- Illustrate the use of different statistical tools and data collection tools used in Six Sigma projects.
- Develop ideas about liking Six Sigma concepts to the overall business mission and objectives.
- Function as a change agent to apply appropriate Six Sigma techniques to improve existing or design new work methods and procedures for a business process in an organization.
- Assess the different ways Six Sigma can be used in different manufacturing and service organizations.
- Construct a full program of using sigma in an organization.

Module Contents:
The course focuses on all aspects of the Body of Knowledge (BOK) of Six Sigma. Students who pass the class will have the knowledge of Six Sigma Green Belts (SSGB) and should be able to pass SSGB certification exams almost anywhere in the world. Six Sigma's BOK covers four major areas: project management, problem-solving techniques, decision-making and statistical analysis. Students will learn all project management and statistical tools used in any Six Sigma project.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- Crib sheets with course notation;
- Blank worksheets that are discussed and solved in lecture and given as extra self-work;
- Real world scenario problem statements discussions in class and left as self-exercise;
- Group-based term projects;
- Teams Presentations for Term projects.

Recommended or Required Reading

- Keller, P. (2011). *Six Sigma Demystified* (2nd Edition). McGraw Hill, ISBN-13: 978-0071746793;
- Pyzdek, T. and Keller, P. (2018). *The Six Sigma Handbook* (5th Edition). McGraw Hill, ISBN-13: 978-1260121827;
- The Council for Six Sigma Certification (2018). *Six Sigma: A Complete Step-by-Step Guide*. Harmony Living, ISBN-13: 978-1732592650.

Usability of the Module:

This module prepares students to a Green Belt level in Six Sigma if they were to choose to pursue the certification.

Prerequisites and Co-requisites:

IE732: Quality Engineering & Management

Language of Instruction:

English

Recommended Optional Program Components:

None

Master

Module Title	Module Code
Operations and Supply Chain Management	IE741

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	3
Elective Module		**Spring Semester**		**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
30% Case study team project
10% Individual assignment problems
40% Final exam

Responsible Lecturer(s)

Prof. Raid Al-Aomar
Dr. Murad Samhouri

Course	Mode of Delivery	Contact Time	Self-Study
Operations and Supply Chain Management	Face-to-face	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Project topic preparation: 10 hours;
- Project teamwork: 30 hours;
- Project report preparation: 20 hours;
- Project presentation preparation: 10 hours;
- Individual assignments preparation: 20 hours;
- Self-study: 30 hours;
- Preparation of midterm exam: 15 hours;
- Preparation of final exam: 20 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Compare the individual components of operations and supply chain and analyze their interrelationships.
- Examine sourcing decisions, logistic systems, transportation models, and distribution networks.
- Utilize advanced mathematical models for demand forecasting, capacity planning, inventory control, production planning, and scheduling.
- Acquire quantitative and analytical skills to analyze, model, and solve supply chain problems.
- Assess the impact of advances in Technologies, ERP, and Electronic Commerce on coordinating the supply chain.

Module Contents:
This module covers the major issues in operations and supply chain management including Sourcing Decisions, Logistics, Demand Forecasting, Capacity Planning, Inventory Control, Production Planning, Lean Production, and Scheduling in different types of organizations. The module emphasizes the utilization of Operations Research methods in designing and optimizing supply chains and logistics networks. It also covers the role of advances in Technologies, Electronic Commerce, and Enterprise Resource Planning (ERP) in coordinating the supply chain of products and services from the point of origin to the point of consumption. The case study requires students to develop the quantitative and analytical skills to analyze, model and solve various supply chain problems.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- In-class discussion of real-word case studies;
- A case analysis of a product or service supply chain;
- Full report writing and in-class presentation of case study analysis.

Recommended or Required Reading:

- Krajewski, L., Malhotra, M. and Ritzman, L. (2019). *Operations Management: Processes & Supply Chain* (12th Edition). Pearson;
- Chopra, S. and Meindl, P. (2014). *Supply Chain Management: Strategy, Planning, and Operation* (6th Edition). Pearson;
- Tapscott, D. (2020). *Supply Chain Revolution: How Blockchain Technology is Transforming the Global Flow of Assets*. Barlow Publishing.

Prerequisites and Co-requisites:
IE711: Operations Research & Simulation (prerequisite)

Language of Instruction:
English with occasional Arabic explanations

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Facilities and Asset Management	IE743

Compulsory Module		**Year of Study**	2	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
30% Midterm exam
10% Class Presentations
20% Term project
40% Theory final exam

Responsible Lecturer(s)

Dr. Hazem Kaylani
Dr. Saleem Ramadan

Course	Mode of Delivery	Contact Time	Self-Study
Facilities and Asset Management	Blended learning	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation class presentations: 15 hours;
- Preparation for midterm exam: 30 hours;
- Preparation of term project: 30 hours;
- Preparation for final exam: 40 hours;
- Self-study: 40 hours.

Learning Outcomes:
On successfully completing this module, the student will be able to:

- Explain different types of layouts, differentiating features and applications.
- Describe product, process and schedule designs and discuss their importance for facilities planning and layout.
- Describe flow, space and activity relationships.
- Explain the basic features of different material handling equipment and their applications.
- Develop, design, and analyse layouts for different facilities.
- Discuss labour performance measurement and evaluation
- Develop a manufacturing facilities design and line balancing.
- Organize and plan a successful facilities project.

Module Contents:
Provides students with the skills and knowledge to determine tools and techniques required for facility management. Students learn the concepts and methodology of facilities planning, in addition to layout planning, line balancing, selection of material handling systems, and assessment of labour performance. Students acquire knowledge and skills in the areas of strategic facilities planning and manufacturing facilities design. Students carry independent project work and research in the area of facilities design, material handling, selection of equipment, and labour performance measurement and evaluation.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples.
- Class presentations (each student gives a presentation on selected topics).
- Term project applied to a real world facility.

Recommended or Required Reading:

- Tompkins, J. A., White, J. A., Bozer, Y. A. and Tanchoco, J. M. A. (2010). *Facilities Planning* (4th Edition). Wiley.
- Stephens, M. P. (2019). *Manufacturing Facilities Design and Material Handling* (6th Edition). Purdue University Press.
- Heragu, S. S. (2016). *Facilities Design* (4th Edition). CRC Press.

Usability of the Module:

This elective module gives the student tools that translate directly to managing a venture with facility and asset components.

Prerequisites and Co-requisites:

IE711: Operations Research & Simulation (prerequisite)

Language of Instruction:

English

Recommended Optional Program Components:

None

Master

Module Title	Module Code
Business Law & Engineering Contracts	MBA740

Compulsory Module		**Year of Study**	1	**Semester Hours**	3
Elective Module	X	**Spring Semester**	x	**Workload**	200
Optional Module		**Winter Semester**		**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
20% Assignments and/or case study
20% Term Project
40% Final Exam

Responsible Lecturer(s)

Dr. Safwan Altarazi

Module	Mode of Delivery	Contact Time	Self-Study
Business Law & Engineering Contracts	Online	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Preparation of term project: 30 hours;
- Preparation of assignments and/or case study: 40 hours;
- Self-study: 60 hours;
- Preparation for midterm and final exams = 25 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Understand contract as a means to deal with project issues.
- Know how to deal with project issues by considering legal, economic, and technical aspects in an integrated way.
- Describe the key terms involved in related legal acts.
- Summarize the key legal provisions of related legal acts.
- Illustrate the use of the acts in common business situations.
- Analyse and optimise a call for tender and draft a contract.
- Outline the various facets of basic case laws of related legal acts from a legal and managerial perspective.
- Develop critical thinking by making judgments related to use of various provisions of the related legal acts in business situations.

Module Contents:
This module explains the working of business law in engineering practice by dealing with legal aspects of external large scale projects such as plant & process engineering, IT, civil engineering, and infrastructure projects. It places special emphasis on a reliable safeguarding of project risks through contractual instruments. It will be demonstrated from a legal point of view, how risk situations are determined by project structures, procurement methods, contracts, and law. Additionallay, the module will expose students to important theories applications relaetd to the follwing

acts: the contract act, sale of goods act, the negotiable instrument act, the companies (amendment) act, the consumer protection act, and information technology act.

Planned Learning Activities and Teaching Methods:

- Lectures with group discussions;
- Assignments at home;
- Practical project work;
- Presenting case study and project outcomes individually and as teams;
- Writing project report.

Recommended or Required Reading:

- DiMatteo, L. A. (2021). Interational Business Law and the Legal Environment: A Transactional Approach (4th Edition). Routledge;
- Chow, D. C. K. and Schoenbaum, T. J. (2020). International Business Transactions: Problems, Cases, and Materials (Aspen Casebook) (4th Edition). Wolters Kluwer;
- Cheeseman, H. R. (2019). Business law (10th Edition). Englewood Cliffs: Prentice Hall.

Usability of the Module:
This module provides a legal base for students to be used if they choose to start their own ventures upon graduation.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Applied Data Analytics	IE751

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	3
Elective Module		**Spring Semester**		**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
10% In-class work
20% Term project
10% Report and presentation
40% Final exam

Responsible Lecturer(s)

Dr. Saleem Ramadan
Dr. Mahmoud El-Banna

Course	Mode of Delivery	Contact Time	Self-Study
Applied Data Analytics	Face-to-face	45	155

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Preparation of term project: 65 hours;
- Preparation of report and presentation: 20 hours;
- Preparation for midterm exam: 30 hours;
- Preparation for final exam: 40 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Demonstrate ability to gather and clean data.
- Demonstrate ability to make appropriate and powerful connections between quantitative analysis and business problems.
- Understanding the concepts and methods; know the advantages and limitations of each method.
- Use advanced techniques to conduct thorough and insightful analysis for business problems including banking and marketing.
- Show substantial understanding of the business problems; conduct deep data analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
- Write an insightful and well-organized report for a business case study, including thoughtful and convincing details.

Module Contents:
At the present time, there is a growing need for specialists with background in Python who can apply data analytics methods to practical problems at their workplace. Working in data analytics requires an understanding of many interdisciplinary concepts, involves data mining and application of various methods. The proposed course is designed to fill this need. Students will learn major Python tools, machine learning classifiers and techniques for data analytics. There are weekly inclass assignments and mini projects on topics covered in class. These assignments will help build necessary statistical, visualization and other data analytics skills in a variety of

applications including finance, time series analysis and recommendation systems. In addition, students will choose a topic for a term project and present it on the last day of class.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- Business problems that are discussed and solved in lectures;
- Self-work problems in class supervised with the instructor;
- Group-based term project;
- Team presentation for term project.

Recommended or Required Reading:

- McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd Edition). O'Reilly Media, ISBN-13: 978-1491957660;
- Geron, A. (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems* (2nd Edition). O'Reilly Media, ISBN-13: 978-1492032649;
- Nussbaumer Knaflic, C. (2015). *Storytelling with Data: A Data Visualization Guide for Business Professionals* (1st Edition). Wiley, ISBN-13: 978-1119002253.

Usability of the Module:
This module provides a direct application to the growing need to handle large data to present project findings, analyse situations, and estimate projections.

Prerequisites and Co-requisites:
IE731 Statistical and Engineering Economy (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Applied Data Analytics	IE751

Compulsory Module		**Year of Study**	2	**Semester Hours**	3
Elective Module	X	**Spring Semester**		**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
10% In-class work
20% Term project
10% Report and presentation
40% Final exam

Responsible Lecturer(s)

Dr. Saleem Ramadan
Dr. Mahmoud El-Banna

Course	Mode of Delivery	Contact Time	Self-Study
Applied Data Analytics	Face-to-face; blended learning	45	155

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Preparation of term project: 65 hours;
- Preparation of report and presentation: 20 hours;
- Preparation for midterm exam: 30 hours;
- Preparation for final exam: 40 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Demonstrate ability to gather and clean data.
- Demonstrate ability to make appropriate and powerful connections between quantitative analysis and business problems.
- Understanding the concepts and methods; know the advantages and limitations of each method.
- Use advanced techniques to conduct thorough and insightful analysis for business problems including banking and marketing.
- Show substantial understanding of the business problems; conduct deep data analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
- Write an insightful and well-organized report for a business case study, including thoughtful and convincing details.

Module Contents:
At the present time, there is a growing need for specialists with background in Python who can apply data analytics methods to practical problems at their workplace. Working in data analytics requires an understanding of many interdisciplinary concepts, involves data mining and application of various methods. The proposed course is designed to fill this need. Students will learn major Python tools, machine learning classifiers and techniques for data analytics. There are weekly inclass assignments and mini projects on topics covered in class. These

assignments will help build necessary statistical, visualization and other data analytics skills in a variety of applications including finance, time series analysis and recommendation systems. In addition, students will choose a topic for a term project and present it on the last day of class.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- Business problems that are discussed and solved in lectures;
- Self-work problems in class supervised with the instructor;
- Group-based term project;
- Team presentation for term project.

Recommended or Required Reading:

- McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd Edition). O'Reilly Media, ISBN-13: 978-1491957660;
- Geron, A. (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems* (2nd Edition). O'Reilly Media, ISBN-13: 978-1492032649;
- Nussbaumer Knaflic, C. (2015). *Storytelling with Data: A Data Visualization Guide for Business Professionals* (1st Edition). Wiley, ISBN-13: 978-1119002253.

Usability of the Module:
This module provides a direct application to the growing need to handle large data to present project findings, analyse situations, and estimate projections.

Prerequisites and Co-requisites:
IE731 Statistical and Engineering Economy (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Sustainability and Energy Management	IE752

Compulsory Module		**Year of Study**	1	**Semester Hours**	3
Elective Module	X	**Spring Semester**		**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
30% Midterm exam
10% Presentation
20% Research paper
40% Final exam

Responsible Lecturer(s)

Dr. Nidal Alshwawreh

Course	Mode of Delivery	Contact Time	Self-Study
Sustainability and Energy Management	Blended learning	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation for midterm exam: 35 hours;
- Preparation of presentation: 15 hours;
- Preparation of the research paper: 65 hours;
- Preparation for final exam: 40 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Understand the concept of sustainability, sustainability pillars, principles, and metrics.
- Evaluate energy systems based on the concept of energy efficiency and differentiate between conventional and renewable energy resources.
- Understand the fundamentals of solar radiation, solar thermal collectors, ocean hydropower, wind energy, and geothermal energy conversion.
- Perform calculations related to the economics of energy generation and conservation.
- Apply energy auditing principles in building and commercial facilities.
- Differentiate various energy storage technologies based on their concept and characteristics.
- Discuss and analyse energy management concepts including energy systems maintenance, green buildings, and greenhouse emissions management.
- Successfully use available software such as RETScreen for clean energy project analysis and management.
- Conduct research related to sustainability and energy management concepts utilizing available resources with focus on local, regional, and global perspectives.
- Develop ideas to tackle sustainability and energy management challenges in Jordan.

Module Contents:
Students will learn about the principle of sustainability and sustainable development in a broader context, sustainability metrics, energy efficiency, conventional and nonconventional energy resources, economics of energy

generation and consumption. They will analyse available data related to energy demand, climate change, and sustainability indicators. They will learn how to perform energy analysis and conduct energy audits in building and industrial facilities. Topics including electricity supply systems, heating, lighting, insulation, and other energy related systems will be reviewed in addition to energy systems maintenance. Students will learn various energy storage technologies like mechanical, electrical, chemical, and thermal technologies. Concepts related to energy in transportation, green buildings, energy management standards will be also covered.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- Sessions to train students on ways to extract and analyse data related to energy production and consumption;
- Sessions to demonstrate energy management software;
- Real world scenario problem statements discussions in class;
- Interviews with energy experts and guest speakers.

Recommended or Required Reading:

- Kutscher, C. F., Milford, J., B., and Kreith, F. (2018). *Principles of Sustainable Energy Systems* (3rd Edition). CRC Press;
- Capehart, B., Turner, W., and Kennedy, W. J. (2016). *Guide to Energy Management* (7th Edition). CRC Press;
- Smith, C. and Parmenter, K. (2013). *Energy Management Principles, Applications, Benefits, Savings* (2nd Edition). CRC Press;
- Sachs, J. (2015). *The Age of Sustainable Development* (1st Edition). Columbia University Press.

Usability of the Module:
This module provides the needed knowledge to incorporate green and sustainable energy choices in managing a venture.

Prerequisites and Co-requisites:
None

Language of Instruction:
English (with occasional Arabic explanations).

Recommended Optional Program Components:
None.

Master

Module Title	Module Code
Research Methods	IE761

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	1
Elective Module		**Spring Semester**	X	**Workload**	75
Optional Module		**Winter Semester**		**ECTS**	3
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
15% Participation and class discussion presentations
45% Three written assignments
40% Final Exam

Responsible Lecturer(s)

Dr. Sameer Al-Dahidi

Course	Mode of Delivery	Contact Time	Self-Study
Research Methods	Face-to-face	15	60

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*1 hours = 15 hours;
- Preparation of assignments and presentations: 45 hours;
- Preparation of final exam: 15 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Recall and outline essential concepts of research: meaning, objectives, motivation, types, approaches, significance, and process.
- Distinguish between various types of research.
- Distinguish between quantitative and qualitative research approaches.
- Organize and plan a literature review and research proposal.
- Explain and make use of various strategies of literature review.
- Find, select, and critically analyze research papers and academic publishers.
- Illustrate the structure of scientific and technical publications.
- Compare and construct various citation styles with an emphasis on APA and IEEE style guidelines.
- Explain the ethical principles of research, ethical challenges, and approval processes.

Module Contents:
This module covers the essential concepts related to research that allow the students to critically analyze published research and/or be able to conduct independent research, starting from developing the research idea up to writing and presenting a scientific paper. Focus is on understanding each component of the research process, qualitative and quantitative research approaches, practical strategies for conducting a literature review, various styles of citations (with an emphasis on APA and IEEE style guidelines), how to read, write effectively, and present technical papers, how to evaluate the effectiveness of research, how to prepare a comprehensive research proposal. Various aspects of research ethics (e.g., professional ethics, intellectual property, plagiarism) will also be addressed in this course. The module includes a number of lectures given by faculty and invited speakers where models of research and case studies in engineering are presented.

Planned Learning Activities and Teaching Methods:

- Lectures and classroom discussions;
- Assignments, e.g., conduct a literature review, summarize a scientific paper, present a topic in research methods, prepare a research proposal.

Recommended or Required Reading:

- Kothari C.R. and Gaurav Garg, Research Methodology: Methods and Techniques, Fourth Edition, New Age International (P) Ltd., Publishers, New Delhi, 2019, ISBN-13 9789386649225.
- Kate L. Turabian, A Manual for Writers of Research Papers, Theses, and Dissertations, Ninth Edition, Chicago Press, 2013, ISBN-13 978-0226430577.
- Glasman-Deal, H., Science Research Writing: for Non-Native Speakers of English, Imperial College Press, London, 2010, ISBN-13 9781848167209.
- Bock, P., Getting It Right: R&D Methods for Science and Engineering, Second Edition, Academic Press, 2019, ISBN-13 978-0128161654.

Usability of the Module:
The skills acquired in this module are directly applicable in all modules involving scientific research, reports, presentations, and writings, especially the Master Thesis (IE781).

Prerequisites and Co-requisites:
None

Language of Instruction:
English (with occasional explanations in Arabic).

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Applied Research Project	IE790

Compulsory Module	X	**Year of Study**	1-2	**Semester Hours**	6
Elective Module		**Spring Semester**	X	**Workload**	375
Optional Module		**Winter Semester**	X	**ECTS**	15
Pre-university		**Pre-program**		**Remedial**	

Examination

Innovation Project Portfolio:
10% Case Studies (Analysing and presenting and innovation project)
5% Individual Assignment (Applying an innovation tool)
15% Midterm
20% Proposal for Research Project (Innovation project idea, rationale, and methodology)
Project Management and Entrepreneurship Portfolio:
5% Technical Paper Analysis and Critique
5% Individual Assignment (Project management problem solving)
20% Midterm exam
20% Research Project Management Report (Project scoping, implementation plan, and entrepreneurship)

Responsible Lecturer(s)

TBD

Course	Mode of Delivery	Contact Time	Self-Study
Innovation Project (IE762)	Blended learning	45	130
Project Management and Entrepreneurship (IE763)	Blended learning	45	155

Duration of Study:
Two semesters

Allocation of Workload Hours:

- Presence time in supervision meetings: 30 weeks*3 hours = 90 hours;
- Case studies preparation and presentation: 30 hours;
- Research project report preparation: 45 hours;
- Research project presentations: 10 hours;
- Preparation of technical paper analysis critique: 30 hours;
- Preparation of research project: 55 hours;
- Research project presentations: 15 hours;
- Self-study (Assignment & Exam): 100 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Interpret, analyze, and use the main concepts in innovation and entrepreneurship.
- Categorize different sources and types of innovation and position them in the current market.
- Distinguish among the possible venues for innovation and utilize innovation tools and methods.
- Compare the different measures in developing a new product/service.
- Create an innovative product/service idea and write a research proposal to rationalize and develop the idea.
- Distinguish the characteristics of a project and a research project.
- Characterize entrepreneurship aspects and integrate them into the project management process.
- Describe the importance of project planning and the role of the project manager in innovation projects.
- Identify innovation project activities and break them down into detailed work packages.

- Prepare project estimates for time, cost, and resource requirements.
- Construct and analyse project network and schedule diagrams.
- Develop project control methods and implementation measures.
- Assess and criticize existing technical models for project management in the literature and practice.
- Evaluate the aspect of constant learning as part of the project management process.

Module Contents:
The first part of the module focuses on introducing innovation and entrepreneurship from multiple angles and by exposing the students to real world examples and case studies. It transforms the student from observing innovations to transferring their own innovation from an idea to a research project and a business plan. The module covers the innovation imperative, sources of innovation, tools and methods of innovation, and the development of innovation research projects. This part focuses on developing new products and services and how to write a research methodology to develop these products and a business plan for their adoption.

The second part of the module examines the organization, planning, and controlling of innovation and research projects and provides theoretical and practical knowledge on managing project scope, schedule and resources. Topics include project life cycle, work breakdown structure, Gantt charts, network diagrams (CPM and PERT), and resource allocation decisions. Concepts and methods are applied through team innovation and applied research projects using project management software competence with a set of tools and methods for entrepreneurship in product/service design and development. The main topics of this part of the module are as follows:

- The process of scoping and planning R&D projects;
- Project cost estimation and the budgeting;
- Project scheduling and allocating resources;
- Research and innovation project risk management;
- Managing projects through information systems: planning-monitoring-controlling cycle, information needs and the reporting process, and earned value analysis.

Planned Learning Activities and Teaching Methods:

- Lectures as guided or directed information sessions for applied research thinking methodology pertaining to innovation, entrepreneurship and project management;
- In-class activities to present the different concepts in the module and discuss them with the students through real success and failure examples in the global and local markets;
- Teams discussions;
- The students evaluate current innovations in the local and the global markets through different case studies to grasp the innovation and entrepreneurship involved for a successful product/service. The case studies are discussed in lecture after;
- The research and innovation portion of the course is in compiling an innovative product/service idea into a research project with a clear methodology, where the student collects feedback from the instructor and reflects on ones work.

Recommended or Required Reading:

- Satell, G. (2017), *Mapping Innovation: A Playbook for Navigating a Disruptive Age*, 1st edition, McGraw Hill, ISBN: 978-1259862250;
- Jain, G., Singh, H., Akter, S., Munjal, A. and Grewal, H. S. (2019), *Technological Innovations for Sustainability and Business Growth,* IGI Global, ISBN-13: 978-1522599401;
- Nicholas, J. M. and Steyn, H. (2020). Project Management for Engineering, Business and Technology (6th Edition). Routledge, ASIN: B08D2XHBD4.

Usability of the Module:
This module provides a guide to applied research, start-up nature and writing business plans to support it.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Management and Cost Accounting	MBA712

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
25% Midterm exam
15% Assignments and mini cases
20% Semester Case study
40% Final exam

Responsible Lecturer(s)

Dr. Majdy Zuriekat

Module	Mode of Delivery	Contact Time	Self-Study
Management and Cost Accounting	Face-to-face	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 45 hours;
- Preparation for semester case study: 35 hours;
- Working on assignments: 15 hours;
- Working on mini cases: 15 hours;
- Revision of material and assignments at home: 60 hours;
- Preparation for midterm and final exams: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Demonstrate general knowledge of cost structure and behavior in today's competitive markets.
- Differentiate between costing systems and managing businesses through analyzing costs and profits.
- Exhibit skills in using cost determination and pricing strategies in changing business environment to achieve the target profit.
- Acquire general knowledge about budgeting as a profit planning tool and its relationship with companies' sustainability and profitability.
- Apply the usage of budgets for effective controlling and performance measurement systems as a continuous learning system.
- Conduct advanced management accounting techniques through competitor analysis and customer profitability analysis to gain a competitive advantage.
- Exhibit relevant knowledge and awareness of the importance of costs and profits to make decisions and evaluate performance.

Module Contents:
This module focuses on understanding the usefulness of management accounting information to businesses and managers to drive effective and efficient decisions. The module provides students with vital information on relevant costs, qualitative factors in the dynamic interaction of cost, volume and profit analysis. This module includes studying costing systems to make operational decisions such as costing and pricing in today's competitive

environments. In addition, discussed is the profit planning and the impact of budgets on strategic plans and objectives, in addition, accounting for control, performance evaluation and appraisal is presented. Strategic management accounting including competitor analysis and customer profitability analysis are explained to evaluate decision-making outcomes. Finally, Ethical practices of management accounting are essential components of this module as a mean of following the new trends of strategic management accounting.

Planned Learning Activities and Teaching Methods:

- Lectures with discussions;
- Weekly assignments at home;
- Presenting semester case study;
- Practical project work and related group discussions.

Recommended or Required Reading:

- Atrill, P. and McLaney, E. (2018). *Management Accounting for Decision Makers* (9th Edition). Pearson;
- Bhimani, A., Datar, S. M., Horngren, C. T., and Rajan, M. V. (2019). *Management and Cost Accounting* (7th Edition). Pearson;
- Blocher, E., Stout, D., Juras, P., and Smith, S. (2018). *Cost Management: A Strategic Emphasis* (8th Edition). McGraw Hill Education.

Usability of the Module:
The module is compulsory for both MBA and Master of Science in Engineering Management programs.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Organizational Behaviour	MBA740

Compulsory Module		**Year of Study**	1	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**	X	**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
10% Assignments and/or case study
30% Term Project
40% Final exam

Responsible Lecturer(s)

Dr. Tasneem Faiez Alrabee

Module	Mode of Delivery	Contact Time	Self-Study
Organizational Behaviour	Online	45	155

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 45 hours;
- Preparation for term project: 45 hours;
- Working on assignments and/or case study: 20 hours;
- Revision of material at home: 60 hours;
- Preparation for midterm and final exams: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able to:

- Understand the nature of individual and group behavior within organizations.
- Draw conclusions and develop inferences about attitudes and behavior, when confronted with different situations that are common in modern organizations
- Identify motives and discriminate between different behavioral and attitudinal mechanisms that affect members of organizations

Module Contents:
This module is designed to expose students to important theories and conceptual models for analyzing, understanding, and managing human behavior within organizations. Organizational behavior encompasses a wide range of topics, such as motivation, attitudes, change, leadership, teams, etc. Some of the topics we will cover during this module are vital in the world of business. Organizational behavior studies cover the study of organizations from multiple viewpoints, methods, and levels of analysis. It examines and analyzes the application of knowledge about how people, individuals, and groups act in organizations. It does this by taking a system approach. That is, it interprets people-organization relationships in terms of the whole person, whole group, whole organization, and whole social system. Its purpose is to build better relationships by achieving human objectives, organizational objectives, and social objectives.

Planned Learning Activities and Teaching Methods:

- Lectures with group discussions;

- Assignments at home;
- Practical project work;
- Presenting case study and project outcomes individually and as teams;
- Writing project report.

Recommended or Required Reading:

- Robbins, S. P. and Judge, T. A. (2018). *Organizational Behavior* (18th Edition). Pearson;
- Robbins, S. P. and Judge, T. A. (2017). *Essentials of Organizational Behavior* (14th Edition). Pearson;
- Kinicki, A. (2020). *Organizational Behavior: A Practical, Problem-solving Approach* (3rd Edition). McGraw Hill.

Usability of the Module:
The module is used by both the MBA program, as a compulsory module; and the Master of Science in Engineering Management Program, as an elective module.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Strategic Management and Business Policy	MBA743

Compulsory Module		**Year of Study**	1	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**		**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
10% Cases analysis, teamwork & participation
30% Business strategy project
40% Final exam

Responsible Lecturer(s)

Prof. Mamoun N. Akroush

Module	Mode of Delivery	Contact Time	Self-Study
Strategic Management and Business Policy	Blended learning	45	155

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 45 hours;
- Preparation for business strategy project: 45 hours;
- Working on case studies: 20 hours;
- Revision of material at home: 60 hours;
- Preparation of mid-term and final exams: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able on high level to:

- Practice essential strategic management compenecties of the business firm.
- Craft and execute a sound business strategy.
- Comrehend a unique package of process tools and analytical techniques that are relevant and contemporary, which should guide a management team to construct a workable strategy to enhance competitiveness and yet exploit the distinctiveness and capabilities of the firm.
- Understnd fundamental concepts of strategic management and strategy making at three levels: corporate, business unit, and functional levels.
- Implement analytical tools of strategic management and strategy making at three levels: corporate, business unit, and functional levels.
- Utilize the most recent trends such as resource-based theory, theory of competitiveness and dynamic strategic capabilities theory in corporate and business strategies formulation and implementation.
- Comprehend the dynamism of strategic management and its emerging paradigms in different contexts.
- Utilise and use strategic thinking skills and competences in different organisational situations in order to maintain an organisation’s position and achieve its intended strategic gaols under different circumstances.

Module Contents:
Strategic management and business policy module is designed to unify the students learning experience at the program. This module builds on students learning experience and acts as a corner-step to the real world of business and success. It integrates the various areas of the business disciplines into strategy to achieve a sustainable

competitive advantage through energetic discussions of strategy formulation, selection and implementation. It relies heavily on interactive and case analysis learning methods. This module teaches students the science and art of business strategy in modern organisations to achieve long-term strategic objectives in today's turbulent business environment. It teaches students the process of strategic management and business policy as a usual business practice, which is embedded in the organisation's culture on the top levels of management.

Planned Learning Activities and Teaching Methods:

- Lectures with group discussions;
- Case studies analyses at home;
- Practical project work;
- Presenting project outcomes individually and as teams;
- Writing project report.

Recommended or Required Reading:

- Thompson, A., Peteraf, M., Gamble, J., Strickland III, A. J., and Jain, A. K. (2019). *Crafting & Executing Strategy: The Quest for Competitive Advantage – Concepts and Cases* (22nd Edition). McGraw-Hill Education;
- Hunger, J. D., Hoffman, A. N., Bomford, C. E., and Wheelan, T. L. (2017). *Concepts in Strategic Management and Business Policy: Globalization, Innovation and Sustainability* (15th Edition). Pearson;
- Johnson, G., Whittington, R., Scholes, K., Angwin, D., and Regnér, P. (2016). *Exploring Strategy*. Financial Times Prentice Hall.

Usability of the Module:
The module is used by both the MBA program, as a compulsory module; and the Master of Science in Engineering Management program, as an elective module.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Master

Module Title	Module Code
Strategic Management and Business Policy	MBA743

Compulsory Module		**Year of Study**	1	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	200
Optional Module		**Winter Semester**		**ECTS**	8
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
10% Cases analysis, teamwork & participation
30% Business strategy project
40% Final exam

Responsible Lecturer(s)

Prof. Mamoun N. Akroush

Module	Mode of Delivery	Contact Time	Self-Study
Strategic Management and Business Policy	Blended learning	45	155

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 45 hours;
- Preparation for business strategy project: 45 hours;
- Working on case studies: 20 hours;
- Revision of material at home: 60 hours;
- Preparation of mid-term and final exams: 30 hours.

Learning Outcomes:
By the end of this module, the student will be able on high level to:

- Practice essential strategic management compenecties of the business firm.
- Craft and execute a sound business strategy.
- Comrehend a unique package of process tools and analytical techniques that are relevant and contemporary, which should guide a management team to construct a workable strategy to enhance competitiveness and yet exploit the distinctiveness and capabilities of the firm.
- Understnd fundamental concepts of strategic management and strategy making at three levels: corporate, business unit, and functional levels.
- Implement analytical tools of strategic management and strategy making at three levels: corporate, business unit, and functional levels.
- Utilize the most recent trends such as resource-based theory, theory of competitiveness and dynamic strategic capabilities theory in corporate and business strategies formulation and implementation.
- Comprehend the dynamism of strategic management and its emerging paradigms in different contexts.
- Utilise and use strategic thinking skills and competences in different organisational situations in order to maintain an organisation’s position and achieve its intended strategic gaols under different circumstances.

Module Contents:
Strategic management and business policy module is designed to unify the students learning experience at the program. This module builds on students learning experience and acts as a corner-step to the real world of business and success. It integrates the various areas of the business disciplines into strategy to achieve a sustainable

competitive advantage through energetic discussions of strategy formulation, selection and implementation. It relies heavily on interactive and case analysis learning methods. This module teaches students the science and art of business strategy in modern organisations to achieve long-term strategic objectives in today's turbulent business environment. It teaches students the process of strategic management and business policy as a usual business practice, which is embedded in the organisation's culture on the top levels of management.

Planned Learning Activities and Teaching Methods:

- Lectures with group discussions;
- Case studies analyses at home;
- Practical project work;
- Presenting project outcomes individually and as teams;
- Writing project report.

Recommended or Required Reading:

- Thompson, A., Peteraf, M., Gamble, J., Strickland III, A. J., and Jain, A. K. (2019). *Crafting & Executing Strategy: The Quest for Competitive Advantage – Concepts and Cases* (22nd Edition). McGraw-Hill Education;
- Hunger, J. D., Hoffman, A. N., Bomford, C. E., and Wheelan, T. L. (2017). *Concepts in Strategic Management and Business Policy: Globalization, Innovation and Sustainability* (15th Edition). Pearson;
- Johnson, G., Whittington, R., Scholes, K., Angwin, D., and Regnér, P. (2016). *Exploring Strategy*. Financial Times Prentice Hall.

Usability of the Module:
The module is used by both the MBA program, as a compulsory module; and the Master of Science in Engineering Management program, as an elective module.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None