



Jordan University of Science and Technology

Faculty of Engineering

Department of Industrial Engineering

***Undergraduate Curriculum for the B.Sc. Degree
in Industrial Engineering***

Date: 16/08/2007

Vision

To achieve excellence in industrial engineering education and applied research.

Mission

Providing IE students with state-of-the-art education, knowledge, and professional skills in addition to meeting local and regional technical needs. This is accomplished through an industry-oriented curriculum, market-driven research, multidisciplinary graduate and undergraduate study plans, highly qualified instructors, well-equipped laboratories, effective training on latest technologies, sustainable industry interaction, and positive atmosphere for students, faculty and staff.

Department Objectives

1. Prepare graduates to function effectively as Industrial Engineers in industry and society with a firm understanding of ethical and professional responsibilities.
2. Emphasize the incorporation of scientific platform and hands-on constituents for system design and problem-solving with a focus on product realization, safety and ergonomics, operations management, maintenance, and total quality management.
3. Produce graduates who meet or exceed market expectations by keeping strong ties with industry through open-days, projects, consultation, and alumni relations.
4. Equip students with the essential soft skills for effective communication, research, critical-thinking, continual learning, entrepreneurship, and team-work.
5. Foster excellence in applied research and scholarship through solid graduate programs, continual faculty development, with national & international impact.
6. Develop safe and attractive facilities, resources, and infrastructure to implement cooperative and interactive learning of contemporary engineering issues, web-based technologies, and other advancements in the delivery of education.

B.Sc in Industrial Engineering Program Learning Outcomes*

- a- Apply knowledge of mathematics, science, and engineering principles in solving industrial problems.
- b- Design, develop, and conduct engineering experiments and analyze outcome data.
- c- Design and realize products and services that meet market needs. Design and develop production and management systems that assure quality and maintain efficiency. Utilize state-of-the-art Computer-Aided Engineering and simulation software tools.
- d- Practice class and graduation team projects, participate effectively in teams, and apply project and time management skills.
- e- Formulate engineering problems using mathematical and computer models and deploy solutions and design controls to maintain performance. Troubleshoot industry problems and prescribe solutions for continuous improvement.
- f- Recognize and practice engineering ethics and professional conduct.
- g- Write technical reports and deliver professional presentations using latest technologies. Practice industry-communication and interaction skills and communicate effectively within teams.
- h- Recognize the impact of engineering solutions on industry, society, and the environment.
- i- Demonstrate the ability to seek knowledge, stay updated, and pursue further learning and training.
- j- Stay aware of latest technologies and advances in disciplines related to Industrial Engineering and engineering in general utilizing latest resources of knowledge.
- k- Apply learned techniques, tools, and skills to solve engineering problems
- l- Develop and apply safety rules and ergonomic standards in the work environment.

* Outcomes a-k are similar to ABET A-K criteria.

IE Undergraduate Curriculum

Undergraduate Degree Plan

Before introducing courses and degree requirements it is important to describe the numbering / coding system of courses at JUST.

Course Coding (Numbering)

A five to six digit number, coded as follows, is used to designate courses:

Department			Level/Year	Field	Sequence
0	0	0	0	0	0
A	B	C	X	Y	Z

The Department codes (A, B, C) are as follows:

Code	Department
AE	Architectural Engineering
CE	Civil Engineering
ME	Mechanical Engineering
EE	Electrical Engineering

Code	Department
IE	Industrial Engineering
ChE	Chemical Engineering
BME	Biomedical Engineering
NE	Nuclear Engineering

Therefore, courses in Industrial Engineering will have numbers of the form **IE XYZ**, where the coding of X, Y and Z will be described later.

The following presents the courses (and their pre/co – requisite) within each of the requirements needed to obtain a B.Sc. in Industrial Engineering.

Framework for IE B.Sc. Degree (159 Semester Credits)

The department of Industrial Engineering at the Faculty of Engineering of Jordan university of Science and Technology offers Bachelor of Science degree after completing **159** credit hours, distributed as classified in Tables 1 and 2.

Table 1: Distribution of credit hours

Classification		Credit Hours		
		Compulsory	Elective	Total
University Requirements		16	9	25
College Requirements		32	-	32
Department Requirements	Compulsory	93	-	93
	Electives	-	9	9
Total =		141	18	159

Table 2: Courses classification

Classification		Credit Hours	Percentage
Humanities	Lecture	24	15.72
	Lab	1	0.6
Basic Sciences	Lecture	33	20.7
	Lab	2	1.2
General Engineering	Lecture	18	11.32
	Lab	4	2.52
Industrial Engineering	Lecture	73	45.91
	Lab	7	4.40
Total	Lecture	145	91.19
	Lab	14	8.81

Degree Requirements

Conditions set by the regulations of awarding the Bachelor of Science degree in Jordan University of Science and Technology issued by the deans' council according to the discipline of awarding the scientific degrees and certificates at Jordan University of Science and Technology for the year 1987.

University Requirements (25 Credit Hours)

A total of 25 credit hours (16 compulsory and 9 electives).

Compulsory: (16 Credit Hours)

Table 1. University Compulsory Courses

Course No.	Course Title	Cr. Hr.	Lecture	Lab.	Prerequisite or *Corequisite
Arb 101	Arabic Language	3	3		
Arb 103	☐☐☐Applied Arabic Language Studies	1		3	
Eng 111 ⁽¹⁾	English Language	3	3		Pass Eng 99
Eng 112	Communication Skills II	3	3		Eng 111
CIS 100 ⁽²⁾	Computer Skills	3	3		
MS100 ⁽³⁾	Military Sciences	3	3		
	Total	16			

- 1) A student who passes the English Language Placement Test with a grade > 80% is exempted from both Eng 099 and Eng. 111, while a student who passes the English Placement Test with a grade between 50% and 80% is exempted from Eng 099 only.
- 2) A student who passes the Computer Skills Placement Test with a grade > 50% is exempted from CIS 100.
- 3) This course is required from Jordanian students only; graded on Pass/Fail basis. Students graduating from Royal Military faculty and military candidates school and equivalent institutes are exempted from taking this course: Non-Jordanian Arabic Speaking students are required to take a substitute for this course from the elective courses and in this case the grade of this course is included in their grade point average (GPA).

Notice: All non Arabic Speaking foreign students in the University are required to study two courses in Arabic language as shown below:

Table 2. Courses for non Arabic Speaking Students

Course No.	Course Title	Cr. Hr.	Lecture	Lab.	Prerequisite or Corequisite
Arb101A	Fundamentals of Arabic Language (for non Arabic speaking students as a substitute for the course Arb101 Arabic Language)	3	3	-	
Arb103A	Fundamentals of Arabic Language Lab for non Arabic speaking students as a substitute for the course Arb103 ☐☐☐Applied Arabic Language Studies)	1	-	3	

Elective: (9 Credit Hours)

The university elective courses are three courses with a total of 9 Cr., as listed in Table 5.

Table 3. University Elective Courses for Engineering Students

Course No.	Course title	Cr. Hr.	Lecture	Lab.	Prerequisite or Corequisit
ES 103	Environment Protection (for non Environment Sciences students)	3	3	0	
PH 200	First Aid and Emergency Procedure (for non Medicine, non Nursing, and non Midwifery students)	3	3	0	
PH 104	Community Health and Nutrition (for non Medicine, non Nursing, and non Midwifery students)	3	3	0	
PHAR 104	Drugs and Medical Plants (for non Medicine, and non Pharmacy students))	3	3	0	
NUR 100	Health Promotion (for non Medicine, non Nursing, and non Midwifery students)	3	3	0	
ADS 100	Oral and Dental Health (for non Dentistry and non Dentistry Sciences students)	3	3	0	
PP 200	Home Gardens (for non Agriculture students)	3	3	0	
PP 201	Bee Keeping (for non Agriculture students)	3	3	0	
VM 211	Animal Health (for non Veterinary Medicine and non Agriculture students)	3	3	0	
VM 212	Pet Animal Care (for non VM and Agriculture students)	3	3	0	
HSS 112	Hadith Shareef	3	3	0	
HSS 113	Aqideh	3	3	0	
HS 114	Fekah	3	3	0	
HSS 115	Islam and Recent Problems	3	3	0	
HSS 116	Islamic Economy System	3	3	0	
HSS 121	Principles of Sociology	3	3	0	
HSS 126	Principles of Psychology	3	3	0	
HSS 127	Educational Technology	3	3	0	
HSS 128	National Education	3	3	0	
HSS 131	Islamic Civilization	3	3	0	
HSS 132	The History of the City of Jerusalem	3	3	0	
HSS 133	Civilization and Recent Cultures	3	3	0	
HSS 141	Introduction to Economics (for non CIS students)	3	3	0	
HSS 142	Library and Information Research	3	3	0	
HSS 151	Introduction to Management Sciences (for non CIS students)	3	3	0	
HSS 161	Contemporary Problems	3	3	0	
HSS 166	Man and Science	3	3	0	
HSS 182	Studies on Women	3	3	0	
HSS 250	Music History (in English)	3	3	0	
HSS 211	Introduction to Sociology in English	3	3	0	
HSS 212	Arab Society	3	3	0	
HSS 213	Individual and Society	3	3	0	
HSS 216	International Global Issues	3	3	0	
HSS 221	Introduction to Psychology in English	3	3	0	

HSS 222	Creativity and Problems Solving	3	3	0	
HSS 224	Leadership and Communication Skills	3	3	0	
HSS 241	Economy in the Third World	3	3	0	
HSS 242	Information and Research	3	3	0	
HSS 429	Behavioral Science and Dealing with Children	3	3	0	
PT 100	Health and Life Styles (for non physical therapy students)	3	3	0	
ME 211	Fundamentals of Automobile Engineering (for non ME students)	3	3	0	
NR 200	Natural Resources and Human Being	3	3	0	
NF 177	Food Preservation (in English)	3	3	0	

Faculty Requirements: (32 Credit Hours)

Table 4. Faculty of Engineering Compulsory Courses

Course No.	Course Title	Cr. hr.	Lecture	Lab.	Prerequisite or Corequisite
Math101	Calculus I	3	3		----
Math 102	Calculus I	3	3		Math 101
Math 201	Intermediate Analysis	3	3		Math 102
Math 203	Ordinary Differential Equations	3	3		Math 102
Phys 101	General Physics I	3	3		----
Phys 102	General Physics II	3	3		Phys 101
Phys 107	General Physics Lab	1		3	Co Phys 102
Chem 101	General Chemistry I	3	3		----
Chem 102	General Chemistry II	3	3		Chem 101
Chem 107	General Chemistry Lab	1		3	Co Chem 102
CS 115	Programming Language (C++)	3	3		CIS 100
EE 202	Communication Skills for Engineers	2	2		2 nd Year Standing
ChE 400	Professional Ethics for Engineers	1	1		90 credits
	Total	32	32		

Department Requirements: (102 Credit Hours)

Course Numbering

Industrial Engineering courses are numbered based on year level, subject area, offering semester, and sequence. The symbol IE denotes Industrial Engineering each number is made of 3 digits defined as follows:

A- The middle digit denotes the course subject area as follows:

Field Number	Specialization
1	Engineering fundamentals
2	Drawing and Design
3	Control and Automation
4	Engineering Management
5	Engineering Management
6	Manufacturing Engineering
7	Manufacturing Engineering
9	Practice and graduation Project

B- The leftmost digit denotes the level of the course according to student's study plan as follows:

Leftmost Digit	Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year
5	Fifth year.

C- The rightmost digit denotes the course sequence in its subject area (Odd numbers represent first semester and even numbers represent second semester)

Example:

Course Number	IE 455		
IE	4	5	5
Department	Year Level (Four)	Field (Eng. Management)	Sequence-First Semester

Department Compulsory: (93 Credit Hours)

Department compulsory courses are 93 credit hours (80 credits from Industrial Engineering and 13 credits are from other engineering departments).

Table 7: Industrial Engineering compulsory courses (80 credit hours)

Course No.	Course Title	Cr. hr.	Lecture	Lab.	Prerequisite or *Corequisite
IE 211	Mechanics of Material	3	3	0	Phys 101
IE 212	Dynamics and Vibration	3	3	0	Math 203
IE 214	Fluids and Thermal Sciences	3	3	0	Chem 102
IE 322	CAD Lab	1	0	3	ME 201
IE 324	Machine Component Design	3	3	0	IE 211
IE 331	Engineering Measurement	2	2	0	ME 101
IE 333	Eng Measurement Lab	1	0	3	Co-IE 331
IE 341	Engineering Economy	2	2	0	Math 201
IE 343	Applied Engineering Statistics	3	3	0	Math 235
IE 344	Operations Research (1)	3	3	0	EE 305
IE 345	Work Measurement and Analysis	3	3	0	EE 202
IE 361	Engineering Materials	3	3	0	IE 211
IE 364	Manufacturing Processes (1)	3	3	0	IE 361
IE 365	Engineering Material Lab	1	0	3	IE 361
IE 420	Design of Machinery	2	2	0	IE 324, IE 212
IE 431	Control and Automation	3	3	0	IE 331, EE 303
IE 432	Control and Automation Lab	1	0	3	IE 431
IE 441	Quality Control	3	3	0	IE 343
IE 444	Cost Accounting and Analysis	3	3	0	IE 341
IE 448	Simulation	3	2	1	IE 455
IE 452	Production Planning and Inventory Control	3	3	0	IE 344
IE 453	Human Factors Engineering	3	3	0	IE 345
IE 454	Human Factors Lab.	1	0	3	Co-IE 453
IE 455	Operations Research (2)	3	3	0	IE 344
IE 466	Manufacturing Processes (2)	3	3	0	IE 364
IE 467	Manufacturing Processes Lab.	1	0	3	Co-IE 466
IE 492	Engineering Training	3	--	--	Pre: Completion of 117 C.H.
IE 543	Manufacturing Information Systems	3	3	0	IE 452
IE 548	Facilities Planning	3	3	0	IE 452
IE 574	Reliability and Maintenance Management	3	3	0	IE 441
IE 591	Graduation Project (1)	1	--	--	Pre: Completion of 114 C.H.
IE 592	Graduation Project (2)	3	--	--	IE 591
IE 593	Product Development Lab	1	0	3	IE 420
Total		80			

Table 8: Department compulsory courses from other engineering departments (13 credit hours)

Course No.	Course Title	Cr. hr.	Lecture	Lab.	Prerequisite or *Corequisite
ME 101	Engineering Workshop	2	1	3	-----
ME 201	Engineering Drawing B	2	1	6	CIS 100
Math 235	Probability and Statistics	3	3	0	Math 102
EE 303	Fundamentals of Electrical Engineering (none EE)	3	3	0	Phys 102, Math 102
EE 305	Numerical Methods for Engineers	3	3	0	Math 203, CS 115
Total		13			

Department Electives: (9 Credit Hours)

Table 9: Department elective courses from Industrial Engineering departments (select 9 credit hours)

Course No.	Course Title	Cr. hr.	Lecture	Lab.	Prerequisite or *Corequisite
IE 521	Tool and Die Design	3	3	0	IE 466
IE 571	Computer-Aided Design & Manufacturing (CAD/CAM)	3	3	0	IE 322, IE 364
IE 531	PLCs in Manufacturing	3	3	0	IE 431
IE 551	Lean Production Systems	3	3	0	IE 452
IE 552	Supply Chain Management	3	3	0	IE 452
IE 553	Enterprise Resource Planning	3	3	0	IE 452, IE 543
IE 554	Human Resource Management	3	3	0	IE 453
IE 555	Safety Engineering and Management	3	3	0	100 hours
IE 556	Total Quality Management	3	3	0	100 hours
IE 557	Introduction to Project Management	3	3	0	100 hours
IE 558	Entrepreneurship for Engineers	3	3	0	CHE 400
IE 539	Special Topics in Design	3	3	0	Department Approval
IE 559	Special Topics in Engineering Management	3	3	0	Department Approval
IE 570	Special Topics in Engineering Materials	3	3	0	Department Approval
IE 579	Special Topics in Manufacturing	3	3	0	Department Approval

Study Plan for the B.Sc. Degree in Industrial Engineering

First Year

First Semester

Second Semester

Course Number	Course Name	Credit Hours	Pre-Requisite	Course Number	Course Name	Credit Hours	Pre-Requisite
ME 101	Engineering Workshops	2	-	Math 102	Calculus II	3	Math 101
Eng 111	English Language	3	Passing Eng 99	Phys 102	General Physics II	3	Phys. 101
Phys 101	General Physics I	3	-	Phys 107	General Physics Lab	1	Co. Phys. 102
Chem 101	General Chemistry I	3	-	Arb 101	Arabic Language	3	-
Math 101	Calculus I	3	-	Arb 103	Applied Arabic Language Studies	1	-
CIS 100	Computer Skills	3		Chem 102	General Chemistry II	3	Chem. 101
				Chem 107	General Chemistry Lab	1	Co Chem. 102
Total		17		Total		15	

Second Year

First Semester

Second Semester

Course Number	Course Name	Credit Hours	Pre-Requisite	Course Number	Course Name	Credit Hours	Pre-Requisite
Eng 112	Communication skills II	3	Eng 111	Math 235	Probability and Statistics	3	Math 102
IE 211	Mechanics of Material	3	Phys 101	CS 115	Programming Language (C++)	3	CIS 100
Math 201	Intermediate Analysis	3	Math 102	IE 212	Dynamics and Vibration	3	Math 203
ME 201	Engineering Drawing B	2	CIS 100	EE 202	Communication Skills for Eng.	2	2 nd year standing
Math 203	Ordinary Differential Equations	3	Math 102	MS 100	Military Science	3	
	University Elective	3		IE 214	Fluids and Thermal Sciences	3	Chem 102
Total		17		Total		17	

Third Year

First Semester

Second Semester

Course Number	Course Name	Credit Hours	Pre-Requisite	Course Number	Course Name	Credit Hours	Pre-Requisite
IE 341	Engineering Economy	2	Math 201	IE 345	Work Measurement and Analysis	3	EE 202
EE 303	Fundamentals of Electrical Engineering (none EE)	3	Math 102 Phys 102	IE 365	Engineering Materials Lab	1	IE 361
IE 331	Engineering Measurements	2	ME 101	IE 324	Machine Component Design	3	IE 211
IE 343	Applied Engineering Statistics	3	Math 235	IE 344	Operations Research (1)	3	EE 305
IE 361	Engineering Materials	3	IE 211	IE 364	Manufacturing processes (1)	3	IE 361
EE 305	Numerical Methods for Engineers	3	Math 203, CS 115		University Elective	3	
IE 333	Engineering Measurements Lab	1	Co-IE 331	IE 322	CAD Lab	1	ME 201
Total		17		Total		17	

Fourth Year

First Semester

Second Semester

Course Number	Course Name	Credit Hours	Pre-Requisite	Course Number	Course Name	Credit Hours	Pre-Requisite
IE 431	Control and Automation	3	IE 331 EE 303	IE 452	Production Planning and Inventory Control	3	IE 344
IE 441	Quality Control	3	IE 343	IE 444	Cost Accounting and Analysis	3	IE 341
IE 420	Design of Machinery	2	IE 324 IE 212		University Elective	3	
CHE 400	Professional Ethics for Engineers	1	90 hours	IE 448	Simulation	3	IE 455
IE 453	Human Factors Engineering	3	IE 345	IE 432	Control and Automation Lab	1	IE 431
IE 455	Operations Research (2)	3	IE 344	IE 466	Manufacturing Processes (2)	3	IE 364
IE 454	Human Factors Lab	1	Co-IE 453	IE 467	Manufacturing Process Lab	1	Co- IE 466
Total		16		Total		17	

Summer Session

Course Number	Course Name	Credit Hours	Pre-Requisite
IE 492	Engineering Training	3	Completion of 117 credit hours
Total		3	

Fifth Year

First Semester

Second Semester

Course Number	Course Name	Credit Hours	Pre-Requisite	Course Number	Course Name	Credit Hours	Pre-Requisite
IE 591	Graduation Project (1)	1	Completion of 114 CH	IE 592	Graduation Project (2)	3	IE 591
IE 548	Facilities Planning	3	IE 452	IE 574	Reliability and Maintenance Management	3	IE 441
IE 593	Product Development Lab	1	IE 420				
IE 543	Manufacturing Information Systems	3	IE 452		Department Elective	3	
	Department Elective	3					
	Department Elective	3					
Total		14		Total		9	

Industrial Engineering Department Course Description

I- Compulsory courses

IE 211: Mechanics of Materials

(3C, 3H)

The course covers force vectors, equilibrium of force systems, rigid body equilibrium, internal forces, and stress and strain. The course also covers generalized Hook's law, axial loading, torsion of circular shafts, bending and shear of beams, and combined loadings.

Pre-requisite: phys 101

IE 212: Dynamics and Vibrations

(3C, 3H)

The course covers planar kinematics of rigid bodies, relative motion analysis of velocity and acceleration, planar kinetics of rigid bodies: force and acceleration, work and energy methods. The course also includes an introduction to free vibrations: harmonic motion, viscous damping, response to harmonic excitation of undamped and damped systems, and an introduction to forced vibrations.

Pre-requisite: Math 203

IE 214: Fluids and Thermal Sciences

(3C,3H)

The course covers fluid properties, flow classifications, fluid statics, conservation of mass equations, conservation of momentum equations, and conservation of energy equations. The course also covers properties of pure substances, P-V-T phase diagrams, property tables, first and second law of thermodynamics, one-dimensional steady-state conduction, free convection, and radiation heat transfer.

Pre-requisite: Chem 102

IE 322: Computer-Aided Drafting (CAD) Lab

(1C, 3H)

The lab covers 3D modeling utilizing different CAD software packages, Drawing of key mechanical elements, Mechanical assembly, Projected and sectional views, Drawing documentation, and Practical implementations of learned CAD techniques in team project.

Pre-requisite: ME 201

IE 324: Machine Component Design

(3C, 3H)

The course covers the design methodology, a review of mechanical properties, failure theories for machine elements under static and dynamic loadings, and the design of shaft, power screws, threaded fasteners, belt drives and chain drives, roller and journal bearings, and spur gears.

Pre-requisite: IE 211

IE 331: Engineering Measurements**(2C, 2H)**

The course covers the process of measurement, standards Common types of error, displacement and dimensional measurement, fixed and deviation types of gauges, strain and stress analysis and measurement, temperature, electrical and acoustical measurements.

Pre-requisite: ME 101**IE 333: Engineering Measurements Lab****(1C, 3H)**

The lab includes experiments on linear measurement, angular measurements, fixed and deviation types of gauges, optical measurements, temperature measurements, and electrical measurements.

Co-requisite: IE 331**IE 341: Engineering Economy****(2C, 2H)**

The course covers cost concepts, time value of money, interest formulas, cash flow and equivalence calculations, inflation and taxation, measures of investment worth, projects evaluation, depreciation, break-even analysis, and replacement analyses.

Pre-requisite: Math 201**IE 345: Work Measurement & Analysis****(3C,3H)**

The course covers basic traditional and modern IE methods with a focus on process mapping, Motion and Time Study (MTS), work methods and standards, work station design, lean techniques, labor efficiency, and Job evaluation.

Pre-requisite: EE 202**IE 343: Applied Engineering Statistics****(3C, 3H)**

This course begins with a review of statistical inference, covers the application of regression analysis in engineering problems, provides the tools necessary for the design of engineering experiments with single and multiple factors, introduces the method of analysis of variance (ANOVA), highlights the use of non-parametric statistics, and includes the use of related statistical software tools such as Minitab, Statistica, SAS, and SPSS.

Pre-requisite: Math 235

IE 344: Operations Research I (3C,3H)

The course covers basic principles of Operations Research with a focus on formulating and solving mathematical models analytically and using software tools. Course topics include linear programming and its applications in production, logistics, and project management (Transportation, transshipment, Assignment, and Network models).

Pre-requisite: EE 305

IE 361: Engineering Materials (3C, 3H)

The course covers atomic structure and bonding, structure of materials (metal, polymer, ceramics, and composites), elastic and plastic deformation, solution hardening, dispersion hardening, introduction to phase diagrams, ferrous and non ferrous metals (steel, cast iron, aluminum and copper), and an introduction to advanced materials.

Pre-requisite: IE 211

IE 365: Engineering Materials Lab. (1C, 3H)

The lab includes experiments on tensile, hardness, fatigue, impact, and creep tests, macro and micro-examination of materials, effect of cold working and heat treatment on metals, hardening and tempering of steel, Jminy test, Carburizing of low carbon steel, and Non-destructive tests.

Pre-requisite: IE 361

IE 364: Manufacturing Processes (1) (3C,3H)

The course includes an introduction to manufacturing processes with a focus on metal casting, rolling, forging, extrusion, drawing, machining, and joining (welding, brazing, soldering, adhesive bonding, and mechanical fastening).

Pre-requisite: IE 361

IE 420: Design of Machinery (2C, 2H)

The course covers Kinematics fundamentals, Mobility, Mechanism type diagrams, Position analysis, and introduction to graphical and analytical linkage synthesis, Velocity and acceleration analysis, Cam mechanisms, Indexing Mechanisms, and Gear Mechanisms.

Pre-requisite: IE 324, IE 212

IE 431: Control and Automation**(3C, 3H)**

The course covers an introduction to linear feedback control theory, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graph, time domain analysis of control systems, test signals, transient response, time domain specifications, steady-state error and stability. The course also covers sensors, actuators, A/D and D/A conversion, hydraulic and pneumatic systems, Programmable Logic controllers (PLCs) and Computer Integrated Manufacturing (CIM).

Pre-requisite: IE 331, EE 303**IE 432 : Control and Automation Lab****(1C,3H)**

The lab includes experiments and practical training on control of mechanical systems using P/PD/PID Controllers, control of x-y table using stepper motors, developing ladder logic programs for PLCs, pneumatic control and servo control systems, control system implementation using related engineering software applications such as Matlab, Labview, and Simulink, identifying different types of sensors, and CIM (Robotics, Conveyor, and Machine Tools).

Pre-requisite: IE 431**IE 441: Quality Control****(3C, 3H)**

The course covers the concepts and methods of quality, engineering specifications and tolerances, quality charts, statistical process control (SPC) using control charts of variables and attribute data, acceptance sampling, process capability indices, and cost and management aspects of quality.

Pre-requisite: IE 343**IE 452: Production Planning and Inventory Control****(3C, 3H)**

The course covers the concept of value chain with a focus on supply chain analyses, capacity planning, inventory models, and demand forecasting. The course also covers the development of a production plan using Master Production Scheduling (MPS) and Material Requirement Planning (MRP), job shop scheduling, and an introduction to lean manufacturing.

Pre-requisite: IE 344**IE 453: Human Factors Engineering****(3C, 3H)**

The course covers basics of ergonomics with a focus on anthropometric measurements, man-machine interaction, work space design using anthropometric data, design of hand tools, occupational hazards, and design of work environment.

Pre-requisite: IE 345

IE 444: Cost Accounting and Analysis**(3C, 3H)**

The course covers basic methods for cost accounting with a focus on product costing and pricing methods (job costing, process costing, and Activity Based Costing (ABC)) in addition to break-even analysis, cost-benefit analysis, performance measurement, and companies' financial statements.

Pre-requisite: IE 341**IE 454: Human Factors Lab****(1C, 3H)**

This course aims to familiarize students with some experimental tools to understand the principles of workstation design. The student will learn how to apply ergonomics principles as well as motion and time study techniques to design an efficient and safe work place. The experiments include anthropometrics measurements, hand tool design, physical and physiological work load measurement, time measurements, application of motion economy, and human cognitive measurements.

Co-requisite: IE 453**IE 455: Operations Research II****(3C, 3H)**

The course is a continuation of the first course in Operations Research (OR I: IE 344). The focus is on complementary concepts and methods of Integer Linear Programming (ILP), Goal Programming (GP), Probabilistic Models (PM), Decision and Risk Analysis (DA), Queuing Systems (QS), and Simulation Modeling (SM).

Pre-requisite: IE 344**IE 448: Simulation****(3C, 3H)**

The course covers the development and analysis of Discrete Event Simulation (DES) models of production and service systems using a specialized simulation package. The focus is on simulation mechanics, model building, validation, and verification, statistical model input/output analysis, comparing simulated systems, running simulation experiments and what-if analysis, and managing simulation projects.

Pre-requisite: IE 455**IE 466: Manufacturing Processes (2)****(3C, 3H)**

The course is a continuation of the first course in manufacturing processes (IE 363) with a focus on sheet-metal forming processes, forming and shaping of plastics and composite materials, forming and shaping of ceramics and glass, powder metallurgy, rapid prototyping technologies, and advanced manufacturing processes.

Pre-requisite: IE 364

IE 467: Manufacturing Processes lab**(1C, 3H)**

The lab includes practical experiments and training on sand casting process and defects, special casting processes, gas welding, electric arc welding, sheet metal forming and press working, machining, cutting force measurement, CNC machines, Robotics, wear measurement, plastic injection molding, blow molding, thermoforming, and rotational molding.

Co-requisite: IE 466**IE 492: Engineering Training****(3C, 3H)**

This is a practical training course in which the student selects a company approved by the department and spends the eight training period and writes a technical report on his training activities and results

Co-requisite: Completing 117 hours**IE 548: Facilities Planning****(3C, 3H)**

The course covers material flow analysis, plant layout design using specialized software, facility location, material handling systems (MHS), materials storage and distribution systems, and employee services and space requirements.

Pre-requisite: IE 452**IE 543: Manufacturing Information Systems****(3C, 3H)**

The course covers the basics of information engineering methods and techniques, enterprise database concepts and design, website development and internet processing, managerial and technical dimensions of information systems, and Telecommunications Implementation, integration of information technology in supply chain operations, data communications and LANs in manufacturing, and information flow control of networked flexible manufacturing.

Pre-requisite: IE 452**IE 574: Reliability and Maintenance Management****(3C,3H)**

The course covers basics of maintainability, availability, and safety of products and systems with a focus on maintenance role and types, building and analyzing reliability models, Fault Tree Analysis (FTA), and Failure Mode & Effect Analysis (FMEA). The course also covers concepts and methods of maintenance planning and management with a focus on reliability centered maintenance (RCM), total productive maintenance (TPM), and costing and scheduling of maintenance activities using computer maintenance management systems (CMMS).

Pre-requisite: IE 441

IE 591: Graduation Project (1)**(1C, 1H)**

This is a graduation project (1) course in which the student selects the topic and project and discuss it with his faculty advisor prepares a proposal of his graduation.

Pre-requisite: Completing 114 hours**IE 592: Graduation Project (2)****(3C, 3H)**

This is a graduation project (2) course in which the students apply his design and problem-solving skills in executing the proposal in graduation project(1) writing a technical report of project details and presenting results to department committee.

Pre-requisite: IE591**IE 593: Product Development Lab****(1C, 3H)**

The course is a team projects on product development with an emphasis on benchmarking QFD, concurrent engineering, reverse engineering, and value engineering in addition to the design of production system and basics of product realizations.

Pre-requisite: IE 420**II- Elective Courses****IE 521: Tool and Die Design****(3C, 3H)**

The course discusses the role of tool design in manufacturing, design of cutting tools, design of dies for various manufacturing processes, clamping and work-holding principles, and design of jigs and fixtures.

Pre-requisite: IE 466**IE 531: PLCs in Manufacturing****(3C, 3H)**

The course covers principles of discrete control, modeling of discrete systems, discrete transfer functions and stability analysis, ladder logic principles, logic control, discrete PID controllers, and PLCs case studies

Pre-requisite: IE 431

IE 551: Lean Production Systems**(3C, 3H)**

The course covers the contemporary techniques of lean manufacturing with a focus on lean thinking, lean principles, value stream mapping, waste and inventory reduction, transition from MRP push to JIT pull production systems, shop floor scheduling and control, Total Productive Maintenance (TPM), and Kaizen continuous improvement.

Pre-requisite: IE 452**IE 552: Supply Chain Management****(3C, 3H)**

The course focuses on studying and analyzing production supply chain, vendor relations, supplier assessment, transportation models, facility location, designing warehouses and material handling systems, and analyzing data and information flow to manage materials flow and controlling logistics.

Pre-requisite: IE 452**IE 553: Enterprise Resource Planning****(3C, 3H)**

The course covers topics related to integrating various business functions in an organization in addition to organizational behaviour. This includes organizational structure, behaviour of individuals and groups in organizations, interpersonal and organizational communication networks, planning and coordinating production resources and logistics, CRM, and ERP databases and software tools.

Pre-requisite: IE 452, IE 543**IE 554 Human Resource Management****(3C, 3H)**

The course is an introduction to human resource management with a focus on hiring, training, developing, and retaining employees. The course covers employee benefits, health, safety, rights, privacy and security, employee and labor relations, compensation, and performance evaluation. The course also discusses the role of personnel departments, organizational strategic planners, and line supervisors.

Pre-requisite: IE 453**IE 555: Safety Engineering and Management****(3C, 3H)**

This course covers the critical role of safety engineering with a focus on safety national and international regulations, standards, and codes, safety analysis and human errors, appraising plant safety, hazards recognition and control, accident losses and its effect on organizations and the national economy, workers' compensation, and developing and maintaining safety programs.

Pre- requisite: Completing 100 hours

IE 556: Total Quality Management**(3C, 3H)**

The course covers Quality improvement philosophies, Total quality management (TQM) pillars, principles, and tools, quality management systems. ISO 9000 requirements and certification. Benchmarking, quality function deployment (QFD), six-sigma, and national and international quality awards.

Pre- requisite: Completing 100 hours**IE 557: Introduction to Project Management****(3C, 3H)**

This course covers the fundamentals of managing projects. Topics include: organization structure, project selection and scope definition, project team selection and development, work breakdown structures and statements of work, project scheduling, and budgeting, resource allocation, risk management planning, project controlling, and the application of project management software.

Pre- requisite: Completing 100 hours**IE 558: Entrepreneurship for Engineers****(3C, 3H)**

The course introduces students to the concepts and practices of entrepreneurship thinking. The course uses a combination of lectures, case studies, student-led discussion and team business plan, and investor presentation format to course teach students life skills that student can utilize in careers ranging from starting companies to instigating cutting edge R&D projects. Major course topics include introduction to entrepreneurship, idea generation, feasibility analysis, business planning, and characteristics of an entrepreneur.

Pre-requisite: CHE 400**IE 571: Computer Aided Design and Manufacturing****(3C, 3H)**

The course is an introduction to the concepts of computer-aided design and manufacturing (CAD/CAM). Subjects include design process, CAD/CAM integration, parametric design, surface modeling, solid modeling, design assembly, documentation with computer-aided drawings, dimensioning, engineering analysis with finite element analysis (FEA), computer numerical controls, and computer integrated manufacturing (CIM).

Pre-requisite: IE 322, IE 364**IE 539: Special Topics in Design****(3C, 3H)**

Selected topics in design.

Pre-requisite: Department Approval

IE 559: Special Topics in Engineering Management

(3C, 3H)

Selected topics in engineering management.

Pre-requisite: Department Approval

IE 570: Special Topics in Engineering Material

(3C, 3H)

Selected topics in engineering management.

Pre-requisite: Department Approval

IE 579: Special Topics in Manufacturing

(3C, 3H)

Selected topics in manufacturing.

Pre-requisite: Department Approval