



**Department of
Industrial Engineering**

**Faculty of Engineering & Technology
University of Jordan**

**B.Sc. Curriculum
2014/2015**

IE		2014	2015
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Department of Industrial Engineering
B.Sc. Curriculum
(2014-2015)

Degree Title (in English): B.Sc. in Industrial Engineering

Degree Title (in Arabic): البكالوريوس في الهندسة الصناعية

a. Degree Requirements:

The student is required to complete (160) credit hours as follows:

No.	Requirements	Credit hours
I	University requirements	27
II	Faculty requirements	21
III	Department requirements	112
	Total	160

-Practical Training: The student is required to undertake practical training after finishing the required number of credit hours in accordance with the relevant regulations for training at the Faculty of Engineering and Technology.

b. Coding System:

1- Codes of Departments:

Code	Department
01	Civil Engineering
02	Architecture Engineering
03	Electrical Engineering
04	Mechanical Engineering
05	Chemical Engineering
06	Industrial Engineering
07	Computer Engineering

2- Codes of Courses:*

Indication of Decimals in Courses Numbers

Code	Field of Specialization	Code	Field of Specialization
0	General Industrial Engineering	5	Operations Research and Statistics
1	Manufacturing	6	Maintenance
2	Management and Economy	7	Materials Science
3	Design	8	Methods Engineering
4	Control and Automation	9	Projects

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09	06	4	5	2
Faculty	Department	Level	Field	Serial

Details of the B.Sc. Curriculum:

I) University Requirements: (27) credit hours, divided as follows:

a- **Mandatory:** (21) credit hours.

b- **Electives:** (6) credit hours.

a. **Mandatory:** (21) credit hours as follows:

<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Prereq.</i>
1501101	Communication Skills / Arabic (1)	3	-
1501102	Communication Skills / Arabic (2)	3	1501101
1502101	Communication Skills / English (1)	3	-
1502102	Communication Skills / English (2)	3	1502101
1500100	Military Sciences	3	-
1900100	Computer Skills (1)	3	-
1700100	National Education	3	-

b **Elective:** 6 credit hours chosen by the student from the following table.

<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Prereq.</i>
0342100	Science and Society	3	-
0305100	The Environment	3	-
1000100	Democracy and Human Rights	3	-
0401100	Islamic Culture	3	-
0402100	Islamic System	3	-
1731101	Logic	3	-
1702101	Arabic and Islamic Civilization	3	-
1704100	Introduction to Social Science	3	-
1736100	Introduction to Sociology Science	3	-
1705100	Jordan Geography	3	-
1733100	Jordan Archeology	3	-
0641100	Home Plantation	3	-
0803100	Introduction to Library Science and Informatics	3	-
0905100	Principles in General Safety	3	-
1132100	Sport and Health	3	-
1601100	Principles of Administration		
0603100	Principles of Human Nutrition	3	-
0630100	Agriculture in Jordan	3	-

II) Faculty Requirements:

- a. **Mandatory:** (21) credit hours.
- b. **Electives:** none.

a. **Mandatory:** (21) credit hours as follows:

<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Weekly Hours</i>		<i>Prereq.</i>
			<i>Lec.</i>	<i>Prac.</i>	
0301101	Calculus (1)	3	3	-	-
0301102	Calculus (2)	3	3	-	0301101
0302101	General Physics (1)	3	3	-	-
0302111	General Physics Lab.(1)	1	-	3	0302101*
0901420	Engineering Economy	3	3	-	4 th year
0904131	Engineering Graphics	3	2	2 drawing 2 computer	-
0906111	Engineering Workshops	1	-	3	-
0906201	Technical Writing	1	1	-	1502102
1901102	Computer Skills (2)	3	3	-	1900100

* Prerequisite or Co-requisite

b. **Electives:** none.

III) Department requirements: (112) credit hours as follows:

- a. **Mandatory:** (91) credit hours.
- b. **Technical Electives:** The student chooses (21) credit hours.

a. **Mandatory:** (91) credit hours as follows:

<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hrs</i>	<i>Lec.</i>	<i>Prac.</i>	<i>Prereq.</i>
0302102	General Physics (2)	3	3	-	0302101
0303101	General Chemistry (1)	3	3	-	-
0303109	General Chemistry Lab	1	-	3	0303101*
0301201	Calculus (3)	3	3	-	0301102
0301202	Engineering Mathematics (1)	3	3	-	0301201
0903203	Electrical Engineering	3	3	-	0302102
0903204	Electrical Engineering Lab	1	-	3	0903203
0901241	Statics	3	3	-	0302101
0904222	Dynamics	3	3	-	0901241
0904248	Thermal and Fluid Sciences	3	3	-	0302102
0904249	Thermal and Fluid Sciences Lab	1	-	3	0904248
0906251	Engineering Statistics-1	3	3	-	0301102
0906273	Properties of Eng. Materials	3	3	-	0303101
0906274	Properties of Eng. Materials Lab	1	3	-	0906273
0906303	Engineering Analysis	3	3	-	0301202+1901102
0906311	Manufacturing Processes-1/metal forming	3	3	-	0906273
0906345	Systems Dynamics and Control	3	3	-	0906303
0906346	Systems Dynamics and Control Lab	1	-	3	0906345
0906352	Quality Control	3	3	-	0906251
0906353	Operations Research -1	3	3	-	0906303
0906355	Engineering Statistics-2	2	2	-	0906251
0906384	Methods Engineering and Work Measurement	3	3	-	0906251
0906411	Manufacturing Processes-2/metal cutting	3	3	-	0906311
0906412	Manufacturing Processes lab.	1	-	3	0906411
0906421	Production Planning and Control	3	3	-	0906353
0906422	Facilities Planning	3	3	-	0906421
0906437	Industrial Machines Design	3	2	3	0906411
0906441	Metrology and Engineering Measurements	3	3	-	0906411
0906442	Metrology and Engg. Measurements Lab	1	-	3	0906441
0906481	Human Factors Engineering	3	3	-	0906384
0906482	Human Factors and Work Measurement Lab	1	-	3	0906481
0906503	Industrial Engineering Information Systems	3	3	-	0906422
0906513	Metallurgical Processes	3	3	-	0906411
0906542	Automation	3	2	3	0906421
0906553	Simulation	3	3	-	0906421
0906599	Graduation Project**	3	-	-	Completion of 124 credit hours

*Prerequisite or Co-requisite.

**Project span is two regular semesters at the end of that the final grade is given.

b. **Technical Electives:** The student chooses 21 credit hours from the following table:

Engineering Management					
Course No.	Course title	Cr. Hrs.	Lec.	Prac.	Prereq.
0906401	Organization Design and Control	3	3	-	0906421
0906423	Cost Accounting	3	3	-	0901420
0906454	Algorithm Design and Programming	3	2	3	0906353
0906483	Industrial Safety Engineering	3	3	-	0906481
0906500	Selected Topics in Engineering Management	3	3	-	0906598*
0906522	Project Management	3	3	-	0901420
0906533	Product Design	3	3	-	0906437
0906551	Quality Management	3	3	-	0906352
0906552	Operations Research-2	3	3	-	0906353
0906561	Reliability and Maintainability	3	3	-	0906352
0906562	Business Systems Modeling and Design	3	3	-	0906503
0906525	Logistics and Supply Chain Management	3	3	-	0906421
0906526	Strategic Planning	3	3	-	0906421
0906527	Marketing Engineering	3	3	-	0906355
Design and Manufacturing					
0906445	Microprocessors in Industrial Engineering	3	3	-	0903207
0906501	Selected Topics in Manufacturing	3	3	-	0906598*
0906531	Computer Aided Design and Manufacturing	3	3	-	0906411
0906534	Tool and Die Design and Manufacturing	3	3	-	0906411
0906572	Biomedical Materials Engineering	3	3	-	0906273
0906573	Polymers and Plastics Engineering	3	3	-	0906273
0906574	Nano-materials Engineering	3	3	-	0906273
0906575	Surface Technology	3	3	-	0906411
0906576	Materials Testing	3	3	-	0906311
0906577	Composite Materials and Powder Technology	3	3	-	0906273
0906578	Design for Manufacture	3	3	-	0906411
0906579	Rapid Prototyping and E-Manufacturing	3	3	-	0906411
0906580	Design of Manufacturing Systems	3	3	-	0906421
0906581	Manufacturing Strategy	3	3	-	0906421+0906411

*Prerequisite or Co-requisite.

Course Offerings List

<i>Course No.</i>	<i>Course title</i>	<i>Weekly Hours</i>		<i>Cr. Hours</i>	<i>Prereq.</i>
		<i>Lec.</i>	<i>Prac.</i>		
0906111	Engineering Workshops	-	3	1	-
0906201	Technical Writing	1	-	1	1502102
0906251	Engineering Statistics-1	3	-	3	0301102
0906271	Properties of Materials	2	-	2	0303101
0906273	Properties of Engineering Materials	3	-	3	0303101
0906274	Properties of Engineering Materials Lab	-	3	1	0906273
0906275	Materials Science	3	-	3	0303101
0906276	Materials Science Lab	-	3	1	0906275
0906303	Engineering Analysis	3	-	3	1901102+ 0301202
0906310	Manufacturing Processes	3	-	3	0904372
0906311	Manufacturing Processes-1/metal forming	3	-	3	0906273
0906312	Manufacturing Processes Lab/Mechanical	-	3	1	0906310
0906345	Systems Dynamics and Control	3	-	3	0906303
0906346	Systems Dynamics and Control Lab	-	3	1	0906345
0906352	Quality Control	3	-	3	0906251
0906353	Operations Research-1	3	-	3	0906303
0906355	Engineering Statistics-2	2	-	2	0906251
0906384	Methods Engineering & Work Measurements	3	-	3	0906251
0906401	Organization Design & Control	3	-	3	0906421
0906411	Manufacturing Processes-2/metal cutting	3	-	3	0906311
0906412	Manufacturing Processes Lab	-	3	1	0906411
0906421	Production Planning and Control	3	-	3	0906353
0906422	Facilities Planning	3	-	3	0906421
0906423	Cost Accounting	3	-	3	0901420
0906437	Industrial Machines Design	2	3	3	0904411
0906441	Metrology Engineering and Measurements	3	-	3	0906411
0906442	Metrology & Engineering Measurements Lab	-	3	1	0906441
0906445	Microprocessors in Industrial Engineering	3	-	3	0903207
0906454	Algorithm Design and Programming	3	-	3	0906353
0906481	Human Factors in Engineering	3	-	3	0906384
0906482	Human Factors & Work Measurements Lab	-	3	1	0906481
0906483	Engineering Safety	3	-	3	0906481
0906500	Special Topics in Engineering Management	3	-	3	0906598*
0906501	Special Topics in Manufacturing	3	-	3	0906598*
0906503	Industrial Engineering Information Systems	3	-	3	0906422

0906513	Metallurgical Processes	3	-	3	0906411
0906522	Project Management	3	-	3	0901420
0906525	Logistics and Supply Chain Management	3	-	3	0906421
0906526	Strategic Planning	3	-	3	0906421
0906527	Marketing Engineering	3	-	3	0906355
0906531	Computer Aided Design and Manufacturing	3	-	3	0906411
0906533	Product Design	3	-	3	0906437
0906534	Tool and Die Design and Manufacture	3	-	3	0906411
0906542	Automation	2	3	3	0906421
0906551	Quality Management	3	-	3	0906352
0906552	Operations Research-2	3	-	3	0906454
0906553	Simulation	3	-	3	0906421
0906561	Reliability & Maintainability	3	-	3	0906352
0906562	Business Systems Modeling and Design	3	-	3	0906503
0906572	Biomaterials Engineering	3	-	3	0906273
0906573	Plastics Engineering	3	-	3	0906273
0906574	Nan materials Engineering	3	-	3	0906273
0906575	Surface Technology	3	-	3	0906411
0906576	Materials Testing	3	-	3	0906311
0906577	Composite Materials and Powder Technology	3	-	3	0906273
0906578	Design for Manufacture	3	-	3	0906411
0906579	Rapid Prototyping and E-Manufacturing	3	-	3	0906411
0906580	Design of Manufacturing Systems	3	-	3	0906421
0906581	Manufacturing Strategy	3	-	3	0906411+ 0906421
0906599	Graduation Project**	-	-	3	Completion of 124 credit hours

*Prerequisite or Co-requisite.

**Project span is two regular semesters at the end of that the final grade is given.

Study Plan for Industrial Engineering Students

First Year

First Semester			Second Semester		
<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>
0301101	Calculus (1)	3	0301102	Calculus (2)	3
0302101	General Physics (1)	3	0302102	General Physics (2)	3
0302111	General Physics Lab.(1)	1	1901102	Computer Skills (2)	3
1900100	Computer Skills (1)	3	0906111	Engineering Workshops	1
0303101	General Chemistry (1)	3	0904131	Engineering Graphics	3
0303109	General Chemistry Lab	1	-	University requirements	3
-	University requirements	3			
	Total	17		Total	16

Second Year

First Semester			Second Semester		
<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>
0906201	Technical Writing	1	0301202	Engineering Mathematics (1)	3
0301201	Calculus (3)	3	0904222	Dynamics	3
0901241	Statics	3	0903204	Electrical Engineering Lab	1
0903203	Electrical Engineering	3	0906274	Properties of Engineering Materials Lab	1
0906273	Properties of Engineering Materials	3	0906251	Engineering Statistics-1	3
-	University requirements	3	0904248	Thermal and Fluid Sciences	3
			-	University requirements	3
	Total	16		Total	17

Third Year

First Semester			Second Semester		
<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>
0904249	Thermal and Fluid Sciences Lab	1	0906355	Engineering Statistics-2	2
0906303	Engineering Analysis	3	0906345	Systems Dynamics and Control	3
0906311	Manufacturing Processes-1/metal forming	3	0906353	Operations Research-1	3
0906352	Quality Control	3	0906481	Human Factors in Engineering	3
0906384	Methods Engineering & Work Measurements	3	0906411	Manufacturing Processes-2/metal cutting	3
-	University requirements	3	-	University requirements	3
	Total	16		Total	17

Fourth Year

First Semester			Second Semester		
<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>
0906346	Systems Dynamics and Control Lab	1	0906422	Facilities Planning	3
0906441	Metrology Engineering and Measurements	3	0906482	Human Factors & Work Measurements Lab	1
0906421	Production Planning and Control	3	0906513	Metallurgical Processes	3
-	University requirements	3	0906442	Metrology & Engineering Measurements Lab	1
0906437	Industrial Machines Design	3	-	Technical Electives	3
0901420	Engineering Economy	3	-	Technical Electives	3
0906412	Manufacturing Processes Lab	1	-	Technical Electives	3
Total		17	Total		17

Fifth Year

First Semester			First Semester		
<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>
0906542	Automation	3	0906553	Simulation	3
0906599	Graduation Project	3			
0906503	Industrial Engineering Information Systems	3	-	Technical Electives	3
-	Technical Electives	3	-	Technical Electives	3
-	Technical Electives	3	-	University requirements	3
Total		15	Total		12

Transitional Plan

The department will continue offering the courses based on the old curriculum for the students who should comply with. After that, those who are left behind should follow the following table:

<i>New Curriculum</i>			<i>Old Curriculum</i>		
<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>	<i>Course No.</i>	<i>Course title</i>	<i>Cr. Hours</i>
0906303	Engineering Analysis*	3	0904301	Numerical Analysis	2
0904 --	Strength of material	3	0906313	Materials Technology	3
		1			
0906384	Methods Engineering & Work Measurements*	3	0906484	Methods Engineering & Work Measurements	3
0906311	Manufacturing Processes-1/metal forming*	3	0906311	Manufacturing Processes-1	3
0906411	Manufacturing Processes-2/metal cutting*	3	0906411	Manufacturing Processes-2	3
0906482	Human Factors & Work Measurements Lab*	1	0906482	Human Factors Lab	1
0906454	Algorithm Design and Programming**	3			
0906355	Engineering Statistics-2*	2			
0906503	Industrial Engineering Information Systems*	3	0906503	Information Systems	2
0906513	Metallurgical Processes*	3	0906513	Manufacturing Processes-3	2
0906552	Operations Research-2**	3	0906552	Operations Research-2	2
0906553	Simulation*	3	0906553	Simulation	2
0901420	Engineering Economy*	3	0906322	Engineering Economy & Management	3
0906401	Organization Design & Control **	3	0906401	Organization Design & Control	2
0906423	Cost Accounting**	3	0906423	Cost Accounting	2
0906483	Engineering Safety**	3	0906483	Engineering Safety	2
0906500	Special Topics in Engineering Management**	3	0906500	Special Topics in Engineering Management	2
0906501	Special Topics in Manufacturing**	3	0906501	Special Topics in Manufacturing	2
0906522	Project Management**	3	0906522	Project Management	2
0906533	Product Design**	3	0906533	Product Design	2
0906551	Quality Management**	3	0906551	Quality Management	2
0906561	Reliability & Maintainability **	3	0906561	Reliability & Maintainability	2
0906445	Microprocessors in Industrial Engineering**	3	0906445	Microprocessors in Industrial Engineering	2
0906531	Computer Aided Design and Manufacturing**	3	0906531	Computer Aided Design and Manufacturing	2
0906534	Tool and Die Design and Manufacture**	3	0906534	Die Design and Manufacture	2
0906573	Plastics Engineering**	3	0906573	Plastics Engineering	2
0906575	Surface Technology**	3	0906575	Surface Technology	2
0906562	Business Systems Modeling and Design**	3			

0906525	Logistics and Supply Chain Management**	3			
0906526	Strategic Planning**	3			
0906527	Marketing Engineering**	3			
0906572	Biomaterials Engineering**	3			
0906574	Nan materials Engineering**	3			
0906576	Materials Testing**	3			
0906577	Composite Materials and Powder Technology**	3			
0906578	Design for Manufacture**	3			
0906579	Rapid Prototyping and E-Manufacturing**	3			
0906580	Design of Manufacturing Systems**	3			
0906581	Manufacturing Strategy**	3			
			0906523	Decisions Analysis	2
			0906512	Theory of Metal Forming and Cutting	2

* Mandatory

** Technical Electives

IE Department - B.Sc. Course Description

- 0906111 *Engineering Workshops* (1 Cr. Hr.)**
General safety, materials and their classifications, measuring devices and their accuracy, fits and tolerances, theoretical background for the practical exercises including fitting, forging, carpentry, casting, welding, mechanical saws, shearers, drills, lathes, milling machines, shapers and grinders.
- 0906201 *Technical Writing* (1 Cr. Hr.)**
Prerequisite: 1502102
Basic technical writing concepts and techniques including report writing. Presentation skills.
- 0906251 *Engineering Statistics-1* (3 Cr. Hrs.)**
Prerequisite: 0301102
Quantitative and graphical descriptive statistics, probability concepts, discrete and continuous random variables and distributions, joint probability distributions, covariance and correlation of random variables, point and interval estimation, sampling distributions, hypothesis testing, introduction to simple linear regression. Practical exercises on the application of statistical methods in engineering.
- 0906273 *Properties of Engineering Materials* (3 Cr. Hrs.)**
Prerequisite: 0303101
Bonding forces and energies. Classification of engineering materials. Crystallography. X-ray diffraction. Imperfection in solids and strengthening mechanisms. Diffusion. Metallography. Mechanical properties of materials. Material testing evaluation and failure. Thermal equilibrium diagram. Corrosion of metals and their protection. Case studies in material selection. Relative cost of materials.
- 0906274 *Properties of Engineering Materials Lab* (1 Cr. Hr.)**
Prerequisite: 0906273
Destructive testing, hardness test, tension test, nondestructive testing, metallic composition testing using optical microscope, electrical and thermal conductivity testing.
- 0906303 *Engineering Analysis* (3 Cr. Hrs.)**
Prerequisite: 1901102+0301202
Linear algebra, vectors, matrices, linear equations and their solution. Transformation methods, Fourier, Laplace, practical applications using MATLAB.
- 0906311 *Manufacturing Processes-1/metal forming* (3 Cr. Hrs.)**
Prerequisite: 0904372
Mechanical behavior and forming of metals, different types of mechanical behavior and main factors affecting it. Yield criteria, representative stress and representative strain, work due to plastic deformation, classification of forming processes with respect to strain rate and temperature. Temperature rise in dynamic forming. Bulk deformation processes: forging, extrusion, rolling, rod and wire drawing. Sheet forming processes: blanking, deep-drawing and bending.

- 0906312 Manufacturing Processes (1) Lab** (1 Cr. Hrs.)
Prerequisite: 0906310
 Laboratory experiments dealing with basic material processing operations.
- 0906345 Systems Dynamics and Control** (3 Cr. Hrs.)
Prerequisite: 0301202
 Systems dynamics and modeling. Time response of systems. System stability. Design and analysis of closed-loop control systems using root locus techniques. Control by microprocessors. System characteristics. ID controllers, open-loop and closed control of systems.
- 0906346 Systems Dynamics and Control Lab** (1 Cr. Hr.)
Prerequisite: 0906345
 Lab experiments that include using existing System control packages such as MATLAB and LabView. PID controllers. Systems characteristics and stability.
- 0906352 Quality Control** (3 Cr. Hrs.)
Prerequisite: 0906251
 Concepts and statistical methods employed in the assurance of product conformance to specifications. Control charts for attributes and variables. Process capability analysis. Acceptance sampling plans and military standards.
- 0906353 Operations Research-1** (3 Cr. Hrs.)
Prerequisite: 0906303
 Mathematical modeling and operations research. Linear programming. Simplex algorithm. Duality. Transportation and assignment problems. Network models.
- 0906355 Engineering Statistics-2** (2 Cr. Hrs.)
Prerequisite: 0906251
 Analysis of Variance, linear regression, full and fractional factorial design of experiments.
- 0906384 Methods Engineering & Work Measurements** (3 Cr. Hrs.)
Prerequisite: 0906251
 Study of manufacturing and service methods and processes, analytical techniques of process flow and efficiency, improving processes study of time and movement, standardization of methods and time measurements, project.
- 0906401 Organization Design & Control** (3 Cr. Hrs.)
Prerequisite: 0906421
 Strategic planning in organizations. Organization structures. Philosophies and models for organizing. Dynamics of organization. Change & self-organization. Organizational behavior & culture.
- 0906411 Manufacturing Processes-2/metal cutting** (3 Cr. Hrs.)
Prerequisite: 0906311
 Fundamentals of material removal processes, cutting tools, cutting fluids, mechanics of chip formation and types of chips: Merchant's theory for determining different forces involved in the orthogonal cutting, power Consumption, different material removal processes, turning, drilling, shaping, milling, grinding, broaching, planning, reaming, vibration and chatter in material removal processes.

- 0906412 *Manufacturing Processes Lab*** (1 Cr. Hr.)
Prerequisite: 0906411
 Experiments on metal Forming: extrusion, forging, blanking and deep drawing. Machining, welding and casting.
- 0906421 *Production Planning and Control*** (3 Cr. Hrs.)
Prerequisite: 0906353
 Strategic issues in designing production planning and control systems. Supply Chain Management, Forecasting, Inventory Management, Aggregate Planning, Master Production Scheduling, and Materials Requirements Planning.
- 0906422 *Facilities Planning*** (3 Cr. Hrs.)
Prerequisite: 0906421
 Strategic Facilities Planning, Location Selection. Product, Process and schedual Design. Flow, Space and Activity Relationships, Personnel Requirements. Material Handling. Layout, Computer-Aided Layout. Warehouses.
- 0906423 *Cost Accounting*** (3 Cr. Hrs.)
Prerequisite: 0906421
 Concepts and theories in accounting and cost accounting, financial statements, product cost accounting models and methods, product cost accounting systems and computerized cost accounting systems.
- 0906437 *Industrial Machines Design*** (3 Cr. Hrs.)
Prerequisite: 0906411
 Transmission mechanisms and kinematics. Joints, pulleys, and belts. Gears, gear trains, cams, clutches, brakes and flywheels. Hydraulic components and circuits, bolts, shafts, keys, and springs. System integration. Design project is part of the course.
- 0906441 *Metrology Engineering and Measurements*** (3 Cr. Hrs.)
Prerequisite: 0906411
 Errors, linear, angular contour measurements, sine bar, rotating table. Fits and tolerances: interchangeability, ISO shaft and hole systems of fits and tolerances. Thread metrology. Gear metrology; surface texture, out of roundness and flatness measurements. Flow and temperature measurements. Basic electrical measurements and sensing devices DC, AC bridge, and measuring systems, transducers, smart sensors and transmitters. Force, torque and strain measurements, design of load cells.
- 0906442 *Metrology & Engineering Measurements Lab*** (1 Cr. Hr.)
Prerequisite: 0906441
 Experiments on alignment, angular measurements, diameters, surface roughness, out of roundness, screws, gears, thermocouples and oscilloscope.
- 0906445 *Microprocessors in Industrial Engineering*** (3 Cr. Hrs.)
Prerequisite: 0903207
 Digital logic design, combinatorial logic, and sequential logic. Elements of microprocessor design. Microprocessors software and hardware. Real-time applications of microprocessors.

- 0906454 *Algorithm Design and Programming*** (3 Cr. Hrs.)
Prerequisite: 0906353
 Advanced programming techniques. Introduction to Industrial Engineering algorithms and their programming. Sorting algorithms, search algorithms, shortest path, matrix operations, curve fitting.
- 0906481 *Human Factors in Engineering*** (3 Cr. Hrs.)
Prerequisite: 0906384
 Physical work and physical and physiological capacity and lamination, improving worker efficiency, anthropometry mental work and information input processing and decision making, design of displays and control, study of physical and social environment the work place.
- 0906482 *Human Factors & Work Measurements Lab*** (1 Cr. Hr.)
Prerequisite: 0906481
 Physical work and physical and physiological capacity and lamination, improving worker efficiency, anthropometry mental work and information input processing and decision making, design of displays and control, study of physical and social environment the work place.
- 0906483 *Engineering Safety*** (3 Cr. Hrs.)
Prerequisite: 0906481
 Study of hazards in the workplace, analytical tools of hazards and accidents, probabilistic concepts, safety and health syloms, national regulations and requirements, hazard control, safety and health management syloms.
- 0906500 *Special Topics in Engineering Management*** (3 Cr. Hrs.)
Prerequisite: 0906598 (or co-requisite)
 Course offered in special topics related to general areas of interest in engineering management.
- 0906501 *Special Topics in Manufacturing*** (3 Cr. Hrs.)
Prerequisite: 0906598 (or co-requisite)
 Course offered in special topics related to general areas of interest in manufacturing.
- 0906503 *Industrial Engineering Information Systems*** (3 Cr. Hrs.)
Prerequisite: 0906422
 Concepts of information systems, analytical tools, organization concepts, computer hardware and software, systems design and analysis, computer and communication systems.
- 0906513 *Metallurgical Processes*** (3 Cr. Hrs.)
Prerequisite: 0906411
 Metallurgy, heat treatment of materials, casting processes, welding processes and methods. Powder metallurgy.
- 0906522 *Project Management*** (3 Cr. Hrs.)
Prerequisite: 0901420
 Basics of project management and its importance in project success and the achievements of objectives within constraints of time, Budget, and standards. Comprehensive integrated planning for all the activities required for project success

using the project life cycle. Gantt chart, activity on arrow, activity on node for scheduling time, expenditure, and resources. Time/Cost analysis and resource allocation.

0906525 *Logistics and Supply Chain Management* (3 Cr. Hrs.)

Prerequisite: 0906421

Analytic tools and their design, factory logistics management, forecasting methods, materials management algorithms, transportation management, transportation planning and scheduling. Design of supply chains.

0906526 *Strategic Planning* (3 Cr. Hrs.)

Prerequisite: 0906421

Nature of strategic planning, development of a strategic plan. Setting vision, mission, and objectives. External evaluation, internal evaluation, analysis and selection of alternatives. Strategy implementation. Strategy review and evaluation.

0906527 *Marketing Engineering* (3 Cr. Hrs.)

Prerequisite: 0906355

Market response models, sector decisions and direction, location decisions, strategic decisions based on market analysis, new product decisions, pricing and marketing decisions.

0906531 *Computer Aided Design and Manufacturing* (3 Cr. Hrs.)

Prerequisite: 0906411

Fundamentals of computer aided engineering and design. CAD applications. Geometric modeling. Engineering analysis and finite element technique. Fundamentals of computer aided manufacturing. CNC concepts and part programming. CAD / CAM integration.

0906533 *Product Design* (3 Cr. Hrs.)

Prerequisite: 0906437

Product life cycle, value analysis and engineering, design and development approaches, feasibility study, market and competitive products analysis, analytical techniques of product design and development product quality, cost, and time parameters, QFD analysis.

0906534 *Tool and Die Design and Manufacture* (3 Cr. Hrs.)

Prerequisite: 0906411

Tools, jigs, and fixtures design. Principles of jig and fixture design. Tool design. Classification of dies, main parameters to be considered in die design, sheet metal forming dies, forming dies. Materials used in dies, manufacturing of dies and its heat treatment.

0906542 *Automation* (3 Cr. Hrs.)

Prerequisite: 0906421

Basic production concepts, analysis of serial production lines, assembly line balancing, computer numerical control, industrial robots, automated material handling systems, automated storage and retrieval systems. Lab experiments concentrate on familiarizing the student with the concepts studied in class and on PLC programming and applications.

0906551 *Quality Management* (3 Cr. Hrs.)

Prerequisite: 0906352

Leadership, customer focus, employee involvement, suppliers partnership, performance measures, tools of TQM, quality assurance systems.

0906552 *Operations Research-2* (3 Cr. Hrs.)

Prerequisite: 0906454

Probabilistic and stochastic models used in industrial engineering systems: Markov processes, stochastic processes, queuing and their applications. Discrete and continuous processes.

0906553 *Simulation* (3 Cr. Hrs.)

Prerequisite: 0906421

Probabilistic models, manual simulation, input modeling, simulation modeling, verification and validation of simulation models, output analysis, tools for reducing the variance of simulation outputs, applications and case studies.

0906561 *Reliability & Maintainability* (3 Cr. Hrs.)

Prerequisite: 0906352

Statistical and analytical concepts of failures, failure and reliability models, life-cycle of machines and its relation with reliability and maintainability, reliability and quality, project.

0906562 *Business Systems Modeling and Design* (3 Cr. Hrs.)

Prerequisite: 0906503

Systematic thinking and modeling, business process modeling, supply chain modeling, model evaluation and validation, decision analysis modeling, effect of feedback.

0906572 *Biomaterials Engineering* (3 Cr. Hrs.)

Prerequisite: 0906273

Introduction to Biomedical Engineering and biomaterials, Properties of biomaterials, Structure and Assembly, Classes of biomaterials, Applications.

0906573 *Plastics Engineering* (3 Cr. Hrs.)

Prerequisite: 0906273

Polymeric materials. Polymer microstructures, mechanical, chemical and physical properties, thermoplastic, thermoset, and elastomeric materials, polymer processing and molds, designing with plastics.

0906574 *Nanomaterials Engineering* (3 Cr. Hrs.)

Prerequisite: 0906273

Introduction to Nanotechnology, Characterization of Nanomaterials, Nanoscale structure in metals, polymers and ceramics. And applications of nanomaterials.

0906575 *Surface Technology* (3 Cr. Hrs.)

Prerequisite: 0906411

Principles of tribology. Surface failures (Corrosion, Oxidation, and wear). Surface treatments to control corrosion, oxidation, and wear. Metallic and conversion coatings (electrochemical deposition, hot dipping, anodizing, phosphating hard phasing). Organic coating. Surface hardening. Carbonizing (gas, liquid and pack), Nitriding induction hardenability and flame hardening.

- 0906576 *Materials Testing* (3 Cr. Hrs.)**
Prerequisite: 0906311
Data collection, error analysis. Tension tests, bending tests, hardness tests, strain, nondestructive testing, ultrasonic testing, electrical testing, radiation testing.
- 0906577 *Composite Materials and Powder Technology* (3 Cr. Hrs.)**
Prerequisite: 0906273
Classification of composite materials, hardening, metallic matrix, polymer matrix, ceramic matrix, powder technology, powder manufacture.
- 0906578 *Design for Manufacturing* (3 Cr. Hrs.)**
Prerequisite: 0906411
Material and process selection, design for manufacture in forming processes, DFM in casting processes. Design for assembly.
- 0906579 *Rapid Prototyping and E-Manufacturing* (3 Cr. Hrs.)**
Prerequisite: 0906437
Rapid prototyping techniques, rapid prototyping applications, e-manufacturing, integrated e-manufacturing.
- 0906580 *Design of Manufacturing Systems* (3 Cr. Hrs.)**
Prerequisite: 0906421
Introduction to production systems and processes, analysis of production systems, cellular manufacturing, flexible manufacturing, computer integrated manufacturing.
- 0906581 *Manufacturing Strategy* (3 Cr. Hrs.)**
Prerequisite: 0906411+0906421
Manufacturing strategy and operations management, process selection, technology management, product and process development, agile manufacturing, lean manufacturing, six-sigma.
- 0906599 *Graduation Project* (3 Cr. Hrs.)**
Prerequisite: Completion of 124 Credit hours
Graduation project in industrial engineering. A comprehensive project in which the student applies the knowledge and skills accumulated from different courses in some area of industrial engineering.