German Jordanian University

School of School of Applied Technical Sciences
Department of Industrial Engineering
Bachelor of Science in Industrial Engineering

Study Plan 2020

I. Program Vision

Provide the local and global community with an excellent applied educational program that will yield professional engineers, with sound academic foundation and diverse industrial experience, that guide us toward a more technology driven, innovative, and sustainable future.

II. Program Mission

To foster industrial engineering professionals known for their diversity, integrity, and initiative to serve the Jordanian and global communities by:

- Providing an educational experience that cultivates the necessary theoretical and practical knowledge for industrial engineering students.
- Offering an educational foundation that provides industrial engineers with analytical thinking, technical capability, and social responsibility.
- Delivering an educational program that will enable students to become engineering leaders with holistic, interdisciplinary, problem-solving mindsets.
- Adding to the knowledge pool and continuously improving the educational experience to serve the profession of Industrial Engineering with the feedback from the market.
- Supporting the local industrial sector by providing them with access to engineers, resources, and expertise that will give them a competitive advantage.
- Building a bridge between the Jordanian community and international businesses.

III. Program General Description

The Industrial Engineering program is hosted in the School of Applied Technical Sciences. The program stands ahead of other competitive programs by incorporating the theoretical knowledge with direct practical applications with every IE course either includes a lab or a project portion. The Dual Studies track further directs the student to have practical application to their theoretical gained knowledge through their yearly summer internship.

The nature of the German Jordanian University dictates a year in Germany, where the student spends a study semester taking technical electives at a partner university and few months doing an internship in the German industry. The German year adds an international component to the student experience that sets our alumni further apart from other IE graduates. Our alumni currently work in many disciplines such as quality, systems, production, manufacturing, consulting, and many others.

The five-year program includes 169 credit hours that are divided as 21 credit hours as University requirements (section 1.2), 6 credit hours as Dual Studies requirements (section 1.3), 43 credit hours as School requirements (section 2), 87 credit hours as compulsory Program requirements (section 3.1), and 12 credit hours technical electives in the Program requirements (section 3.2).

IV. Program Objectives

Industrial Engineering (IE) educational program emphasizes the application of technologies and tools in the short term, and the ability to discover, acquire, and adapt new knowledge and skills in the long term, such that our graduates are prepared:

i. To define, analyze, and solve complex problems within and between enterprises.

ii. To discover, understand, and incorporate appropriate new technologies in the design and operation of enterprises.

iii. To lead/ manage design, development, and improvement efforts that benefit customers, employees, and stakeholders.

iv. To function in culturally diverse teams, communicate in a professional manner, and uphold the ethical standards of the engineering profession.

V. Learning Outcomes

IE Graduating baccalaureate students will possess an understanding of fundamental industrial engineering and management concepts, methodologies, and technologies as demonstrated by:

a) An ability to apply knowledge of mathematics, probability and statistics, science, engineering, and engineering economics.

b) An ability to design and conduct experiments involving risk and uncertainty, as well as to analyze and interpret data.

c) An ability to design a system, component, or process to meet desired needs.

d) An ability to function on culturally diverse, multi-disciplinary teams.

e) An ability to identify, to formulate, and to solve engineering problems involving physical, human, and economic parameters.

f) An understanding of professional and ethical responsibility.

g) An ability to communicate effectively.

h) An ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering and management practice.

VI. Assessment of Learning Outcome

The above outcomes can be assessed as follows:

- Outcome a includes understanding fundamental mathematics, probability and statistics, physics, engineering science, engineering management, and engineering economics. Performance of this outcome is achieved when students show their knowledge of relevant concepts, and build and execute appropriate models. Student achievement of this learning outcome is assessed by passing exams set for the classes in the above fields, performing capstone projects in these fields and by self-evaluation of the classes offered.
- Outcome b includes understanding fundamental design of experiments, which includes factor selection, randomization techniques and fundamental designs, graphical and statistical analysis, and interpretation of the results. Performance of this outcome is achieved when students show their knowledge of relevant concepts, and build, execute and analyze data from appropriate models. Student achievement of this learning outcome is assessed by passing exams set for the classes in the above fields, performing capstone projects in these fields and by self-evaluation of the classes offered.
- Outcome c includes successfully integrating awareness, analysis, and synthesis to identify, assess, and address a well-defined problem and/or opportunity need. Performance of this outcome is achieved

when students show their understanding of design context and system design process, and show their ability in executing the system design process and explaining the results. Student achievement of this learning outcome is assessed by performing capstone projects in these areas and by surveys from industries regarding graduate students performance.

- Outcome d includes effective teamwork in assigned projects regardless of the composition, background, or characteristics of the assigned team members. Performance of this outcome is achieved when students show appreciation to the value of member's contribution to team success, understanding the team roles, and ability to take responsibility. Student achievement of this learning outcome is assessed by successfully participating in various teams while attending applied classes and by surveys from industries regarding graduate students performance.
- Outcome e includes successfully integrating awareness, analysis, and synthesis to address an open ended problem and/or opportunity (having physical, human and economic parameters) within an enterprise. Performance of this outcome is achieved when students show their understanding of design context and system design process, and show the ability to execute the system design process, and explain the results. Student achievement of this learning outcome is assessed by performing capstone projects in these areas and by surveys from industries regarding graduate students performance.
- Outcome f includes an understanding of professional and ethical responsibility in the conduct of relationships with peers, faculty, and clients. Performance of this outcome is achieved when students show awareness of professional ethics, understanding context, and ability to discern impact. Student achievement of this learning outcome is assessed by reviews and assessment from professors and by surveys from industries regarding graduate students performance.
- Outcome g includes an ability to produce effective oral, written, and graphical communications. Performance of this outcome is achieved when students show their ability to determine appropriate content, appropriately organize material for audience, and appropriately use style/mechanics and exhibit professionalism in speech. Student achievement of this learning outcome is assessed by reviewing project reports, project presentation and by reviewing exit (graduating) surveys from student.
- Outcome h includes an awareness, analysis, and synthesis of contemporary industrial engineering and management tools in the context of addressing a problem or opportunity. Performance of this outcome is achieved when students show awareness of IE techniques, skill sets and tools, understanding of problem context and opportunities, ability to apply appropriate techniques, skills and tools, and ability to interpret results. Student achievement of this learning outcome is assessed by instructor evaluation and by student self-assessment of their engineering abilities.

VII. Framework for B.Sc. Degree (Credit Hours)

Classification	Credit Hours			ECTS		
	Compulsory	Elective	Total	Compulsory	Elective	Total
University Requirements	21	6	27	31	6	37
School Requirements	43	-	43	72	-	72
Program Requirements	87	12	99	171	20	191
Total	**151**	**18**	**169**	**274**	**26**	**300**

1. University Requirements: (27 credit hours)

1.1. Prerequisite courses (6 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Prerequisites / Co-requisites
				Lect	Lab	
ARB099	Arabic 99[a]	0	0	3	-	-
ENGL099	English II[b]	0	0	3	-	-
	Total	**0**	**0**	**6**	**0**	

1.2. Compulsory: (21 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
ARB100	Arabic	3	3	Online	3	-	ARB099
ENGL101	English III	1	3	Physical	3	-	ENGL099
ENGL102	English IV	1	3	Physical	3	-	ENGL101
ENGL201	English V	2	3	Physical	3	-	ENGL102
ENGL202	English VI	2	3	Physical	3	-	ENGL201
GERL101B1	German I B1 track	3	6	Physical	9	-	-
GERL102B1 GERL102B2	German II B1 track German II B2 track	3 3	6 6	Physical	9 9	- -	GERL101B1 GERL101B1
MILS100	Military Science	3	2	Online	3	-	-
NE101 NEE101	National Education National Education (English)	3	2	Online	3	-	-
	Total	**21**	**31**		**39**	**0**	

1.3. Elective: (6 Credit Hours) (two courses out of the following)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
BE302	Business Entrepreneurship	3	3	Online	3	-	ENGL101
DES101	Arts' Appreciation	3	3	Online	3	-	ENGL101, ARB099
EI101	Leadership and Emotional Intelligence	3	3	Online	3	-	ENGL101
IC101	Intercultural Communications	3	3	Online	3	-	ENGL101
PE101	Sports and Health	3	3	Online	3	-	ARB099
SE301	Social Entrepreneurship and	3	3	Online	3	-	ENGL101

[a] Not required for students who pass placement test
[b] Not required for students who pass placement test

	Enterprises						
SFTS101	Soft Skills	3	3	Online	3	-	ENGL101
TW303	Technical and Workplace Writing	3	3	Online	3	3	ENGL102
	Total	**6**	**6**		**6**	**0**	

2. School Requirements: (43 Credit Hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
IE0121	Probability and Statistics	3	5	Physical	3	-	MATH101
IE0141	Engineering Workshop	1	2	Blended	-	3	-
IE0281	Technical Writing and Engineering Ethics	2	3	Physical	2	-	ENGL201
IE0361	Engineering Economics	3	5	Online	3	-	IE0121
ME0111	Computer Aided Engineering Drawing	2	4	Blended	-	6	CS116
CHEM103	General Chemistry	3	5	Physical	3	-	-
CS116	Computing Fundamentals	3	6	Physical	3	-	-
CS1160	Computing Fundamentals Lab	1	0	Blended	-	3	Coreq: CS116
GERL201	German III	3	4	Physical	6	-	GERL102
GERL202	German IV	3	6	Physical	6	-	GERL201
MATH099	Pre-MATH[a]	0	0		3	-	-
MATH101	Calculus I	3	5	Blended	3	-	MATH099
MATH102	Calculus II	3	5	Physical	3	-	MATH101
MATH203	Applied Mathematics for Engineers	3	5	Physical	3	-	MATH102
MATH205	Differential Equations	3	5	Physical	3	-	MATH102
PHYS103	Physics I	3	5	Blended	3	-	-
PHYS104	Physics II	3	5	Physical	3	-	PHYS103, Coreq: PHYS106
PHYS106	General Physics Lab	1	2	Blended	-	3	PHYS103, Coreq: PHYS104
	Total	**43**	**72**		**47**	**15**	

3. Program Requirements (99 credit hours)

3.1 Program Requirements (Compulsory): (87 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
IE0111	Introduction to IE	1	2	Blended	1	-	-
IE0222	Computer Aided MATH For IE	2	4	Blended	-	6	MATH102, CS116, IE0121
IE0223	Applied Statistics	3	5	Physical	3	-	IE0121, IE0222
IE0231	Operations Research	4	6	Blended	3	3	MATH203, CS116,

							Co-requisite IE0232
IE0232	Operations Research Lab	0	0	Blended	-	3	Co-requisite IE0231
IE0242	Materials Science and Engineering	3	5	Physical	3	-	IE0141, CHEM103
IE0243	Materials Science and Engineering Lab	1	2	Blended	-	3	IE0242, MECH0216
IE0251	Work Measurement and Standards	3	5	Blended	2	3	IE0121, Co-requisite IE0252
IE0252	Work Measurement and Standards Lab.	0	0	Blended	-	3	Co-requisite IE0251
IE0312	Simulation	3	5	Physical	2	3	IE0223, Co-requisite IE0313
IE0313	Simulation Lab	0	0	Blended	-	3	Co-requisite IE0312
IE0314	Production Planning	3	5	Blended	3	-	IE0312, IE0223, IE0231
IE0324	Quality Engineering	4	6	Blended	3	3	IE0223, Co-requisite IE0325
IE0325	Quality Engineering Lab	0	0	Blended	-	3	Co-requisite IE0324
IE0344	Manufacturing Processes	4	6	Blended	3	3	IE0242, Co-requisite IE0345
IE0345	Manufacturing Processes Lab	0	0	Blended	-	3	Co-requisite IE0344
IE0353	Ergonomics	3	5	Physical	2	3	IE0251, IE0223, Co-requisite IE0354
IE0354	Ergonomics Lab	0	0	Blended	-	3	Co-requisite IE0353
IE0382	Field Training	0	6	Physical	-	160HR	DEP. APPROV.
IE0483	International Internship	12	30	Physical	-	20 WEEKS	IE0382, DEP. APPROV.
IE0515	Product Development and Entrepreneurship	3	6	Blended	3	-	IE0314
IE0516	Facility and Asset Management	3	6	Physical	3	-	IE0314
IE0526	Data Analytics for Industrial Engineering	3	6	Physical	3	-	IE0222, IE0223, IE0231
IE0533	Supply Chain Engineering	3	5	Physical	3	-	IE0231, IE0314
IE0546	Modern Manufacturing Technology	3	6	Physical	2	3	IE0344, Co-requisite IE0547
IE0547	Modern Manufacturing Technology Lab.	0	0	Blended	-	3	Co-requisite IE0546
IE0562	Industrial Cost analysis	3	6	Blended	3	-	IE0361

IE0584	Graduation Project I	1	2	Blended	-	3	IE0483, MIN 132 CH
IE0585	Graduation Project II	3	6	Blended	-	9	IE0584
IE0586	Industrial Systems Integration Capstone Project	1	4	Blended	-	3	IE0483, MIN 132 CH
ME0212	Electrical Circuits and Machines	3	5	Physical	3	-	PHYS104
ME0346	Instrumentation and Measurements	2	3	Blended	2	-	MATH205, ME0212 Co-requisite ME0347
ME0347	Instrumentation and Measurements Lab	1	2	Blended	-	3	Co-requisite ME0346
ME0577	Automation and Industry 4.0	3	5	Physical	2	3	ME0212, IE0314, ME0346, Co-requisite ME0578
ME0578	Automation and Industry 4.0 Lab	0	0	Blended	-	3	Co-requisite: ME0577
MECH0216	Statics and Strength of Materials	3	5	Blended	3	-	PHYS103, MATH102
GERL301	German V	3	6	Physical	9	-	GERL202
GERL302	German VI	3	6	Physical	9	-	GERL301
	Total	**87**	**171**		**70**	**75**	

3.2 Program Requirements (Electives[c]): (12 credit hours)

A minimum of 12 credit hours/20 ECTS of engineering coursework are required. This list is open for modifications based on school council decisions.

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Prerequisites / Co-requisites
				Lect	Lab	
IE0401	Engineering Project Management	3	5	3	-	IE0231, IE0361
IE0402	Reliability and Maintainability	3	5	3		Department Approval
IE0403	Special Topics in Statistics and Quality Engineering	3	5	3	-	Department Approval
IE0404	Special Topics in Manufacturing processes and Engineering Materials	3	5	3	-	Department Approval
IE0405	Multi-Criteria Decision Making	3	5	3	-	Department Approval
IE0406	Special Topics in Optimization and Mathematics	3	5	3	-	Department Approval
IE0407	Nonlinear Programming	3	5	3	-	Department Approval
IE0408	Design of Industrial Information Systems	3	5	3	-	Department Approval
IE0409	Fuzzy Logic and Neural Networks	3	5	3	-	Department Approval

[c] BSC001 is the registration code for the study semester of the German Year, during which technical elective courses are taken. Failing to pass any of these courses during the German Year enables the student to take a technical elective course at GJU once appropriate paperwork is completed and BSC001 is fulfilled.

IE0410	Special Topics in Informatics	3	5	3	-	Department Approval
IE0411	Occupational Health and Safety	3	5	3	-	Department Approval
IE0412	Special Topics in Ergonomics	3	5	3	-	Department Approval
IE0413	Advanced Engineering Economics	3	5	3	-	Department Approval
IE0414	Special Topics in Engineering Economics and Finance	3	5	3	-	Department Approval
IE0417	Business and Labor Law	3	5	3		Department Approval
IE0419	Strategic Planning	3	5	3		Department Approval
IE0420	Lean Manufacturing	3	5	3	-	Department Approval
IE0421	Special Topics in Operations Management and Managerial Sciences	3	5	3	-	Department Approval
IE0422	Special Topics in IE I	1	-	1	-	Department Approval
IE0423	Special Topics in IE II	2	-	2	-	Department Approval
IE0424	Special topics in IE	3	5	3	-	Department Approval
IE0425	Applied Project	3	5	3	-	Department Approval
MGT314	Human Resource Management	3	5	3	-	Department Approval
MGT418	Quality Management	3	5	3	-	Department Approval
MGT493	Leadership	3	5	3	-	Department Approval

VIII. Study Plan[d] Guide for the Bachelor's Degree in (Industrial Engineering)

First Year					
First Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
PHYS103	Physics I	3	5	-	-
CHEM103	General Chemistry	3	5	-	-
CS116	Computing Fundamentals	3	6	-	-
CS1160	Computing Fundamentals Lab	1	0	-	CS116
ENGL101	English III	1	3	ENGL099	-
GERL101B1	German I	3	6	-	-
MATH101	Calculus I	3	5	MATH099	-
	Total	**17**	**30**		

First Year					
Second Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0111	Introduction to IE	1	2	-	-
IE0121	Probability and Statistics	3	5	MATH101	-
IE0141	Engineering Workshop	1	2	-	-
ENGL102	English IV	1	3	ENGL101	-
GERL102B1 GERL102B2	German II B1 track German II B2 track	3 3	6 6	GERL101B1	-
MATH102	Calculus II	3	5	MATH101	-
PHYS104	Physics II	3	5	PHYS103	PHYS106
PHYS106	General Physics Lab	1	2	PHYS103	PHYS104
	Total	**16**	**30**		

[d] The following study plan guide assumes having passed all placement tests.

Second Year					
First Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0222	Computer Aided MATH For IE	2	4	MATH102, CS116, IE0121	-
IE0242	Materials Science and engineering	3	5	IE0141, CHEM103	-
ME0212	Electrical Circuits and Machines	3	5	PHYS104	-
MECH0216	Statics and strength of materials	3	5	PHYS103, MATH102	-
ENGL201	English V	2	3	ENGL102	-
GERL201	German III	3	4	GERL102	-
MATH203	Applied Math for Engineers	3	5	MATH102	-
	Total	**19**	**31**		

Second Year					
Second Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0223	Applied Statistics	3	5	IE0121, IE0222	-
IE0231	Operations Research	4	6	MATH203, CS116	IE0232
IE0232	Operations Research Lab	0	0	-	IE0231
IE0243	Materials science and engineering Lab	1	2	IE0242, MECH0216	-
IE0251	Work Measurements and Standards	3	5	IE0121	IE0252
IE0252	Work Measurements and Standards Lab	0	0	-	IE0251
GERL202	German IV	3	6	GERL201	-
MATH205	Differential Equations	3	5	MATH102	-
	Total	**17**	**29**		

Third Year					
First Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0281	Technical Writing and Engineering Ethics	2	3	ENGL201	-
IE0312	Simulation	3	5	IE0223	IE0313
IE0313	Simulation Lab	0	0	-	IE0312
IE0324	Quality Engineering	4	6	IE0223	IE0325
IE0325	Quality Engineering Lab	0	0	-	IE0324
ME0346	Instrumentation and Measurements	2	3	MATH205, ME0212	ME0347
ME0347	Instrumentation and Measurements Lab	1	2	-	ME0346
MILS100	Military Science	3	2	-	-
ENGL202	English VI	2	3	ENGL201	-
GERL301	German V	3	6	GERL202	-
	Total	**20**	**30**		

Third Year					
Second Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0314	Production Planning	3	5	IE0223, IE0231 IE0312	-
IE0344	Manufacturing Processes	4	6	IE0242	IE0345
IE0345	Manufacturing Processes I Lab	0	0	-	IE0344
IE0353	Ergonomics	3	5	IE0223, IE0251	IE0354
IE0354	Ergonomics Lab	0	0	-	IE0353
IE0382	Field Training	0	6	DEP. APPROV.	-
GERL302	German VI	3	6	GERL301	-
NE101	National Education	3	2	-	-
	Total	**16**	**30**		

Fourth Year					
First Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0361	Engineering Economics	3	5	IE0121	-
IE0533	Supply Chain Engineering	3	5	IE0231, IE0314	-
-	Technical Elective	3	5	-	-
-	Technical Elective	3	5	-	-
-	Technical Elective	3	5	-	-
-	Technical Elective	3	5	-	-
	Total	**18**	**30**		

Fourth Year					
Second Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0483	International Internship [e]	12	30	IE0382, DEP. APPROV.	-
	Total	**12**	**30**		

German year prerequisites are:

1. A minimum GPA of 61.0%.
2. Successful completion of 90 credit hours excluding all German language courses.
3. Passing GERL302 German VI and B1 German language test (all 4 language skills) conducted by Goethe Institute or another approved provider.
4. ENGL201 English V and Arabic 99.
5. Passing four out of the five following courses:
   - IE0231 Operations Research.
   - IE0251 Work Measurement and Standards.
   - IE0324 Quality Engineering.
   - IE0344 Manufacturing Processes.
   - IE0314 Production Planning.

[e] Courses attended and/or passed during International Internship are not transferable

Fifth Year					
First Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0516	Facility and Asset Management	3	6	IE0314	-
IE0562	Industrial Cost Analysis	3	6	IE0361	-
IE0584	Graduation Project I	1	2	IE0483, MIN 132 CH	-
ME0111	Computer Aided Engineering Drawing	2	4	CS116	-
ME0577	Automation and Industry 4.0	3	5	IE0314, ME0212, ME0346	ME0578
ME0578	Automation and Industry 4.0 Lab	0	0	-	ME0577
ARB100	Arabic	3	3	ARB99	-
-	University Elective	3	3	-	-
	Total	**18**	**29**		

Fifth Year					
Second Semester					
Course ID	**Course Name**	**Credit Hours**	**ECTS**	**Prerequisites**	**Co-requisite**
IE0515	Product Development and Entrepreneurship	3	6	IE0314	-
IE0526	Data Analytics for Industrial Engineering	3	6	IE0222, IE0223, IE0231	-
IE0546	Modern Manufacturing Technology	3	6	IE0344	IE0547
IE0547	Modern Manufacturing Technology Lab	0	0	-	IE0546
IE0585	Graduation Project II	3	6	IE0584	-
IE0586	Industrial Systems Integration Capstone Project	1	4	IE0483, min. 132 CH	-
-	University Elective	3	3	-	-
	Total	**16**	**31**		

IX. Industrial Engineering Modules' Description

Bachelor

Module Title	Module Code
Introduction to Industrial Engineering	IE0111

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	1
Elective Module		**Spring Semester**	X	**Workload**	60
Optional Module		**Winter Semester**	X	**ECTS**	2
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
40% Two group projects (20% each)
10% Participation
10% Technical report
40% Final Exam

Responsible Lecturer(s)

Dr. Lena Abu-El-Haija
Dr. Safwan Altarazi
Dr. Laith AbuHilal

Course	Mode of Delivery	Contact Time	Self-Study
Introduction to Industrial Engineering	Blended	15	45

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*1 hour = 15 hours;
- Group projects preparation: 25 hours;
- Term paper and presentation preparation: 15 hours;
- Preparation for final exam: 5 hours.

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

- Understand the engineering discipline and distinguish between industrial engineering and other engineering fields.
- Identify the different disciplines and educational fields within industrial engineering.
- Know possible career paths after graduation.
- Understand the details accompanied with choosing the workforce after graduation.
- Understand the components within graduate school in industrial engineering and the potential career in further education.
- Practice moral judgment in conditions of dilemma.

Module Contents:
The module is designed to familiarize first year industrial engineering students with the definition, need, scope, evolution and developments of industrial engineering. The different disciplines in industrial engineering including: systems optimization, variability in systems, production systems, industrial automation, manufacturing processes, operations management, and ergonomics. In addition, the course presents various guest speakers from different IE fields and industries to open up the door for possibilities.

Planned Learning Activities and Teaching Methods:
- Handouts on IE terminology and summaries of IE fields;
- Guest speakers with Q/A session;
- Group discussions on the possible routes the students can take within IE;
- Guidance to what an IE needs to consider when dealing with a project.

Recommended or Required Reading:
- Fraser, J. M. (2019). *Introduction to Industrial Engineering*. Retrieved from www.introtoie.com/IntroV2.pdf;
- Salvendy, G. (2001). *Handbook of Industrial Engineering: Technology and Operations Management* (3rd Edition). Wiley;
- Darwish, H., & Van Dyk, L. (2016). *The Industrial Engineering Identity: From Historic Skills to Modern Values, Duties, and Roles*. South African Journal of Industrial Engineering, 27(3), 50-63.

Usability of the Module:
This module introduces the IE field in practice for students to plan their careers.

Prerequisites and Co-requisites:
None

Language of Instruction:
English

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Probability and Statistics					IE0121

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
5% Attendance and Participation
10% Quizzes
15% Case exercise
30% Midterm exam
40% Final exam

Responsible Lecturer(s)

Eng. Sarah Qareish
Eng. Maram Shqair
Eng. Abdallah Albashir
Dr. Fadwa Dababneh
Dr. Lena Abu-El-Haija

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Probability and Statistics	Physical	45	105

Duration of Study:
One Semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours= 45 hours;
- Preparation of midterm exam: 20 hours;
- Preparation of final exam: 30 hours;
- Preparation of case exercise: 20 hours;
- Preparation of quizzes: 20 hours;
- Self-study: 15 hours.

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

- Compute and interpret descriptive statistics using numerical and graphical techniques.
- Classify and distinguish between a qualitative variable, discrete quantitative or continuous quantitative variable for analysis.
- Successfully select appropriate basic counting techniques (multiplication rule, combinations, permutations) to count the number of possible outcomes of an experiment or specific events.
- Compute probability of an event and utilize the complement, addition and multiplication rules of probability.

- Interpret problems that include conditional probability and determine if involved events are independent.
- Construct probability distributions and cumulative probability distributions for discrete, continuous and jointly distributed variables, find their expected values and variances and explain their values.
- Identify different types of discrete and continuous distributions based on their properties.
- Construct confidence intervals on the mean, variance and standard deviation of a normal distribution.

Module Contents:

- Uncertainty and variation in experiments;
- Random sampling, data collection, descriptive statistics and graphical presentation of collected data, using; stem-and-leaf plots, box plots and histograms;
- Basic principles of sample spaces, probability, conditional probability, independence, random variables, discrete and continuous probability distributions, expected values and variances, joint probability distributions;
- Applications of specific distributions in real-life scientific and engineering studies;
- Different types of confidence intervals for single samples of a normal distribution or approximately normal.

Planned Learning Activities and Teaching Methods:

- Lectures to present course contents through oral and multimedia presentations and solved examples;
- Seminars to present problems and solve them interactively with students;
- Practical tutorial sessions where students solve problems separately or in groups, either by hand or using MS Excel.

Recommended or Required Reading:

- Walpole, R. E., Myers, R. H., Ye, K., and Myers, S. L. (2016). *Probability and Statistics for Engineers and Scientists* (9th edition). Pearson, ISBN 13: 978-0-321-62911-1;
- Montgomery, D. C. and Runger, G. C. (2018). *Applied Statistics and Probability for Engineers* (7th edition). Wiley, ISBN 13: 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.

Usability of the Module:

This module lays a probability and statistics foundation that is used in many other courses that the student can utilize and build on, and it is a required module for the Bachelors of Industrial Engineering, Mechanical Engineering, and Mechatronics Engineering and Artificial Intelligence. It is a prerequisite module for the modules *IE0222: Computer Aided Math for IE*, *IE0223: Applied Statistics*, *IE0251: Work Measurements and Standards*, *IE0361: Engineering Economics*, and *MECH0551: Reliability and Quality Control*

Prerequisites and Co-requisites:

MATH101: Calculus I (prerequisite)

Language of Instruction:

English with occasional Arabic explanations.

Recommended Optional Program Components:

None

Bachelor

Module Title					**Module Code**
Engineering Workshop					IE0141
Compulsory Module	X	**Year of Study**	1	**Semester Hours**	2.6
Elective Module		**Spring Semester**	X	**Workload**	60
Optional Module		**Winter Semester**	X	**ECTS**	2
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Reports and Exercises
40% Practical Sessions
40% Final Exam

Responsible Lecturer(s)

Eng. Abdallah Albashir

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Engineering Workshop	Blended	39	21

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time lectures and training sessions: 13 weeks*3 hours = 39 hours;
- Prelab preparation: 12 hours;
- Preparation for lab exam: 9 hours.

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

- Understand and follow workshop safety guidelines.
- Describe machines used in the manufacturing and production processes.
- Understand the basic function of a workshop.
- Apply simple concepts and perform basic tasks in each of the following areas: engineering measurement, welding, machining, sheet metal forming, electrical and plumbing maintenance.

Module Contents:

- General safety in the workshop;
- Engineering materials and their classifications;
- Measuring devices and their accuracy;
- Theoretical background and practical exercises covering the following topics: carpentry, welding, mechanical fasteners, drilling, metal cutting, sheet-metal working, maintaining electrical and plumbing systems.

Planned Learning Activities and Teaching Methods:

- Lectures with intensive discussions;
- Practical workshop sessions.

Recommended or Required Reading:

- Engineering Workshop Handout (School of Applied Technical Sciences, German Jordanian University).

Usability of the Module:

This module is a fundamental course for engineering students in the disciplines of Industrial Engineering, Mechanical Engineering and Mechatronics Engineering and Artificial Intelligence. It is a pre-requisite for the modules *IE0242: Materials Science and Engineering* and *IE0348: Materials and Manufacturing Engineering*.

Prerequisites and Co-requisites:

None

Language of Instruction:

English; whenever required some explanation may be given in the Arabic language

Recommended Optional Programme Components:

None

Bachelor

Module Title					**Module Code**
Computer Aided MATH For IE					IE0222

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	2
Elective Module		**Spring Semester**	X	**Workload**	120
Optional Module		**Winter Semester**	X	**ECTS**	4
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% Midterm exam
20% In-class exercises
20% Project
40% Final exam

Responsible Lecturer(s)

Dr. Maysa Ammouri
Dr. Nidal Alshawawreh

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Computer Aided MATH For IE	Blended	30	90

Duration of Study:

One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*2 hours = 30 hours;
- Exercises and self-reading at home: 30 hours;
- Preparation of project: 30 hours;
- Preparation for exams: 30 hours.

Learning Outcomes:

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

- Successfully install and use various programming software such as R, PYTHON and/or equivalent to solve statistical and mathematical problems.
- Demonstrate an understanding of the fundamental concepts and principles of programming for effective data analytics.
- Understand basic concepts such as data types and how to manipulate, read, write and manage data in programming.
- Design and examine important mathematical and numerical concepts through hand-on coding.
- Demonstrate use of control structures, loop functions, and debugging tools.
- Construct tables, figures, and graphs to depict the analysed data.

Module Contents:
This module provides an introduction to open source programming language used in the industry. The module gives the students an insight on generic programming language concepts and their application on data analytics and conducting mathematical calculations. The programming methods learned in this course will be easily transferred to other programming languages. Students will be familiar with software such as R or Python to provide them with the skill of utilizing different libraries. The module will teach students to use the programming language to perform mathematical operations on various types of data. The module also introduces the production of different charts to represent the data in curves, scatter plots, or histograms.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through examples;
- In-class self-work problems and exercises;
- Interactive sessions in computer labs;
- Project designed to demonstrate skills taught;
- Computer software implementation.

Recommended or Required Reading:
- E. Matthes, (2019). *Python Crash Course. A Hands-On, Project-Based Introduction to Programming* (2nd Edition). No Starch Press.
- W. Mckinney, (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd Edition), O'Reilly Media.
- Wickham, H. and Grolemund, G. (2017). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data* (1st Edition). O'Reilly Media.

Usability of the Module:
This module is a compulsory module for Industrial Engineering. This a prerequisite module for the modules Applied Statistics (IE0223) and Industrial Cost Analysis (IE0526).

Prerequisites and Co-requisites:
- MATH102: Calculus II (prerequisite)
- CS116: Computing Fundamentals (prerequisite)
- IE0121: Probability and Statistics (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Applied Statistics					IE0223

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

10% In Class Work
10% Term Project
40% Two midterm exams
40% Final exam

Responsible Lecturer(s)

Dr. Tamer Yared
Dr. Murad Samhouri
Prof. Safwan Altarazi

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Applied Statistics	Physical	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation of term project: 25 hours;
- Preparation for theory exams: 30 hours;
- Preparation for final exam: 20 hours;
- Self-study: 30 hours.

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

- Recall how to present statistical data graphically and by descriptive statistics.
- Apply and Evaluate estimation principles including confidence intervals and point estimates for estimating a population mean, estimating the parameter of a binomial distribution, estimating the difference between two means, estimating the difference between two binomial parameters, population variances, two population variances, and choosing the sample size.
- Apply and Evaluate sample tests of hypothesis including elements of a hypothesis test, type I and II errors, and using p values to indicate significance tests for population proportion, difference between two population proportions, population mean, difference between two means, paired differences, population variances, and two population variances.
- Apply and Analyse the principles of simple and multiple linear regression and correlation, including least square method and predict a particular value of y for a given value(s) of x and significance of the correlation coefficient.

- Make use of statistical software such as Minitab and programming language such as R to solve statistical problems.
- Design experiments for the process of random sampling in real life applications.
- Assess the test of equality of two or more means using ANOVA for real life examples.
- Apply the appropriate non-parametric statistical method to solve statistical problems in real applications.

Module Content:
Students learn statistical inference for two samples, simple and multiple linear regression analyses, analysis of variances (ANOVA), and design of experiment for single and several factors, and non-parametric statistics.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through examples;
- IE problems that are discussed and solved in lectures;
- Self-work problems in class supervised with the instructor;
- Group-based term projects;
- Teams presentations for term projects.

Recommended or Required Reading:
- Walpole, R. E., Myers, R. H., Ye, K., and Myers, S. L. (2016). *Probability and Statistics for Engineers and Scientists* (9th edition). Pearson, ISBN 13: 978-0-321-62911-1;
- Montgomery, D. C. and Runger, G. C. (2018). *Applied Statistics and Probability for Engineers* (7th edition). Wiley, ISBN-13: 978-1-119-40036-3;
- Montgomery, D. C. (2020). *Design and Analysis of Experiments* (10th Edition). Wiley, ISBN-13: 978-1119722106.

Usability of Module:
This module lays a statistical foundation for the modules *IE0312: Simulation*, *IE314: Production Planning*, *IE0324: Quality Engineering*, *IE0353: Ergonomics*, and *IE0526: Data Analytics for Industrial Engineering*.

Prerequisites and Co-requisites:
- IE0121: Probability and Statistics (prerequisite)
- IE0222: Computer Aided Math in IE (prerequisite)

Language of Instruction:
English with occasional explanations in Arabic.

Recommended Optional Program Components:
None

Bachelor

Module Title	Course Code
Operations Research	IE0231

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	5.6
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
5% Quizzes
30% Two midterm exams
15% Lab assignments
10% Lab assessment
40% Theory final exam

Responsible Lecturer(s)

Dr. Lena Abu-El-Haija
Dr. Mahmoud El-Banna
Prof. Raid Al-Aomar

Course	Mode of Delivery	Contact Time	Self-Study
Operations Research	Blended	45	71
Operations Research Lab	Blended	39	25

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Presence time in labs: 39 hours;
- Prelab preparation: 10 hours;
- Self-study for module: 21 hours;
- Preparation for midterm exams: 30 hours;
- Preparation for lab assessment: 15 hours;
- Preparation for final exam: 20 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 a problem description into a linear program for basic production planning problems.
- Graph and solve graphically two-dimensional problems.
- Solve using Simplex method small linear programming models.
- Apply the concepts of duality theory and sensitivity analysis to post optimally evaluate OR models.

- Formulate popular OR problems and their variations such as Transportation, Assignment, Traveling Salesman, Max-Flow, and Set Covering into linear and mixed-integer programming models.
- Successfully use a programming language such as Python or CPLEX to solve linear programs.

Course Contents:
Students learn principles of linear programming as well as modelling techniques of simple production problems, network problems, and binary integer problems. Students learn solving models graphically for a two-dimensional model, using Simplex Method for more than two variables, and coding a linear program on Python and use the package Pulp to solve the models to optimality. Students learn post-optimality analysis as well as duality theory and their uses.

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;
- 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;
- Lab sessions 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);
- Coding to solve given linear programming models throughout the semester with some help and provision by instructors.

Recommended or Required Reading:
- 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
- Taylor, B. W. III (2018). *Introduction to Management Science* (13th Edition), Pearson, ISBN-13: 978-0134730660

Usability of the Module:
This module provides part of the theoretical base required for the modules *IE0314: Production Planning*, *IE0526: Data Analytics for Industrial Engineering*, and *IE0533: Supply Chain Engineering*.

Prerequisites and Co-requisites:
- MATH 203: Applied Mathematics for Engineers (prerequisite)
- CS 116: Computing Fundamentals (prerequisite)

Language of Instruction:
English with occasional Arabic explanations

Recommended Optional Program Components:
None

Bachelor

Module Title	Module Code
Materials Science and Engineering	IE0242

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
30% Midterm
10% Assignments
5% Quizzes
15% Semester project and presentation
40% Final exam

Responsible Lecturer(s)

Dr. Rula Allaf
Dr. Iyas Khader
Dr. Mohammad AbuShams
Dr. Nidal Alshwawreh
Dr. Anas Atieh

Course	Mode of Delivery	Contact Time	Self-Study
Materials Science and Engineering	Physical	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 15 weeks x 3 hours = 45 hours;
- Exercises and self-reading at home: 45 hours;
- Preparation of semester project and presentation: 24 hours;
- Preparation for quizzes: 12 hours;
- Preparation for midterm exams: 8 hours;
- Preparation for final exams: 16 hours.

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

- Understand the link between processing, structure, properties, and performance of engineering materials.
- Describe the structure of engineering materials at atomic, subatomic, micro, and macro levels using classical and modern theories.
- Categorize engineering materials according to their physical, chemical, electrical, and mechanical behaviour.

- Evaluate the impact of deformation and defects on the structure and properties of solid-state engineering properties.
- Apply various processing methods to design engineering materials with optimal performance using techniques like diffusion and heat treatment.
- Analyse the mechanical response and predict the failure mode in engineering materials when subjected to static and dynamic stresses.
- Recognize the various strengthening mechanisms and describe microstructure evolution processes in deformed materials.
- Interpret phase diagrams, differentiate between equilibrium and non-equilibrium phases, and calculate the kinetics of phase transformations in engineering materials.
- Identify the best material candidates for a given engineering application taking performance, safety, and economics into consideration.
- Communicate and present a summary of a recent study concerning advanced materials, biomaterials, smart materials, recycling, and the use of materials characterization tools.

Module Contents:
Students will be acquainted with the fundamental concepts of materials science and engineering involving the aspects of processing, structure, properties, and performance. They will learn about the basic theories of crystallography, elasticity, plasticity, and processing involving diffusion and thermal treatment. Different failure modes in engineering materials will be discussed and ways to characterize those using destructive and non-destructive testing methods. Concepts of equilibrium, phase transformation, microstructure evolution under thermal processing will be covered as well as the various ways to strengthen engineering materials. Aspects related to safety in design, economics, and environmental considerations will be addressed. The course will prepare students for roles ranging from materials testing, materials selection, and design of innovative engineering materials.

Planned Learning Activities and Teaching Methods:
- Lectures with intensive discussions;
- Exercises in class and at home;
- Real case simulations;
- Presenting a topic related to materials science and engineering in group work.

Recommended or Required Reading:
- Callister W.D., Rethwisch D.G. (2020). *Materials Science and Engineering* (10th Edition). Wiley.
- Callister W.D., Rethwisch D.G. (2020). *Fundamentals of Materials Science and Engineering: An Integrated Approach* (5th Edition). Wiley.
- Askeland D.R., Wright W.J. (2015). *The Science and Engineering of Materials* (7th Edition). Cengage Learning.

Usability of the Module:
This module is a pre-requisite for the modules *IE0245: Materials Science and Engineering Lab* and *IE0344: Manufacturing Processes*, which is a compulsory module in the Bachelor's Degree Program of Industrial Engineering.

Prerequisites and Co-requisites:
CHEM103: General Chemistry (prerequisite)
IE0141: Engineering Workshop (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Materials Science and Engineering Lab					IE0243

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	2.4
Elective Module		**Spring Semester**	X	**Workload**	60
Optional Module		**Winter Semester**	X	**ECTS**	2
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
50% Lab reports
10% Quizzes
40% Final exam

Responsible Lecturer(s)

Dr. Rula Allaf
Dr. Iyas Khader
Dr. Mohammad AbuShams
Dr. Nidal Alshwawreh
Dr. Anas Atieh
Eng. Abdullah Albashir

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Materials Science and Engineering Lab	Blended	36	24

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in labs: 12 weeks x 3 hours = 36 hours;
- Lab report preparation: 14 hours;
- Preparation for quizzes: 2 hours;
- Preparation for final exam: 8 hours.

Learning Outcomes:

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

- Apply the fundamentals of the lab safety and machine handling.
- Transfer theoretical knowledge of the basic concepts in materials science through the implementation of the laboratories experiments.
- Apply sample preparation techniques in the laboratory.
- Use and calibrate test rigs and machines to perform simple experiments
- Describe, analyse and discuss experimental procedures and results through technical reports.
- Being able to apply the laboratory skills and hands on experience in real life problems.

Module Contents:
Studying the properties of engineering materials and the relationship between these properties and atomic structure.
Applying the following techniques and performing the following experiments: sample preparation, optical microscopy, heat treatment, corrosion behavior, tensile and compression strength measurement, hardness test, impact test, creep behavior test, and fatigue behavior test.

Planned Learning Activities and Teaching Methods:
- Lab experiments with discussions;
- Writing technical reports.

Recommended or Required Reading:
- Callister W.D., Rethwisch D.G. (2020). *Materials Science and Engineering* (10th Edition). Wiley.
- Callister W.D., Rethwisch D.G. (2020). *Fundamentals of Materials Science and Engineering: An Integrated Approach* (5th Edition). Wiley.
- Askeland D.R., Wright W.J. (2015). *The Science and Engineering of Materials* (7th Edition). Cengage Learning.
- Laboratory manual (Department of Industrial Engineering, GJU)

Usability of the Module:
This is a compulsory module in the Bachelor's Degree Program Industrial Engineering. No other modules are dependent on this module.

Prerequisites and Co-requisites:
- MECH0216: Statics and Strength of Materials (prerequisite)
- IE0242: Materials Science and engineering (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Work Measurement and Standards					IE0251

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	4.6
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
6% Course quizzes
6% Lab Quizzes
12% Lab Reports
26% Midterm exam (6% on Lab)
10% Project
40% Final Exam (8% on Lab)

Responsible Lecturer(s)

Eng. Abdallah Albashir
Dr. Tamer Yared

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Work Measurement & Standards	Blended	30	67
Work Measurement & Standards Lab	Blended	39	14

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*2 hours = 30 hours;
- Presence time in labs: 13 weeks*3 hours = 39 hours;
- Prelab preparation: 6 hours;
- Preparation of theory exams: 15 hours;
- Preparation of lab exams: 3 hours;
- Working on project: 12 hours:
- Preparation of final exam: 20 hours;
- Preparation of lab final exam: 5 hours;
- Self-study: 20 hours.

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

- Provide the student with knowledge regarding motion and time study.
- Describe techniques and procedures of motion and time study.
- Provide a clear description of operational data and solutions that deal with bottlenecks and lean manufacturing systems.

- Apply industrial engineering standards in both manufacturing and service sectors.

Module Contents:
The student will be introduced to work systems, concepts of productivity, and work study. Students learn basic procedure for motion study, time study, charting techniques, multiple activity charts, operation charts, flow processes charts, and two-handed charts. Students study the principles of motion economy, fundamental hand motions, and how to perform micro-motion and macro-motion studies. The module also covers the topics of work measurement, work sampling, computerized work measurement, work factors, standard data, and wage payment and incentive plans.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through examples;
- In class exercises and discussions;
- Lab sessions for handling practical experiments and later analysis;
- Doing a practical related project and in-class presentation.

Recommended or Required Reading:
- Groover, M. P. (2007). *Work Systems: The Methods, Measurement and Management of Work*. Pearson, ISBN-13: 978-0131355699.
- Meyers, F. E. and Stewart, J. R. (2002). *Motion and Time Study for Lean Manufacturing* (3rd edition), Prentice Hall, ISBN-13: 978-0130316707.
- Ammouri, M. and Alofi, A. (2015). *Work Measurement and Standards Laboratory Manual*, German Jordanian University.

Usability of Module:
This module provides theoretical and practical bases for the *IE0353: Ergonomics* module. It also provides skills that students utilize in their internships.

Prerequisites and Co-requisites:
IE0121: Probability and Statistics (prerequisite)

Language of Instruction:
English with occasional Arabic explanations

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Technical Writing and Engineering Ethics					IE0281

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	2
Elective Module		**Spring Semester**	X	**Workload**	90
Optional Module		**Winter Semester**	X	**ECTS**	3
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
15% Quizzes in Ethics
15% Writing Assignments
30% Midterm exam
40% Final exam

Responsible Lecturer(s)

Dr. Hazem Kaylani

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Technical Writing and Engineering Ethics	Physical	30	60

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*2 hours = 30 hours;
- Preparation for ethics quizzes: 10 hours;
- Preparation of practical assignments: 20 hours;
- Preparation for midterm exams: 15 hours;
- Preparation for final exam: 15 hours.

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

- Identify and understand the facets and functions of the primary genres of technical writing, including letters, memos, reports, resumes, proposals, technical descriptions, and technical definitions.
- Present concise, coherent, and grammatically correct materials (written and oral) that reflect critical analysis and synthesis, and appropriately address the needs of the audience.
- Develop professional calibre technical documents.
- Understand and respect email etiquette.
- Build and deliver effective presentation.
- Create accurate and complete technical graphics to explain, interpret, and assess information.
- Illustrate ethical decision making, professional code of ethics, and intellectual property.
- Apprehend integrity in research, product development, and workplace code of conduct.
- Reflect principles of engineering ethics and equity to issues encountered during engineering practice.
- Effectively make use of arguments and ethical tools for analyses and analytical thinking.

Course Contents:
Course content includes multiple forms of effective writing and oral presentation skills, different writing styles, approaches and formats, and methods to adapt writing to different audiences, purposes and contexts. Students learn to organize complex arguments in writing using thesis statements, claims and evidence, and to analyse writing for errors in logic. Students will also learn how to communicate in different kinds of workplace environments and professional/technical discourse communities and how to build and deliver effective presentations. Throughout the semester, students will produce and analyse common technical writing genres, including emails through modern email etiquette, letters, resumes, memos, reports, proposals, technical descriptions, technical definitions, technical manuals, and proposals. Students will work toward understanding how to analyse and react to rhetorical situations each genre and writing situation presents, including issues of audience, organization, visual design, style, and the material production of documents. In addition, students will learn how to apply principles of engineering ethics and equity to issues encountered during engineering practice, and how to analyse social and environmental aspects of engineering activities.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples, practical exercise and case studies
- Material preparation and reading due before classes
- Worksheets that are discussed in lectures and given as extra self-work
- Real world scenarios discussions of writing/communicating/engineering ethics in class and left as self-exercise.
- Group discussions of different technical writing real cases, assignments and engineering ethics incidents

Recommended or Required Reading:

- Beer, D. F. and McMurrey, D. A. (2019). *A Guide to Writing as an Engineer* (5th Edition). Wiley, ISBN: 978-1119285960
- Shafer-Landau, R. (2011). *The Fundamentals of Ethics* (2nd Edition). Oxford University Press.
- Johnson-Sheehan, R. (2017). *Technical Communication Today* (6th Edition). Pearson/Longman, ISBN: 9780321907981

Usability of the Module:
This module provides students with the appropriate ethics and writing techniques to be used in the rest of their curricula and professional careers.

Prerequisites and Co-requisites:
ENGL201: English V (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components
None

Bachelor

Module Title					**Module Code**
Simulation					IE0312

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	4.4
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
5% Homework assignments
30% One midterm exam
15% Lab assignments
10% Project
40% Theory final exam

Responsible Lecturer(s)

Dr. Hazem Kaylani
Dr. Laith Abuhilal

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Simulation	Physical	30	59
Simulation Lab	Blended	36	25

Duration of Study:

One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*2 hours = 30 hours;
- Presence time in labs: 12 weeks*3 hours = 36 hours;
- Preparation of homework assignments: 9 hours;
- Preparation of project: 15 hours;
- Prelab preparation: 10 hours;
- Preparation of theory exams: 15 hours;
- Preparation of lab exam: 15 hours;
- Preparation of final exam: 20 hours.

Learning outcomes:

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

- Explain the principles and applications of discrete event simulation.
- Formulate and conceptualise a problem in a way that it can be approached using modelling.
- Utilize quantitative and qualitative modelling approaches.
- Make use of basic statistical techniques (e.g., sampling from distributions, replications, and goodness of fit) related to simulation.
- Demonstrate the ability to interpret output data and make statistical statements on performance.

- Explain the principles and applications of queueing theorem.
- Explain the principles and applications of random number generators.
- Create and run simulation models using ARENA modelling software.

Module Contents:
Students develop an understanding of numerical models of dynamic systems, understand statistical techniques for modelling and simulation as well as apply modelling and simulation techniques to real world problems. Students will be able to identify, model, and analyse systems that are appropriately modelled using discrete event computer simulation. Students learn how to apply queueing tools to design and evaluate the performance of queueing systems.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through real world case studies.
- Manual simulation of real world problems using Excel sheets.
- Real world simulation case studies; discussions in class and self-study exercise.
- Homework assignments.
- Lab sessions on using main building blocks of ARENA software and how to apply to real world systems.
- Term project applied to a real world system.

Recommended or Required Reading:
- Banks, J., Carson, J. II, Nelson, B., and Nicol, D. (2009). *Discrete-Event System Simulation* (5th Edition). Prentice Hall, ISBN-13: 978-0136062127.
- Kelton, W. D., Sadowski, R. P., and Sadowski, D. A. (2014). *Simulation with Arena* (6th Edition). McGraw Hill Education, ISBN-13: 978-0073401317.
- Ross, S. (2012). *Simulation* (5th Edition). Academic Press, ISBN-13: 978-0124158252.

Prerequisites and Co-requisites:
IE0223: Applied Statistics (prerequisite)

Language of Instruction:
English with occasional Arabic explanations

Recommended Optional Program Components:
None

Bachelor

Module Title	Module Code
Production Planning	IE0314

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	3
Elective Module		**Spring Semester**		**Workload**	150
Optional Module		**Winter Semester**		**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

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

Responsible Lecturer(s)

Eng. Dina Elayan
Eng. Maram Shqair
Dr. Abdallah Abdallah

Course	Mode of Delivery	Contact Time	Self-Study
Production Planning	Blended	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Preparation of assignments: 15 hours;
- Preparation for midterm and quizzes: 30 hours;
- Preparation for final exam: 20 hours;
- Preparation of the semester project: 25 hours;
- Self-study: 15 hours.

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

- Recognize the objectives, functions, applications of production planning and forecasting techniques.
- Explain different inventory control techniques.
- Solve routing and scheduling problems.
- Formulate different production and inventory models and analyse their performance.
- Summarize various aggregate production planning techniques.
- Describe way of integrating different departments to execute production planning functions.
- Evaluate and assess different inventory management models used in real world.

Module Contents:
Students are introduced to production planning and inventory control concepts. The course is designed to view this subject as an essential tool that enhances managers' abilities to improve production systems. Concepts, quantitative techniques, examples, exercises and case studies used in this class are given from a wide variety of engineering disciplines to cover main topics such as forecasting, process analysis, capacity planning, production planning, inventory management, and production constrains management.

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;
- Team presentations for term projects.

Recommended or Required Reading:
- Kraiweski, L. L., Malhotra, M. K. & Ritzman, L. P. (2018). *Operations Management: Processes and Supply Chains* (12th Edition). Pearson.
- Chapman, S. N., Arnold, J. R. T., Gatewood, A. K. & Clive, L. M. (2017). *Introduction to Materials Management* (8th Edition). Pearson.
- Hopp, W. J. & Spearman, M. L. (2011). *Factory Physics*, 3rd Edition. Waveland Press, INC.

Usability of the Module:
This module provides part of the theoretical base required for the modules *IE0515: Product Development and Entrepreneurship*, *IE0516: Facility and Asset Management*, *IE0533: Supply Chain Engineering*, and *ME0577: Automation and Industry 4.0.*

Prerequisites and Co-requisites:
- IE0223: Applied Statistics (prerequisite)
- IE0231: Operations Research (prerequisite)
- IE0312: Simulation (prerequisite)

Language of Instruction:
English with occasional Arabic explanations

Recommended Optional Program Components:
None

Bachelor

Module Title	Module Code
Quality Engineering	IE0324

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	5
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
20% mid-term exam
20% Project
10% Quizzes and homework assignments
10% Lab reports
10% In-lab assessments
30% final exam

Responsible Lecturer(s)

Prof. Safwan Altarazi
Prof. Raid Alomar
Dr. Abdallah Abdallah

Course	Mode of Delivery	Contact Time	Self-Study
Quality Engineering	Blended	45	85
Quality Engineering Lab	Blended	30	20

Duration of Study:

One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Presence time in lab sessions: 30 hours;
- Preparation of class project: 20 hours;
- Preparation for quizzes and homework assignments: 25 hours;
- Preparation of lab reports: 20 hours;
- Preparation for midterm: 20 hours;
- Preparation for final exam: 20 hours.

Learning Outcomes:

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

- Explain basic knowledge in the fields of quality engineering.
- Differentiate between different quality management philosophies.
- 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.
- Communicate quality engineering and management tools findings to individuals who do not share technical and statistical expertise.

Module Contents:
To familiarize students with fundamentals quality engineering concepts and tools. The covered topics include: Quality definitions, Quality management principles, TQM strategy, Quality management systems, Excellence models, Economics of quality, DMAIC methodology, Statistical process control, Acceptance sampling, Capability analysis, and Measurement system analysis. For the lab part, it will covers topics of: ISO standards, quality management system documentation, quality planning and control tools (quality function deployment, FMEA, magnificent seven) implementation, SPC and DoE computer applications, Gauge R&R studies, and DMIAC project.

Planned Learning Activities and Teaching Methods:
- Lectures with discussions;
- Exercises in class and at home;
- Presenting project outcomes as teams;
- Practical project work and related group discussions;
- Lab sessions.

Recommended or Required Reading:
- Montgomery, D. C. (2019). *Introduction to Statistical Quality Control* (8th Edition). John Wiley & Sons, ISBN-13: 978-1119657118.
- Goetsch, D. L. and Davis, S. B. (2015). *Quality Management for Organizational Excellence* (8th Edition). Pearson, ISBN-13: 978-0133791853.
- Pyzdek, T. and Keller, P. A. (2018). *The Six Sigma Handbook* (5th Edition). McGraw-Hill Education, ISBN-13: 978-1260121827.

Usability of the Module:
This module provides the tools for students to use in an internship or a job to maintain quality standards in production.

Prerequisites and Co-requisites:
IE0223: Applied Statistics (prerequisite)

Language of Instruction:
English with occasional explanations in Arabic

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Manufacturing Processes					IE0344

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	5.4
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

20% midterm exam
10% quizzes
10% final assignment
5% presentation
15% lab reports
40% final exam (10% lab and 30% course)

Responsible Lecturer(s)

Dr. Mohammad AbuShams
Dr. Iyas Khader
Dr. Nidal Alshawawreh
Eng. Abdallah Albashir

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Manufacturing Processes	Blended	45	83
Manufacturing Processes Lab	Blended	36	16

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks x 3 hours: 45 hours;
- Presence time in labs: 12 weeks x 3 hours: 36 hours;
- Exercises and self-reading at home: 30 hours;
- Preparation of final project and presentation: 15 hours;
- Pre-lab preparation: 6 hours;
- Preparation for quizzes: 8 hours;
- Preparation for theoretical exams: 30 hours;
- Preparation for lab exam: 10 hours**.**

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

- Describe the basic properties and mechanical behaviour of materials and their impact on different manufacturing processes.
- Asses the use of a manufacturing process under given constrains in terms of efficiency and economy.
- Understand various bulk deformation operations such as forging, rolling, extrusion, and drawing.
- Understand basic metal forming terminology such as sheet metal forming and machining.

- Estimate the force, energy, and defects associated with various metal forming processes.
- Select the appropriate manufacturing process based on the efficiency, advantages, and disadvantages of the process.
- Apply the fundamentals of the lab safety regulations and machine protection.
- Transfer theoretical knowledge of the basic manufacturing processes through the implementation of the laboratory experiments.
- Describe and analyse experiments results in technical reports.
- Apply the laboratory skills and hands on experience in real life problems.

Module Contents:

- Typical manufacturing processes utilized in the industry such as forging, rolling, casting, extrusion and drawing with their impact on environmental and economy consideration;
- Basic manufacturing methods in sheet metal forming and machining;
- Materials mechanical properties: inhomogeneous deformation, yield criteria and triaxial stresses, and work hardening;
- Experiments involve sand casting, machining, polymers extrusion, sheet metal forming, metal finishing and coating, wear analysis, mechanical behaviour, welding principles, and forging.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- In-class exercises and discussions;
- Real-life scenario discussions and interactive sessions;
- Writing reports and in-class presentations;
- Designing and conducting experiments.

Recommended or Required Reading:

- Kalpakjian S. and Schmid S. (2020). *Manufacturing Engineering and Technology* (8th Edition). Pearson.
- Kalpakjian S. and Schmid S. (2016). *Manufacturing Processes for Engineering Materials* (6th Edition). Pearson.
- Groover M.P. (2019). *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems* (7th Edition). Wiley.
- Laboratory Handouts (School of Applied Technical Sciences, GJU)

Usability of the Module:

This is a compulsory module in the Bachelor's program of Industrial Engineering. It is also elective in the in the Bachelor's program of Mechatronics Engineering. This module is an introductory course on manufacturing processes and a prerequisite for the module IE0546 Modern Manufacturing Technology in the Bachelor's program of Industrial Engineering.

Prerequisites and Co-requisites:

- IE0242 Materials Science and Engineering (perquisite)

Language of Instruction:

English

Recommended Optional Program Components:

None

Bachelor

Module Title					Course Code
Ergonomics					IE0353

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	4.4
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
10% Course project
25% Midterm exam
25% Lab reports
40% Theory final exam

Responsible Lecturer(s)

Eng. Sarah Qareish
Dr. Tamer Yared

Course	Mode of Delivery	Contact Time	Self-Study
Ergonomics	Physical	30	62
Ergonomics Lab	Blended	36	22

Duration of Study:
One Semester.

Allocation of Workload Hours:

- Presence time in lectures: 30 hours;
- Presence time in labs: 36 hours;
- Prelab preparation: 2 hours;
- Preparation of lab reports: 20 hours;
- Preparation of midterm exam: 32 hours;
- Preparation of final exam: 20 hours;
- Preparation of course project: 10 hours.

Learning Outcomes:

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

- Explain how work environments in terms of temperature, humidity, noise, vibration and illumination, affect workers health and subsequently their productivity.
- Identify the risk factors associated with cumulative trauma disorders.
- Design workstations, tools, controls, work tasks and job procedures to fit and accommodate the human operator.
- Evaluate and redesign displays.
- Apply the appropriate techniques and tools for job evaluation and design.
- Recognize which collected anthropometric and physiological measurements to use in design applications and task evaluations.

- Discuss the basic principles of manual material handling to apply the NIOSH lifting equation and to recommend the lifting weight limit based on their calculations.
- Improve productivity of individuals and systems through the design of safe and efficient work environments.

Course Contents:

- Basic concepts of anthropometry, to match the physical dimensions of workplaces and products with the body dimensions of intended users;
- An introduction to occupational biomechanics, the structure and properties of the musculoskeletal system, and related upper extremity related cumulative trauma disorders;
- Physiological aspects of muscle work and the implications of work capacity limits for ergonomic job design;
- Nature of light stimulus, eyeball anatomy and characteristics of the visual sensory system;
- Human information processing model, cognition processes, limitations of the human cognitive system, implications and solutions for design problems;
- Human factors principles in the design of displays and controls.

Planned Learning Activities and Teaching Methods:

- Lectures to introduce module's various topics through oral and multimedia presentations;
- Seminar format is used interchangeably with lectures to allow students to discuss their own findings about a list of course topics;
- Worksheets on postural analysis tools are used by students to analyze real life working postures and evaluate associated risks of musculoskeletal disorders;
- Lab sessions to teach students how to collect proper anthropometric and physiological data using associated tools, measure several environmental conditions and apply correct statistical analysis techniques;
- Students work in groups to apply their gained knowledge in ergonomic assessment of certain occupations or work environments.

Recommended or Required Reading:

- Wickens, C. D., Gordon, S. E., Lee, J., and Liu, Y. (2014). *An Introduction to Human Factors Engineering* (2nd Edition). Pearson, ISBN-13: 978-1292022314.
- Kroemer, K. H. E., Kroemer, H. B., and Kroemer-Elbert, K. E. (2001). *Ergonomics: How to Design for Ease and Efficiency* (2nd Edition). Prentice Hall, ISBN-13: 9780137524785.
- Bridger, R. S. (2008). *Introduction to Ergonomics* (3rd Edition). CRC Press, ISBN-13: 978-1439894927.

Prerequisites and Co-requisites:

- IE0223: Applied Statistics (prerequisite)
- IE0251: Work Measurement and Standards (prerequisite)

Language of Instruction:

English with occasional Arabic explanations

Recommended Optional Program Components:

None

Bachelor

Module Title					**Module Code**
Engineering Economics					IE0361

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
15% Quizzes
15% Assignments
30% Midterm exam
40% Final exam

Responsible Lecturer(s)

Eng. Dina Elayan
Eng. Maram Shqair
Eng. Sarah Qareish
Dr. Rula Allaf

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Engineering Economics	Online	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Preparation for quizzes: 20 hours;
- Preparation for assignments: 25 hours;
- Preparation of midterm exam: 25 hours;
- Preparation of final exam: 35 hours;

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

- Differentiate between different cost types and their uses.
- Evaluate the economic desirability of a project considering time value of money.
- Select among alternative projects based on economic merits.
- Make use of different methods to calculate depreciation.
- Apply tax rules in economic analyses.
- Measure breakeven point and sensitivity analysis for investments.

Module Contents:
This module provides an introduction to engineering economics. Students learn principles of economic concepts and analysis techniques. Topics covered include overview of cost concepts, time value of money and

equivalent worth, rate of return, payback period, depreciation, taxes, discounted cash flow calculations, evaluation of single projects and comparing alternatives, sensitivity and breakeven analysis, and replacement analysis.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- Crib sheets with course notation;
- Economics and financing case studies discussions in class;
- Quizzes and assignments to assist students in practicing principles learned in module.

Recommended or Required Reading:

- Sullivan, W. G., Wicks, E. M. and Koelling, C. P. (2018). *Engineering Economy* (17th Edition). Pearson.
- Park, C. S. (2015). *Contemporary Engineering Economics* (6th Edition), Pearson.
- Newnan, D. G., Eschenbach, T. G. and Lavelle, J. P. (2017). *Engineering Economic Analysis* (13th Edition) Oxford University press.

Usability of Module:

This module covers basic monetary aspects that engineering students need to remain aware of in practice. This module is a prerequisite to the modules *IE0562: Industrial Cost Analysis* and *MECH0552: Management of Maintenance Systems*.

Prerequisites and Co-requisites:

IE0121: Probability and Statistics (prerequisite)

Language of Instruction:

English with occasional explanations in Arabic.

Recommended Optional Program Components:

None

Bachelor

Module Title					**Module Code**
Field Training					IE0382

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Pass-fail module

Responsible Lecturer(s)

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Field Training			160 hrs.

Duration of Study:
One semester.

Allocation of Workload Hours:

- Sending applications, communication with companies and other formalities: 10 hours;
- Internship at a local or regional/international approved company: 160 hours;
- Writing final report: 10 hours.

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

- Work in a professional environment;
- Work in a team and communicating with professionals;
- Apply concepts in the field of study to the real life examples and vice versa.

Module Contents:
Training at a local or regional/international approved company. The training must cover any topic or multiple areas of the respective field of study.

Planned Learning Activities and Teaching Methods:

- Application and communication with companies;
- Practical internship.

Recommended or Required Reading:
None extra; however, recommended literature from the modules relevant to the context of the internship.

Usability of the Module:
This module is a fundamental module for all engineering students. It is a prerequisite to the International Training planned in the 8th semester of studies.

Prerequisites and Co-requisites:
Department approval (prerequisites)

Language of Instruction:
None

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Engineering Project Management					IE0401

Compulsory Module		**Year of Study**	X	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

20% Course Project
40% Two Midterm exams
40% Theory final exam

Responsible Lecturer(s)

Dr. Murad Samhouri

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Engineering Project Management	Physical; blended learning	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation for midterm exams: 40 hours;
- Preparation of practical course project: 35 hours;
- Preparation for final exam: 30 hours.

Learning Outcomes:

- Distinguish the characteristics of a project.
- Describe the importance of project planning and the role of the project manager.
- Identify project activities and break them down into detailed work packages.
- Prepare project estimates for time, cost, and resource requirements.
- Construct project network diagrams and schedule charts.
- Determine project control methods and implementation measures.
- Prepare and present final project plans.

Module Contents:

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

- Selecting projects strategically: project selection models and project portfolio process.

- The project Manager and the project team: the project manager role, selecting the project manager, cultural differences and environmental impacts, project team, and MBTI.
- The role of projects in the organization: the project as a part of the organization, pure and functional project organizations, matrix organization, and mixed organization systems.
- The process of planning projects: project coordination, systems integration, the work breakdown structure and linear responsibility charts.
- Cost estimation and the budgeting process: estimating project budgets and improving the process of cost estimation.
- The function of scheduling: creating time tables using network techniques such as PERT and CPM, and risk analysis.
- Allocating resources: critical path method, the resource allocation problem, constrained resource scheduling, and multiproject scheduling and resource allocation.
- Managing projects through information systems: planning-monitoring-controlling cycle, information needs and the reporting process, and earned value analysis.
- Controlling projects: purposes of control, types of control processes, and control systems.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through real examples, practical case studies, technical papers and exercise
- Real world case analysis and critique of case studies in project management
- Group discussions of the practical course projects

Recommended or Required Reading:

- Meredith, J. R., Shafer, S. M., and Mantel, S. M. (2017). *Project Management: A Strategic Managerial Approach* (10th Edition). Wiley, ISBN: 978-1119369097
- Nicholas, J. M. and Steyn, H. (2020). Project Management for Engineering, Business and Technology (6th Edition). Routledge, ASIN: B08D2XHBD4
- Gido, J. and Clements, J. (2014). Successful Project Management (6th edition). Cengage Learning, ISBN: 978-1285068374

Prerequisites and Co-requisites:

- IE0231: Operations Research (prerequisite)
- IE0361: Engineering Economics (prerequisite)

Language of Instruction:

English with occasional explanations in Arabic

Recommended Optional Programme Components:

None

Bachelor

Module Title					**Module Code**
Reliability and Maintainability					IE0402

Compulsory Module		**Year of Study**	5	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
35% mid-term exam
15% 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 Maintainability	Physical; blended learning	45	105

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: 10 hours;
- Preparation of report and presentation: 30 hours;
- Preparation of mid-term and final exams and exams: 65 hours.

Learning Outcomes:

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

- Outline the importance of reliability and maintenance of industrial components and systems across multiple industries.
- Define the concepts of reliability and 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, analyse, 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.
- Identify the importance of statistical distributions for modelling failure data and the physical meanings of model parameters.
- Illustrate the ways for failure prevention and understand the Design for Reliability process in enhancing the reliability of components & systems.

- Compare various maintenance intervention approaches (corrective, scheduled, condition-based, and predictive) and maintenance strategic planning (reliability-centered maintenance and risk-based maintenance).
- Explain the significance of maintenance spare parts management and other logistics support systems on the overall plant availability and the maintenance investment costs.

Module Contents:
Reliability is one of the most important quality characteristics of systems, structures, and components. The scope of this course is to provide the students with the fundamental concepts and the necessary knowledge and skills related to reliability engineering of industrial systems, structures, and components. Specifically, this course contains FIVE main parts: Part 1 introduces an overview of the course and illustrates its context; Part II defines the reliability and its importance, explains the factors associated with the reliability, discusses the life model distributions and how to estimate the reliability of an industrial component, describes the typical behaviour of failure rate of a component (bathtub curve), introduces some reliability models and reliability measures and statistics; Part III evolves from that of Part II and presents 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); Part IV discusses the parametric and non-parametric reliability models, the life tests and accelerated life tests carried out to collect the failure occurrences data of an industrial component. It also covers the techniques used to estimate the component's failure rates. All of these aspects will be, then, confined within Part V that is dedicated to failure prevention through the Design For Reliability (DFR) to improve the overall system reliability, as well as to introduce maintenance intervention approaches and quality definition and its control methods. The course 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 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:
- 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.

Usability of the Module:
This is an elective module in the Bachelor's program of Industrial Engineering.

Prerequisites and Co-requisites:
IE0121: Probability and Statistics (prerequisite)

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

Recommended Optional Program Components:
None

Bachelor

Module Title	**Module Code**
Special Topics in Manufacturing processes and Engineering Materials	IE0404

Compulsory Module		**Year of Study**	4	**Semester Hours**	3
Elective Module	X	**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

20% assignments
80% final exam

Responsible Lecturer(s)

Dr. Iyas Khader

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Special Topics in Manufacturing processes and Engineering Materials	Physical; blended learning	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks * 3 hours: 45 hours;
- Experimental work, preparation of experiments: 45 hours;
- Presentation or semester assignments: 36 hours;
- Preparation for final exams: 24 hours.

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

- Describe specific manufacturing techniques and processes.
- Apply specific manufacturing techniques in producing sample materials.
- Describe the engineering and synthesizing procedure of specific materials.
- Identify applications for the material under consideration.
- Describe the parameters and processes that affect the properties or functionality of the material
- Prepare sample materials.
- Inspect material samples using various microscopy and analytical techniques (e.g., light and electron microscopy SEM/EDX, Raman spectroscopy, XRD, XPS, XRF, etc.).

Module Contents:

- Understanding specific modern manufacturing techniques;
- Application of the manufacturing techniques in producing samples;
- Understanding the engineering and synthesis of specific materials and material classes;
- Applying the knowledge in producing samples;

- Inspecting and studying materials using various microscopy and analytical techniques.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through examples;
- In-class exercises and discussions;
- Real-life scenario discussions and interactive sessions;
- Writing reports and in-class presentations;
- Designing and conducting experiments.

Recommended or Required Reading:
To be assigned based on the specific module contents

Usability of the Module:
This is an elective module in the Bachelor's program of Industrial Engineering. The module may be custom-designed to teach the theory and application of specific manufacturing processes and engineering materials. The module requires prior knowledge of basic manufacturing processes.

Prerequisites and Co-requisites:
- IE0242 Materials Science and Engineering (perquisite)
- IE0344 Manufacturing Processes (perquisite)

Language of Instruction:
English/German

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Special Topics in Ergonomics					IE0412
Compulsory Module		**Year of Study**	4	**Semester Hours**	3
Elective Module	X	**Spring Semester**		**Workload**	150
Optional Module		**Winter Semester**		**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

30% Assignments
30% Midterm exam
40% Final exam

Responsible Lecturer(s)

Eng. Sarah Qareish

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Special Topics in Ergonomics	Physical; blended learning	45	105

Duration of Study:
One Semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks × 3 hours = 45 hours;
- Preparation of midterm exam: 30 hours;
- Preparation of final exam: 25 hours;
- Presentation and semester assignments: 30 hours;
- Experimental work, vehicles auditing: 20.

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

- Classify and explain a set of critical ergonomic issues in the design of road vehicles.
- Identify the anthropometric measurements associated with vehicle occupant packaging.
- Evaluate the dimensions of 'occupant envelope' in a range of vehicles and determine their compatibility with the target user population through the application of necessary statistical analyses.
- Identify and evaluate driver's line of sight and visual field in vehicles to detect any possible visual restrictions.
- Discuss visual sensory limitations and their impacts on safe driving and propose solutions to avoid such limitations.
- List the ergonomics principles underpinning controls and displays and decide how these principles apply to vehicle design.
- Compare between vehicle design requirements for different types of drivers and passengers.

Module Contents:
Students will gain knowledge about:

- The diverse human factors issues associated with the design and use of road vehicles within a systems context;
- Related anthropometric measurements of drivers and passengers and their applications in vehicles design;
- Driver vision, field of view and sensory conspicuity;
- In-vehicle systems; controls and displays;
- Driver interaction with vehicle systems;
- Types of drivers, passengers and their vehicles including but not limited to; impaired drivers, older drivers and child passengers;
- Driving Safety Improvements.

Planned Learning Activities and Teaching Methods:

- Lectures to present module's various topics through oral and multimedia presentations;
- In-class exercises and discussions;
- Interactive sessions, where students steer their own discussions about recent issues concerning automotive ergonomics;
- Group and individual reports and in-class presentations;
- Preparing and conducting real-life ergonomic vehicle audits.

Recommended or Required Reading:

- Bhise, V. D. (2016). *Ergonomics in the Automotive Design Process*. CRC, ISBN-13: 9781439842119;
- Gkikas, N. (2013). *Automotive Ergonomics: Driver-Vehicle Interaction*. CRC, ISBN-13: 9781439894279;
- Bridger, R. S. (2008). *Introduction to Ergonomics* (3rd Edition). CRC Press, ISBN-13: 978-1439894927.

Prerequisites and Co-requisites:

- IE0353: Ergonomics (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None

Bachelor

Course Title	Course Code
Product Development and Entrepreneurship	IE0515

Compulsory Module	X	**Year of Study**	5	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

15% Case Study Critique
15% Course Project
30% Midterm exam
40% Theory final exam

Responsible Lecturer(s)

Dr. Fadwa Dababneh
Dr. Murad Samhouri

Course	Mode of Delivery	Contact Time	Self-Study
Product Development and Entrepreneurship	Blended	45	135

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation for midterm exams: 20 hours;
- Preparation of case study critique: 30 hours;
- Preparation of practical course project: 35 hours;
- Preparation for final exam: 20 hours;
- Self-study: 30 hours.

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

- Understand the holistic view at all activities included in the product development process.
- Identify the impact of marketing and manufacturing input into the design and development of a product.
- Define and implement the components of the design process.
- Understand the prototyping concept.
- Master the validation –verification – testing of a design.
- Appreciate the importance of Concurrent Engineering.
- Analyse the business environment in order to identify business opportunities.
- Identify the elements of success of entrepreneurial ventures and consider the legal and financial conditions for starting a business venture.
- Evaluate the effectiveness of different entrepreneurial strategies and specify the basic performance indicators of entrepreneurial activity.

Module Contents:
Product Development and Entrepreneurship's main emphasis is the integration of the marketing, design, and manufacturing functions of organizations in creating entrepreneurial and new innovative products. This course is designed with the following content:

- Competence with a set of tools and methods for product design and development;
- Confidence in your own abilities to create a new product;
- Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production);
- Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective;
- Conceptual definition of entrepreneurs and entrepreneurship;
- Entrepreneurship in economic theory and historical development of entrepreneurship;
- Entrepreneurial practice and the importance of small business;
- Entrepreneurial economy, entrepreneurship and economic development;
- Type of entrepreneurship and features and types of businesses and entrepreneurs;
- Sources of business ideas;
- Innovation and entrepreneurship;
- Entrepreneurship and small business.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples, practical exercise and case studies;
- Worksheets that are discussed in lectures and given as extra self-work;
- Real world case analysis and critique of case studies in product development, innovation and entrepreneurship;
- Group discussions of the practical course projects.

Recommended or Required Reading:

- Ulrich, K.T. and Eppinger, S.D. (2019). *Product Design and Development* (7th Edition). Mc-Graw Hill, ISBN: 978-1260566437
- Reinertsen, D. G. (2009). *The Principles of Product Development Flow: Second Generation Lean Product Development* (1st Edition). Celeritas Publishing, ISBN: 978-1935401001
- Neck, H. M., Neck, C. P., and Murray E. L. (2020). *Entrepreneurship: The Practice and Mindset* (2nd Edition). SAGE Publications, Inc, ISBN: 978-1544354620

Prerequisites and Co-requisites:
IE0314: Production Planning (prerequisite)

Language of Instruction:
English with occasional explanations in Arabic

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Facilities and Asset Management					IE0516

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
5% Homework
30% Midterm exam
5% Class Presentation
20% Term project
40% Theory final exam

Responsible Lecturer(s)

Dr. Fadwa Dababneh
Dr. Murad Samhouri
Dr. Hazem Kaylani

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Facilities and Asset Management	Physical	45	135

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation of homework assignments: 15 hours;
- Preparation for midterm exam: 30 hours;
- Preparation of term project: 30 hours;
- Preparation for final exam: 30 hours;
- Self-study: 30 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.
- Develop Material handling systems design
- Discuss how warehouse operations integrate with facility layout.
- Utilize quantitative models for facilities planning and layout.

Module Contents:
Students learn the concepts and methodology of facilities planning as well as layout planning, optimization algorithms applied to facilities layout, selection of material handling systems, and operations of warehouse. 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 field.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through examples.
- Short class presentations (each student gives 5-10 minutes presentation on selected topics).
- Homework assignments.
- Term project applied to a real world system.

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 is a compulsory module for Industrial Engineering.

Prerequisites and Co-requisites:
IE0314: Production Planning (prerequisite)

Language of Instruction:
English with occasional explanations Arabic

Recommended Optional Program Components:
None

Bachelor

Course Title	Course Code
Data Analytics for Industrial Engineering	IE0526

Compulsory Module	X	**Year of Study**	5	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
40% Two midterm exams (20% each)
5% in-class work
15% Term project report and presentation
40% Theory final exam

Responsible Lecturer(s)

Dr. Mahmoud El-Banna
Dr. Lena Abu-El-Haija

Course	Mode of Delivery	Contact Time	Self-Study
Data Analytics for Industrial Engineering	Physical	45	135

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation of term project: 40 hours;
- Preparation for midterm exams: 40 hours;
- Preparation for final exam: 25 hours;
- Self-study: 30 hours.

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

- Proficiently use the statistical and open source software, R.;
- Read\load data from difference sources; excel, csv, text file, etc.;
- Perform statistical summaries of the examined data;
- Perform manipulations and transformations on the examined data;
- Transfer the date into visual domain, such as scatter plots, boxplots, histograms, etc.;
- Build different statistical models such as clustering, regression models, and classification models;
- Evaluate built model performance with different measures such as positive predictive rate, negative predictive rate, and area under the curve.

Module Contents:
This course prepares students to use the statistical software R to describe and analyze data and to use advanced statistical tools to make decisions on operations, risk management, finance, marketing, etc. Topics include univariate analysis, bivariate analysis, classification, clustering, regression, association rules, dimensionality reduction, and attributes selection. Students also learn model evaluation measures such as true positive or negative, false positive or negative, positive and negative predictive values, and other accuracy measures. By the end of this course, students will be able to gather sufficient relevant data, demonstrate a sophisticated understanding of the concepts and methods, and use advanced techniques to conduct thoroughand insightful analysis, and interpret the results correctly with detailed and useful information.

Planned Learning Activities and Teaching Methods:
- Lectures to present concepts theoretically and through examples.
- IE problems that are discussed and solved in lectures.
- Self-work problems in class supervised with the instructor.
- Group-based term projects
- Teams Presentations for Term projects

Recommended or Required Reading:
- Ledolter, J. (2013). *Data Mining and Business Analytics with R*. Wiley, ISBN-13: 978-1118447147
- James, G., Witten, D., Hastie, T. and Tibshirani, R. (2013). An Introduction to Statistical Learning with Application in R. Springer, ISBN-13: 978-1461471370
- Hastie, T., Tibshirani, R. and Friedman, J. (2016). *Elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd Edition). Springer, ISBN-13: 978-0387848570
- R user manuals that can be retrieved from http://cran.r-project.org/manuals.html

Usability of the Module:
This module has a direct transferability into the workforce and the current realm of large data. Graduating students will be able to use the methods introduced in this module to explain any data that is either gathered in another module or the workplace.

Prerequisites and Co-requisites:
- IE0222: Computer Aided Math for IE (prerequisite)
- IE0223: Applied Statistics (prerequisite)
- IE0231: Operations Research (prerequisite)

Language of Instruction:
English with occasional explanations in Arabic

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Supply Chain Engineering					IE0533

Compulsory Module	X	**Year of Study**	4	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
25% Midterm exam
25% Team project report
10% Team project presentation
40% Final exam

Responsible Lecturer(s)

Dr. Murad Samhouri
Dr. Raid Al-Aomar
Dr. Safwan Altarazi

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Supply Chain Engineering	Physical	45	105

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;
- Preparation for midterm exam: 15 hours;
- Preparation for final exam: 20 hours.

Learning Outcomes:

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

- Explain the impact of supply chain management on enterprise efficiency
- Interpret various business functions, processes and supply chain terminology
- Classify various supply chain viewpoints
- Assess concepts and mathematical models behind different supply chain software
- Outline competing supply chain operations and reference models
- Make use of broader trends in the area of supply chain management.

Module Content:
The module covers topics related to supply chain design, planning, and integration. This includes sourcing decisions, logistic systems, capacity analyses, aggregate planning, and distribution networks. The module also discusses latest development in supply chain management including sustainability and technology applications. The team project portion of the module allows the students to model and evaluate a real-world supply chain. This includes developing a SIPOC structure, setting KPIs, and optimizing the supply chain network.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples.
- In-class discussion of textbook short case studies.
- Team-based exploration and discussion of structures and challenges of local companies supply chains.
- Team project full report writing and in-class presentation of team project progress.
- Demos of software tools for supply chain management and optimization (SAP, CPLEX, and ARENA).

Recommended or Required Reading:

- Bozarth, C. and Handfield, R. (2018). *Introduction to Operations and Supply Chain Management* (5th Edition). Pearson, ISBN-13: 978-0134740607
- Chopra, S. (2018). *Supply Chain Management: Strategy, Planning, and Operation* (7th Edition). Pearson, ISBN-13: 978-0134731889
- Shapiro, J. F. (2006). *Modeling the Supply Chain* (2nd Edition). Cengage Learning ISBN-13: 978-0495126096

Prerequisites and Co-requisites:

- IE0231: Operations Research (prerequisite)
- IE0314: Production Planning (prerequisite)

Language of Instruction:
English with occasional explanations in Arabic

Recommended Optional Program Components:
None

Bachelor

Module Title					Module Code
Modern Manufacturing Technology					IE0546

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	5.4
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

20% midterm exam
10% quizzes
10% final assignment
5% presentation
15% lab reports
40% final exam (10% lab and 30% course)

Responsible Lecturer(s)

Dr. Iyas Khader
Dr. Nidal Alshawawreh
Dr. Mohammad AbuShams
Eng. Abdallah Albashir

Course	Mode of Delivery	Contact Time	Self-Study
Modern Manufacturing Technology	Physical	45	80
Modern Manufacturing Technology Lab	Blended	36	19

Duration of Study:

One semester.

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks x 3 hours: 45 hours;
- Presence time in labs: 12 weeks x 3 hours: 36 hours;
- Exercises and self-reading at home: 30 hours;
- Preparation of final project and presentation: 20 hours;
- Pre-lab preparation: 9 hours;
- Preparation for quizzes: 10 hours;
- Preparation for theoretical exams: 20 hours;
- Preparation for lab exam: 10 hours.

Learning Outcomes:

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

- Describe various modern manufacturing techniques.
- Assess the use of modern manufacturing processes under given constrains in terms of efficiency and economy.
- Understand the basics of CAD/CAM.

- Program using a CAD/CAM system.
- Produce sample parts by relying on a selected CAD/CAM system.
- Understand the basics of various additive manufacturing techniques.
- Classify various types of additive manufacturing techniques.
- Produce sample parts by relying on selected additive manufacturing techniques.
- Understand the basics concepts of non-traditional machining, non-traditional welding and powder metallurgy techniques.
- Understand the basic concepts of microfabrication techniques.
- Classify various microfabrication techniques.

Module Contents:

- Traditional and non-traditional manufacturing processes, green manufacturing, additive manufacturing and rapid prototyping;
- Digital manufacturing and CAD/CAM;
- Non-conventional machining: electric discharge machining and electro-chemical machining
- Powder metallurgy;
- Non-conventional welding and cutting processes;
- Microfabrication and microelectromechanical systems (MEMS);
- Selected topics in advanced manufacturing technologies.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- In class exercises and discussions;
- Real life scenarios discussions and interactive sessions;
- Writing a final report and in-class presentation;
- Hands on experience.

Recommended or Required Reading:

- Kalpakjian, S. and Schmid, S. (2020). *Manufacturing Engineering and Technology* (8th Edition). Pearson.
- Groover, M.P. (2019). *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems* (7th Edition). Wiley.
- Gibson, I., Rosen, D., Stucker, B., and Khorasani, M. (2021). *Additive Manufacturing Technologies* (3rd Edition). Springer.
- Laboratory Handouts (School of Applied Technical Sciences, GJU).

Usability of the Module:

This is a compulsory module in the bachelor program of Industrial Engineering.

Prerequisites and Co-requisites:

- IE0344 Manufacturing Processes (perquisite)
- IE0547 Modern Manufacturing Technology Lab (co-requisite)

Language of Instruction:

English

Recommended Optional Program Components:

None

Bachelor

Module Title					Module Code
Industrial Cost Analysis					IE0562

Compulsory Module	X	**Year of Study**	5	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
15% Quizzes
15% Assignments
30% Midterm exam
40% Final exam

Responsible Lecturer(s)

Eng. Dina Elayan
Dr. Abdallah Abdallah

Course	Mode of Delivery	Contact Time	Self-Study
Industrial Cost Analysis	Blended	45	135

Duration of Study:

One semester

Allocation of Workload Hours:

- Presence time in lectures: 15 weeks*3 hours = 45 hours;
- Preparation for quizzes: 35 hours;
- Preparation for assignments: 40 hours;
- Preparation of midterm exam: 25 hours;
- Preparation of final exam: 35 hours.

Learning Outcomes:

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

- Make use of different cost accounting techniques like job-order costing, process costing and ABC costing.
- Perform breakeven analysis, variance analysis, and differential analysis for managerial decision making.
- Make use of Cost-Volume-Profit Relationships in analyses.
- Prepare budgets.
- Identify direction for improvement based on current performance of a system.
- Develop comprehensive systems for Management Accounting including cost and performance evaluation.

Module Contents:
Students gain knowledge regarding managerial accounting and cost concepts, classifications and calculations. Module also introduces ABC and other costing methods such as cost for pricing, cost evaluation and improvement, costs for decision making, budgeting, and variance analysis. Students are introduced to financial balance sheet calculations, depreciation, assets and liabilities, and taxes.

Planned Learning Activities and Teaching Methods:

- Lectures to present concepts theoretically and through examples;
- Crib sheets with course notation;
- Accounting and financing case studies discussions in class.
- Quizzes to evaluate students' understanding of given concepts.
- Group assignments to enhance research and team work.

Recommended or Required Reading:

- Garrison, R., Noreen, E. and Brewer, P. (2020). *Managerial Accounting* (17th Edition). McGraw Hill;
- Weygandt, J. J., Kimmel P. D. and Kieso, D. E. (2018). *Managerial Accounting: Tools for Business Decision Making* (8th Edition). Wiley;
- Datar, S. and Rajan, M. (2017). *Horngren's Cost Accounting: A Managerial Emphasis* (16th Edition). Pearson.

Prerequisites and Co-requisites:
IE0361: Engineering Economics (prerequisite)

Language of Instruction:
English with occasional explanations in Arabic.

Recommended Optional Program Components:
None

Bachelor

Module Title	**Module Code**
Graduation Project I	IE0584

Compulsory Module	X	**Year of Study**	5	**Semester Hours**	1
Elective Module		**Spring Semester**	X	**Workload**	60
Optional Module		**Winter Semester**	X	**ECTS**	2
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
60% In-term progress presentations
40% Proposal Report

Responsible Lecturer(s)

All Industrial Engineering Department faculty members

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Graduation Project I	Blended	15	45

Duration of Study:
One Semester.

Allocation of Workload Hours:

- Presence time in meetings: 15 hours;
- Literature review and problem statement definition: 25 hours;
- Preparation and writing project report: 20 hours.

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

- Understand an existing system and assess it for potential problems and improvements.
- Define the various industrial engineering topics that can be used in real life projects.
- Demonstrate the various methods of collecting scientific, engineering and market data on a particular problem.
- Identify a process for research, literature review and documenting project findings.
- Formally construct a problem statement to be solved as a graduation project.

Module Contents:
This is a no-lecture project course that will allow students to apply knowledge gained throughout their course of undergraduate study on a real-life problem or opportunity. It is typically a teamwork project with up to three students. Instructor with students select a project topic and get the project completed through guiding them in searching relevant literature, collecting and analysing data, preparing and presenting results, and writing reports.

Planned Learning Activities and Teaching Methods:

- Meetings to present the students with detailed instructions and requirements;

- Student-engaged discussions and presentations of progress;
- Assignments;
- Teamwork;
- Continuous evaluation and feedback on progress;
- Writing and presenting project reports.

Recommended or Required Reading:

- SATS guidelines for the preparation of graduation reports. http://www.gju.edu.jo/content/regulations-and-forms-6068;
- Turabian, K.L., 2013. A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers. University of Chicago Press.
- Morgan, K., Spajic, S., 2015. Technical Writing Process, 1st Edition. Better on Paper Publications.

Usability of the Module:

This module acts as a preparation step for the bachelor thesis module, Graduation Project II, where the preliminary work for the project occurs prior to truly embarking on the project itself.

Prerequisites and Co-requisites:

IE0483: International Internship (prerequisite)

Language of Instruction:

English and occasional Arabic explanations

Recommended Optional Program Components:

None

Bachelor

Module Title	Module Code
Graduation Project II	IE0585

Compulsory Module	X	**Year of Study**	5	**Semester Hours**	2
Elective Module		**Spring Semester**	X	**Workload**	180
Optional Module		**Winter Semester**	X	**ECTS**	6
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
40% in-term presentations and report updates
60% thesis report and defence

Responsible Lecturer(s)

All Industrial Engineering Department faculty members

Course	Mode of Delivery	Contact Time	Self-Study
Graduation Project II	Blended	30	150

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in meetings with advisor: 30 hours;
- Preparation for weekly meetings: 15 hours;
- Presence time in labs/plants collecting data: 45 hours;
- Data analysis and comparing results to existing literature: 45 hours;
- Completion of graduation project report: 30 hours;
- Preparation of project defence: 15 hours.

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

- Define the various industrial engineering topics that can be used in real life projects.
- Construct needed plans and time schedule for a long-term project to resolve a real-life problem.
- Contrast and analyse collected data in order to select the best solutions and tools during project analysis phase.
- Assess the different tools and approaches that can be used by the targeted organization to improve performance.
- Design final solutions based on project finings.

Module Contents:
This is a no-lecture project course that will allow students to apply knowledge gained throughout their course of undergraduate study on a real-life problem or opportunity. It is typically a teamwork project with up to three students. Instructor and students select a project topic and get the project completed through guiding them in searching relevant literature, collecting and analysing data, preparing and presenting results, and writing reports.

Planned Learning Activities and Teaching Methods:

- Meetings to present the students with detailed instructions and requirements;
- Student-engaged discussions and presentations of progress;
- Assignments;
- Teamwork;
- Continuous evaluation and feedback on progress;
- Writing and presenting project reports.

Recommended or Required Reading:

- SATS guidelines for the preparation of graduation reports. http://www.gju.edu.jo/content/regulations-and-forms-6068.
- Turabian, K.L., 2013. A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers. University of Chicago Press.
- Morgan, K., Spajic, S., 2015. Technical Writing Process, 1st Edition. Better on Paper Publications.

Usability of the Module:

The module prepares the student to embark on real new projects whether in the workforce or in graduate school.

Prerequisites and Co-requisites:

IE0584: Graduation Project I (prerequisite)

Language of Instruction:

English with occasional Arabic explanations

Recommended Optional Program Components:

None

Bachelor

Module Title					Module Code
Industrial Systems Integration Lab					IE0586

Compulsory Module	x	**Year of Study**	5	**Semester Hours**	2
Elective Module		**Spring Semester**	X	**Workload**	120
Optional Module		**Winter Semester**	X	**ECTS**	4
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
10% Lab reports
10% In-lab assessments
30% Project
10% Lab assignments
40% Final exam

Responsible Lecturer(s)

Prof. Safwan Altarazi

Module	Mode of Delivery	Contact Time	Self-Study
Industrial Systems Integration Lab	Blended	30	90

Duration of Study:
One semester

Allocation of Workload Hours:

- Presence time in lab sessions: 30 hours;
- Preparation of class project: 50 hours;
- Revision of material and assignments at home: 20 hours;
- Preparation for final exam: 10 hours.

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

- Understand system engineers' role and responsibilities.
- Develop a systems engineering plan for a realistic project.
- Apply systems engineering tools (e.g., requirements development and management, robust design, Design Structure Matrix) to realistic problems.
- Know how to proactively design for and manage system lifecycle targets.

Module Contents:
The major element of this lab is a group project on the design of an industrial system or an industrial-related product or service. The group project is to integrate the applications of various topics including: Business analysis and decision making process; industrial modelling and simulation; project management; product life-cycle management; quality engineering; cost accounting; production planning and scheduling; transportation

planning; material handling; layout planning and workflow design; human factors; distribution and marketing; value chain analysis and critical success factors; etc.

Planned Learning Activities and Teaching Methods:

- Lab sessions;
- Exercises in lab and at home;
- Presenting project outcomes as teams;
- Practical project work and related group discussions.

Recommended or Required Reading:

- Miller, J. (2004) *QBQ! The Question Behind the Question: Practicing Personal Accountability at Work and in Life*. Putnam Publishing Group, ISBN: 9780399152337.

Usability of the Module:
The lab can be used as a special topic technical elective course by other engineering majors.

Prerequisites and Co-requisites:
IE0483: International Internship (prerequisite)

Language of Instruction:
English, with occasional explanations in Arabic.

Recommended Optional Program Components:
None.

Bachelor

Module Title					Module Code
Computer Aided Engineering Drawing					ME0111

Compulsory Module	X	**Year of Study**	1	**Semester Hours**	6
Elective Module		**Spring Semester**		**Workload**	120
Optional Module		**Winter Semester**	X	**ECTS**	4

Examination

Portfolio:
10% Quizzes
4% Home works
6% Class works
20% Midterm Exam
20% Autodesk Certified Professional (ACP) Exam
40% Portfolio assessment

Responsible Lecturer(s)

Eng. Dina Karasneh
Eng. Shouroq Shawish
Dr. Natheer Almtireen

Course	Mode of Delivery	Contact Time	Self-Study
Computer Aided Engineering Drawing	Blended	90	30

Duration of Study:

One semester.

Allocation of Workload Hours:

- Presence time in lecture: 90 hours;
- Guided, task driven and monitored (weekly) self-study for module (part of portfolio): 21 hours;
- Preparation of portfolio: 7 hours;
- Portfolio assessment: 2 hours.

Learning Outcomes:

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

- Draw line types, arcs, circles, geometric construction and polygons.
- Interpret third angle orthographic projection.
- Draw the three principal views of objects (top, front & profile).
- Draw isometric pictorial drawings.
- Draw sectional views.
- Interpret AutoCAD interface, change settings, open and save drawings.
- Use AutoCAD panels/commands (Draw, modify, dimensions, text, solid, surface, object snaps, User Coordinate System (UCS), views, etc.) to draw 2D and 3D objects.
- Identify the Autodesk certified professional (ACP) exam.

Module Contents
Students learn the principle of 2D and 3D AutoCAD commands necessary to draw any 2D or 3D object. They will learn how to draw the orthographic projection of any 3D object, the isometric and section views. They also will learn how to draw a 3D model using 3D commands and find the orthogonal projection from the 3D model using solid draw and solid edit command. The student will learn the presspull command to draw different 3D objects.

Planned Learning Activities and Teaching Methods:
- Lectures with intensive discussions;
- Exercises in class and at home;
- Quizzes from real case problems.

Recommended or Required Reading:
- James H. Earle, Engineering design Graphics, 11th edition, 2004.
- Frederick E. Giesecke, Engineering Graphics, 8th edition, 2003.
- James D. Bethune, Engineering Graphics with AutoCAD, 1st edition, 2017.

Usability of the Module:
This is a compulsory module in the following Bachelor's Degree Programs: Mechatronics and Artificial Intelligence Engineering; Industrial engineering; Mechanical and Maintenance Engineering; Civil Engineering; Computer Engineering; Energy Engineering; and Electrical & Communication Engineering. It is a prerequisite for Fundamentals of Mechanical Design module (MECH0211).

Prerequisites:
CS116: Computing Fundamentals (prerequisite)

Language of Instruction:
English with occasional Arabic explanations

Recommended Optional Program Components:
None

Bachelor

Module Title					**Module Code**
Electrical Circuits and Machines					ME0212

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	3
Elective Module		**Spring Semester**		**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5

Examination

Portfolio:
30% Midterm exam
20% Assignments
10% Quizzes
40% Portfolio assessment

Responsible Lecturer(s)

Dr. Hani Muhsen
Dr. Ghaith Al Refai

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Electrical Circuits and Machines	Physical	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Guided, task driven and monitored (weekly) self-study for module (part of portfolio): 80 hours;
- Preparation of Portfolio: 23 hours;
- Portfolio assessment: 2 hours.

Learning Outcomes:

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

- Analyse circuit using direct application of Kirchoff's current and voltage laws along with Ohm's law.
- Interpret analytical circuit results to power, current, and voltage in view of passive sign convention.
- Explain the characteristics of capacitor, inductor, and operational amplifier.
- Compute Phasors and Sinusoidal steady-state response.
- Understand and analyse the basics of electronics (semiconductor diodes and Op-Amps, Transistors, bipolar junction transistors, Thyristors).
- Understand the principle of operation of Direct Current and Alternating Current machines.

Module Contents

- Definitions, circuit laws, simple circuit, circuit analysis techniques;
- Phasor concept, Sinusoidal steady-state response;
- Average power and root mean square values, complex power and power factor;
- Poly-phase circuits, tsransformers (single phase);

- Basics in electronics (semiconductor diodes and Op-Amps, transistors, bipolar junction transistor, thyristors);
- DC machines (separately and shunt), three-phase induction motors, special purpose motors.

Planned Learning Activities and Teaching Methods:

- Lectures.
- In class exercises.
- Tutorials.
- Simulation.

Recommended or Required Reading:

- Svoboda, James A., and Richard C. Dorf, Introduction to electric circuits. John Wiley & Sons, 9th edition, 2013.
- Charles, K. Alexander, and N. O. Matthew, Fundamentals of electric circuits. McGraw-Hill Education, 6th edition, 2017.
- Chapman, Stephen J., Electric machinery fundamentals, 5th edition, 2012.
- Franchi, and Claiton Moro, Electrical Machine Drives: Fundamental Basics and Practice, CRC Press, 1st edition, 2019.

Usability of the Module:

This is a compulsory module in Industrial Engineering, and Mechanical and Maintenance Engineering programs. It is a prerequisite for Instrumentation and Measurements and lab module (ME0346), Automation and Industry 4.0 and lab module (ME0577), Building Services module (MECH0544).

Prerequisites and Co-requisites:

PHYS104: Physics II (-prerequisite)

Language of Instruction:

English

Recommended Optional Program Components:

None

Bachelor

Module Title	Module Code
Instrumentation and Measurement + Lab	ME0346 ME0347

Compulsory Module	X	**Year of Study**	3	**Semester Hours**	5.6
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5

Examination

Portfolio:
20% Midterm exam
20% Lab assignments
5% Lab Project
10% Report
5% Presentation
40% Portfolio assessment

Responsible Lecturer(s)

Dr. Mariam Ibrahim
Dr. Hani Muhsen
Dr. Natheer Almtireen

Course	Mode of Delivery	Contact Time	Self-Study
Instrumentation and Measurement	Blended	45	47
Instrumentation and Measurement Lab	Blended	36	22

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures: 45 hours;
- Presence time in labs: 36 hours;
- Guided, task driven and monitored (weekly) self-study for module (part of portfolio): 12 hours;
- Writing a report (mandatory part of portfolio): 7 hours;
- Preparing a presentation (mandatory part of portfolio): 3 hours;
- Prelab preparation (mandatory part of portfolio): 13 hours;
- Preparation of lab project (mandatory part of portfolio): 8 hours;
- Lab project assessment/presentation: 1 hour;
- Preparation of Portfolio: 23 hours;
- Portfolio assessment: 2 hours.

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

- Understand measurement principles and apply them within measurement systems.
- Select and specify suitable instrumentation for measurement of physical quantities.
- Analyze and interpret experimental data.

- Perform analog and digital signal processing.
- Identify various sensor technologies and their use in measurement systems.

Module Contents:

- Fundamentals of measurement systems: measurement units, measurement system applications, elements of a measurement system;
- Instrument types and performance characteristics: a review of instrument types, static characteristics, dynamic characteristics, calibration;
- Measurement uncertainty: sources and reduction of systematic error, random errors, and statistical analysis of measurements;
- Measurement noise and signal processing: sources of measurement noise, techniques for reducing measurement noise, analog signal processing, digital signal processing, introduction to data acquisition and processing using LabVIEW;
- Electrical indicating and test instruments: digital meters, analog meters, oscilloscopes;
- Display, recording, and presentation of measurement data: displays, recorders, linear least-squares regression;
- Variable conversion elements: bridge circuits, resistance measurement, inductance measurement, capacitance measurement, current measurement, frequency measurement;
- Sensor technologies: capacitive and resistive sensors, magnetic sensors, hall-effect sensors, piezoelectric transducers, strain gauges, optical sensors, ultrasonic sensors;
- Measurement sensors and instruments: temperature measurement, pressure measurement, flow measurement, level measurement, mass, force, and torque measurement, translational and rotational motion transducers.

Planned Learning Activities and Teaching Methods:

- Lectures with intensive discussions;
- Quizzes;
- Exercises in class and at home;
- Experiments;
- Design Projects.

Recommended or Required Reading:

- Morris, Alan S., and Reza Langari. M Measurement and Instrumentation,3rd edition, 2020.
- Bakshi, Uday A., and Late Ajay V. Bakshi, Measurements and Instrumentation. Technical Publications,1st edition, 2020.
- Ghosh, Arun K., Introduction to measurements and instrumentation. PHI Learning Pvt. Ltd., 4th edition, 2012.

Usability of the Module:

This is a compulsory module for the following programs: Industrial Engineering; Mechanical and Maintenance Engineering; and Energy Engineering. It is a prerequisite for the module Automation and Industry 4.0 in the Industrial Engineering program.

Prerequisites and Co-requisites:

- MATH205: Differential Equations (prerequisite)
- ME0212: Electrical Circuits and Machines (prerequisite)

Language of Instruction:

English

Recommended Optional Program Components:

None

Bachelor

Module Title	**Module Code**
Automation and Industry 4.0 and Lab	ME0577 ME0578

Compulsory Module	X	**Year of Study**	5	**Semester Hours**	5
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5

Examination

Portfolio:
25% Midterm Exam
20% Lab assignments
15% Lab assessment
40% Portfolio assessment

Responsible Lecturer(s)

Dr. Hani Muhsen
Dr.Mutaz Ryalat

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Automation and Industry 4.0	Physical	30	60
Automation and Industry 4.0 Lab	Blended	45	15

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 30 hours;
- Presence time in LAB: 45 hours;
- Guided, task driven and monitored (weekly) self-study for module (part of portfolio): 50 hours;
- Prelab preparation (mandatory part of portfolio): 10 hours;
- Preparation of lab (mandatory part of portfolio): 4 hours;
- Lab assessment: 1 hour:
- Preparation of portfolio: 8 hours;
- Portfolio assessment: 2 hours.

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

- Define and distinguish industrial automation systems components, technologies, and applications.
- Understand the purpose, functions, and operations of a Programmable Logic Controller (PLC).
- Identify the essential components of the PLC and how they function.
- Integrate and program a PLC.
- Design and analyse of industrial automation systems.
- Comprehend how digital transformation changes the manufacturing technologies.
- Identify and distinguish technologies under the Industry 4.0 umbrella.

- understand how the core elements and technologies are connected and can take a holistic approach to improve processes and products.

Module Contents:

- Introduction to production concepts, serial production lines, assembly systems, and types of automation;
- Programmable Logic Controllers (PLC); Theoretical and applied material, including application and hardware composition of programmable logic controllers; functional programming blocks such as logic gates including AND, OR;
- Timers, counters, and analog blocks; design approaches based on Boolean and structured logic, state machines, flowcharts; programming methodologies including ladder diagrams, blocks and text based;
- Concepts and definitions for Industry 4.0 approaches, Industry 4.0 and the Future of Production;
- Smart Factory Architecture and overview of Smart Production Systems and Integrated production technology;
- Enabling technologies for Industry 4.0. Industrial Internet of Things (IIoT) for production systems;
- Security and vulnerability challenges, authentication and authorization, data/device security, and cloud computing.

Planned Learning Activities and Teaching Methods:

- Lectures with intensive discussions;
- Exercises in class and at home;
- Real case simulations;
- Experiments;
- Design Projects.

Recommended or Required Reading:

- Frank D. Petruzella, Programmable Logic Controller, 5th edition, 2017.
- John Soldatos et. al, Industrial Automation in the Industry 4.0 Era, 1st Edition, 2019.
- Schwab, Klaus, The fourth industrial revolution. Currency, 1st Edition, 2017.

Usability of the Module:

This is a compulsory module for Mechatronics and Artificial Intelligence Engineering, and Industrial Engineering programs. It is also elective for Mechanical and Maintenance Engineering program.

Prerequisites and Co-requisites:

ME0344: Control Systems I (prerequisite)

Language of Instruction:

English

Recommended Optional Program Components:

None

Bachelor

Module Title					**Module Code**
Statics and Strength of Materials					MECH0216

Compulsory Module	X	**Year of Study**	2	**Semester Hours**	3
Elective Module		**Spring Semester**	X	**Workload**	150
Optional Module		**Winter Semester**	X	**ECTS**	5
Pre-university		**Pre-program**		**Remedial**	

Examination

Portfolio:
40% first and second exams
10% Quizzes
10% Team project or exercise
40% final exam

Responsible Lecturer(s)

Dr. Ahmad Almuhtady

Course	**Mode of Delivery**	**Contact Time**	**Self-Study**
Statics and strength of Materials	Blended	45	105

Duration of Study:
One semester.

Allocation of Workload Hours:

- Presence time in lectures, exercises and presentations: 15 weeks * 3 hours = 45 hours;
- Preparation and writing team project: 3 hours;
- Preparation for first and second exam: 25 hours;
- Day to Day Studying, Exercises and self-reading at home (includes preparation for Quizzes): 60 hours;
- Preparation for final exam: 17 hours.

Learning Outcomes:

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

- Define force vectors in 2-D and 3-D problems in Cartesian and other representations and find the moment of any force in 2-D or 3-D problems.
- Model particles and rigid bodies equilibrium problems through creation of free body diagram, identifying equations of equilibrium and solving them.
- Analyze internal loadings of a loaded member.
- Determine geometric properties.
- Define the fundamental concepts of stress and strain.
- Define the characteristics and calculate the magnitude of selected mechanical properties of materials.
- Relate and classify the stress and the strain experienced by a member to the loads, geometry, and materials properties.
- Apply the formal theory of solid mechanics to calculate forces, deflections, moments, stresses, and strains in a wide variety of structural members subjected to tension, compression, bending.

- Analyze principal stresses and angles, maximum shearing stresses and angles, and the stresses acting on any arbitrary plane within a structural element.
- Utilize basic properties of materials such as elastic moduli and Poisson's ratio to appropriately to solve problems related to isotropic elasticity.
- Utilize appropriate materials in design considering engineering properties, cost and weight.

Module Contents:
The course covers the core of the applied mechanics (statics) in addition to an introduction to the strength of materials, including the followings: Vector mechanics of forces and moments and resultants, equilibrium of particles and rigid bodies in two and three dimensions, internal loadings, geometric properties, stress and strain, mechanical properties of materials, axial load, bending, transverse shear, design of beams, column buckling.

Planned Learning Activities and Teaching Methods:
- Lectures with intensive discussions;
- Exercises in class and at home;
- Real case simulations;
- Teamwork approach to tackle project or exercise.

Recommended or Required Reading:
- Hibbeler, R.C. (2016). *Engineering Mechanics: Statics* (14th Edition). Pearson Prentice Hall, ISBN-13: 978-1292089331;
- Hibbeler, R.C. (2016). *Mechanics of Materials in SI Units* (10th Edition). Pearson Prentice Hall, ISBN-13: 978-1292178202;
- Beer, F., Johnston, E., DeWolf, J., and Mazurek, D. (2019). Mechanics of Materials (8th Edition). McGraw Hill, ISBN-13: 978-1260113273.

Usability of the Module:
This module is a require module for the bachelors in Industrial Engineering and Mechatronics and Artificial Intelligence Engineering. The module is a prerequisite to the modules *MECH0215: Dynamics* and *IE0243: Materials Science and Engineering Lab*.

Prerequisites and Co-requisites:
- PHYS103: Physics 1 (prerequisite)
- MATH102: Calculus II (prerequisite)

Language of Instruction:
English

Recommended Optional Program Components:
None