Industrial Engineering Department

History:

the Department of Industrial Engineering was established in the Faculty of Engineering, King Abdulaziz University, Rabigh Campus in 1430/1431 AH.

Department requirements:

In order to qualify for a B.Sc. degree in Industrial Engineering:

- A student must successfully complete 155 credit hours with an overall GPA of 2.75 out of 5 or better while satisfying the curricular requirements of his program of specialization.
- Each student is also required to complete one summer training of 10 weeks in industry under the supervision of a faculty member.
- The typical study period is five years (10 semesters) and the credit hours are distributed as follows;
    - University Requirements 26
    - Faculty Requirements 44
    - Program Compulsory Requirements 67
    - Program Elective Requirements 12
    - Free Courses (from outside Faculty) 6

Compulsory courses:

No.	Course code and number	Course title	credit hours	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	prerequiste
1-	IEN 256	Engineering Management	3	4	(3 , 0 , 1)	IEN 202, IEN 255
2-	IEN 311	Operations Research I	3	4	(3 , 0 , 1)	MATH 204
3-	IEN 322	Computer Programming for IE	3	5	(2, 3 , 0)	EEN 170
4-	IEN 323	System Analysis and Design	2	3	(2, 0 , 1)	IEN 322, MATH 204
5-	IEN 331	Engineering Prob.& Statistics	3	4	(3 , 0 , 1)	STAT110, MATH 202
6-	IEN 341	Work Study	3	6	(2 , 3 , 1)	IEN 331
7-	IEN 342	Human Factors Engineering	3	6	(2 , 3 , 1)	IEN 341
8-	IEN 361	Manufacturing Processes I	3	4	(3, 1 , 0)	MEN 130, CHEN 210
9-	IEN 363	Manufacturing Systems Design	3	4	(3 , 0 , 1)	IEN 361
10-	IEN 390	Summer Training	2	40	(0 , 0, 40)	Complete 110 CU
11-	IEN 421	Industrial Information Systems	2	4	(2, 1 , 1)	IEN 323
12-	IEN 422	Industrial Systems Simulation	3	5	(2 , 3 , 0)	IEN 322, IEN 331
13-	IEN 431	Industrial Quality Control	3	4	(3 , 0 , 1)	IEN 331
14-	IEN 432	Designof Experiments	3	4	(3 , 0 , 1)	IEN 331
15-	IEN 451	Production Planning& Control	3	4	(3 , 0 , 1)	IEN 256, IEN 341
16-	IEN 453	Facilities Planning& Design	3	4	(3 , 0 , 1)	IEN 323, IEN 341
17-	IEN 482	Industrial Entrepreneurship	2	3	(2, 0 , 1)	IEN 256
18-	IEN 498	Senior Project I	1	2	(1, 0 , 1)	Complete 110 CU
19-	IEN 499	Senior Project II	3	6	(1, 4 , 1)	IEN 498
	Total		51	116	(43,18,55)	

Courses Description

1- IEN 256 Engineering Management

Role of engineers in management of organizations. Managerial functions related to production, inventory and human resources. Project planning and control. Case studies pertaining to engineering problems.

2- IEN 311 Operations Research I

Introduction to Operations Research. Formulation of linear programming problems. Graphical solution. The Simplex algorithm. Duality and sensitivity analysis. Transportation and assignment problems. Integer and Goal programming.

3- IEN 322 Computer Programming for IE

Basics of computer programming languages. Object oriented programming concepts. Development of application and appropriate algorithms for solving Industrial Engineering problems.

4- **IEN 323 System Analysis and Design**

System definition, characteristics and concepts. Systems development projects: identification, selection, initiation, planning and managing. System analysis: determining and structuring requirements. System design: overview, forms and reports, interfaces and dialogues, and finalizing design specifications. Designing distributed and internet systems. System implementation and maintenance.

5- IEN 331 Engineering Prob. & Statistics

Descriptive statistics with graphical summaries. Basic concepts of probability and its engineering applications. Probability distributions of random variables. Confidence intervals. Introduction to hypothesis testing. Correlation and linear regression.

6- IEN 341 Work Study

Introduction to Work Study (WS). Productivity and WS. WS approaches. Basic procedure of motion study: job selection, recording facts, critical examination, etc. String diagram, Multiple activity chart, Travel chart. Principles of motion economy. Two-handed chart. Fundamental hand motions. Micro-motion and Memo-motion studies. Cyclegraph and Chrono-cyclegraph. Work Measurement (WM). Work sampling. Time study. Computerized WM. PMTS: MTM, Work factor and Standard data. Wage payment and incentive plans.

7- IEN 342 Human Factors Engineering

Introduction to human factors engineering. Muscular work. Nervous control. Work efficiency. Body size and anthropometrics. Work station design. Heavy work. Handling loads. Man-machine systems. Mental activity. Fatigue. Stress and boredom. Vision and lighting. Noise and vibration.

8- IEN 361 Manufacturing Processes I

To introduce the students with the fundamentals of: the role of manufacturing processes, mechanical behavior of materials, casting processes, bulk deformation processes, material removal processes, sheet metal forming processes and modern manufacturing systems.

9- IEN 363 Manufacturing Systems Design

Manufacturing operations, manufacturing models and performance metrics, design of manufacturing systems including cellular, manufacturing and flexible manufacturing

systems. Analysis of process selection, planning, optimization and economic of manufacturing systems, group technology, transfer lines. Computer–aided manufacturing.

10- IEN 390 Summer Training

On-site industry based training spanning over a period of 8 weeks in a manufacturing or service industry under the supervision of an industry based advisor. Documentation of the training in the form of an Industrial Training report presenting details of the work undertaken. Multimedia presentation illustrating the achievements of training.

11- IEN 421 Industrial Information Systems

Basics of computer programming languages. Object oriented programming concepts. Development of application and appropriate algorithms for solving Industrial Engineering problems.

12- IEN 422 Industrial Systems Simulation

Basic theory of industrial simulation. Building simulation models. Organization of simulation studies. Simulation modeling and application to medium and large-scale production and service system problems. Output analysis. Variance reduction and optimization. Use of software such as ARENA for discrete and continuous system simulation.

13- IEN 431 Industrial Quality Control

Introduction to quality systems. Cost of quality. Total quality management. Quality systems and standards: six sigma and ISO. Reengineering. Statistical quality control: control charts for variables and attributes, process capability analysis, acceptance sampling plans. Quality function deployment. Quality circles. Quality loss functions.

14- IEN 432 Design of Experiments

Principles of experimental design. Randomized complete block designs. Latin square and Graeco-Latin square designs. General factorial designs. 2^k Factorial designs. Response surface methodology and robust design. Planning, performing and analyzing industrial experiments.

15- IEN 451 Production Planning and Control

Basic concepts of Production and Operations Management (POM). Design of products and services. Processes and technologies. E-commerce and operations management. Inventory management. Supply-Chain management. Just-in-time and lean production. Forecasting. Material Requirements Planning (MRP). Introduction to Enterprise Requirement Planning (ERP). Capacity and Aggregate planning. Scheduling.

16- IEN 453 Facilities Planning and Design

Fundamentals of facilities planning. Facilities design. Flow, space and activity relationships. Material handling systems. Layout planning models. Warehouse operations. Quantitative facilities planning models. Preparing, presenting, implementing and maintaining facilities plan**.**

17- IEN 482 Industrial Entrepreneurship

Overview of the entrepreneurial process from an engineering perspective. Idea generation, planning, financing, marketing, protecting, staffing, leading, growing, and harvesting. Basic framework for understanding the process of entrepreneurship, principles of management and related techniques in decision making, planning,

marketing, and financial control. Exercises in product design and prototype development, preparation of workable project feasibility reports, practical ideas about launching own enterprises. Classroom lectures are combined with field study and exercises supplemented with guest lectures and case studies on small and medium scale industries. Students write startup business plans.

18- IEN 498 Senior Project I

Technical writing skills. Project work: a team-based capstone design work involving a practical, open ended, real life unstructured problem having a set of alternative solutions; emphasis on synthesis of knowledge and skills to assimilate and demonstrate a professional attitude and ethics in problem solving with assessment of environmental, cultural and social impacts; final output in the form of written report based on specified standard format, followed by a multimedia presentation of the work undertaken in the project.

19- IEN 499 Senior Project II

Technical writing skills. Project work: a team-based capstone design work involving a practical, open ended, real life unstructured problem having a set of alternative solutions; emphasis on synthesis of knowledge and skills to assimilate and demonstrate a professional attitude and ethics in problem solving with assessment of environmental, cultural and social impacts; final output in the form of written report based on specified standard format, followed by a multimedia presentation of the work undertaken in the project.

Compulsory courses from outside the department

Course code and number	Course title	credit hours	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	prerequiste
EEN 100	Electrical Circuits I	3	6	(2 ، 2 ، 2)	PHYS 202
MEN 130	Basic Workshop	1	4	(0 ، 3 ، 1)	---
CHEN 210	Materials Science &Eng.	3	5	(2 ، 2 ، 1)	CHEM 281
MEN 225	Engineering Mechanics	3	5	(3 ، 0 ، 2)	PHYS 281
EEN 332	Numerical Methods in Eng	3	4	(3, 0 , 1)	EEN 170, MATH 204
MEN 367	Thermo–Fluids	3	4	(3 , 0 , 1)	PHYS 281, MATH 202
Total		16	28	(13,7,8)	

1- EEN 100: Electrical Circuits

Electric quantities and circuit elements; Kirchhoff's laws; Mesh and node analyses; Sinusoidal steady-state analysis using phasors; Network theorem and transformations. Three-phase circuits.

2- MEN 130 Basic Workshop I

Introduction to principles of production, Engineering materials, Measurements, Standards Specifications, Foundry, Metal forming (forging, extrusion, drawing, press work, rolling, wire drawing), Sheet metal work, Welding, metal cutting and machine tools (sawing, drilling, turning, milling, shaping, slotting, grinding), Fitting, Industrial safety, Production management and production planning.

3- CHEN 210 Materials Science and Eng

Classification of engineering materials. Atomic and molecular bonding. Properties and microstructure. Elastic and plastic behavior. Order in solids, phases and solid- solutions, crystal geometry, disorder in solids, atomic movement and rearrangement, phase diagrams, solid-state transformations. Applications of metals, ceramics, polymers and composites. Service stability, corrosion and failure. Involves laboratory experiments and practices

4- MEN 225 Engineering Mechanics

General Principles of Statics; Force Vectors (2D & 3D); Equilibrium of a Particle (2D & 3D); Force System Resultants (2D & 3D); Equilibrium of a Rigid Body (2D); Center of Gravity and centroid of a Body, Mass moment of inertia, Rotation and translation of a rigid body in the plane, General plane motion, Displacement, velocity, and acceleration of rigid bodies, Equations of motion for a rigid body,

5- MEN 367 Thermo-Fluids

Fundamentals of Thermodynamics, First and Second Laws of Thermodynamics, Various power and refrigeration cycles, Heat transfer modes including steady and unsteady conduction, convection and radiation, Flow statics and buoyancy, Mass, momentum and energy conservation, Bernoulli equations, Internal and external flows.

List of selective courses for Industrial Engineering department.

No.	Course code and number	Course title	credit hours	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	prerequiste
1-	IEN 321	Automation and Control	3	5	(2, 3, 0)	MATH 204, EEN 170
2-	IEN 362	Manufacturing Processes II	3	4	(3,0,1)	IEN 361
3-	IEN 393	Industrial Internship*	6	5	(2,3,0)	IEN 101, IEN 202, IEN 390, GPA 3.0
4-	IEN 411	Operations Research II	3	5	(2,3,0)	IEN 311, IEN 331
5-	IEN 412	Industrial Stochastic Systems	3	4	(3,0,1)	IEN 331
6-	IEN 423	Feasibility Studies	3	4	(3,1,0)	IEN 255, IEN 323
7-	IEN 424	Industrial Data Systems	3	4	(3,0,1)	IEN 421
8-	IEN 433	Reliability Engineering	3	4	(3,0,1)	IEN 331
9-	IEN 434	Maintenance Engineering	3	4	(3,0,1)	IEN 256, IEN 331
10-	IEN 441	Industrial Safety Engineering	3	4	(3,0,1)	IEN 342
11-	IEN 450	Marketing Management and Research	3	4	(3,0,1)	IEN 256
12-	IEN 454	Engineering Cost Analysis	3	4	(3,0,1)	IEN 255
13-	IEN 455	Global Logistics Management	3	4	(3,0,1)	IEN 255, IEN 331
14-	IEN 456	Project Management	3	4	(3,0,1)	IEN 256
15-	IEN 457	Supply Chain Management	3	4	(3,0,1)	IEN 256, IEN 451
16-	IEN 458	Strategic Management	3	4	(3,0,1)	IEN 256
17-	IEN 459	Operations Management	3	4	(3,0,1)	IEN 451
18-	IEN 461	CAD / CAM	3	4	(3,0,1)	MEN 100, IEN 361
19-	IEN 462	Computer Integrated Mfg.	3	4	(3,0,1)	MEN 100, IEN 361
20-	IEN 463	Design for Mfg. and Assembly	3	4	(3,1,0)	MEN 130
21-	IEN 464	Engineering Metrology	3	40	(0,0,40)	IEN 361
22-	IEN 490	Special Topics in IE	3	4	(3,0,1)	Department Approval
	Total		69	127	(60,11,56)	

Courses Desc.:

1- IEN 321 Automation and Control

Provide the student with basic skills useful in identifying the concepts of automatic control, automated machines and equipment and describe the terms and phrases associated with automatic control and industrial automation. The student will perform preventative maintenance, identify or solve problems in machines, and other technologies. Performance will be satisfactory when student can demonstrate competence in maintaining and troubleshooting technology includes identifying, understanding, and performing routine preventative maintenance and service on technology; detecting more serious problems; generating workable solutions to correct deviations; and recognizing when to get additional help.

2- IEN 362 Manufacturing Processes II

Fundamentals of cutting. Mechanics of chip formation. Cutting forces and power. Effect of temperature on cutting. Tool life. Machinability: Metal removal rate, Cutting tool materials and fluids. Machining processes: turning, thread cutting, boring, drilling, reaming, milling, shaping and planning, broaching, gear cutting. Abrasives, grinding wheels, grinding processes. Super finishing process: Lapping, honing, blasting. Non-conventional machining: Principles, Ultrasonic machining, Electromechanical Machining, Electro-discharge Machining, Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining. Numerical Control of Machine Tools: Automation of Manufacturing Processes, Numerical Control, Coordinate systems, Types and components of CNC systems, Programming for CNC, Adaptive control, Computer Integrated Manufacturing.

3- IEN 393 Industrial Internship

Occupational experience in an industrial facility for one complete semester (4 months). Work experience is cooperatively planned by the department and employer to fulfill the student's objectives. Students apply classroom and laboratory concepts and principles in an industry work environment.

4- IEN 411 Operations Research II

Non-linear programming. Dynamic programming. Inventory models. Waiting line models. Markov analysis. Introduction to Game theory. Applications in industrial, service and public systems.

5- IEN 412 Industrial Stochastic Systems

Deterministic and stochastic processes. Poisson process and related distributions. Birth and death processes. Markov processes with continuous state space. Renewal process and theory. Markovian decision processes in industry. Markovian and non-Markovian systems. Stochastic models for transportation and maintenance systems. Introduction to simulation modeling of stochastic systems.

6- IEN 423 Feasibility Studies

Introduction to feasibility studies: project identification, product mix and scope. Marketing feasibility: present and future market study, demand, pricing, and revenue. Technical feasibility: site selection, material, labor, equipment, knowhow, and shipping. Financial feasibility: project financing, production cost, break-even analysis, profitability analysis Organizational and administrative feasibility: Organizational

structure, governmental regulations, safety and environmental standards, patents and human relations. Reporting and presentation. Case studies.

7- IEN 424 Industrial Data Systems

Concepts of advanced database management system design, principles and techniques. Entity relationship diagram. Normalization. Object oriented and object relational databases. Data warehousing. Data mining. Web and semi structural data. Data Security.

8- IEN 433 Reliability Engineering

Introduction to reliability analysis. Reliability measures: reliability function, expected life, hazard function of important distribution functions. Hazard models and product life. Extreme value distribution. Static reliability models. Dynamic reliability models. System effectiveness measures. Reliability allocation and optimization. Introduction to fault tree analysis and human reliability

9- IEN 434 Maintenance Engineering

Maintenance systems. Maintenance operation and control. Preventive Maintenance: concepts, modeling, and analysis. Maintenance planning and scheduling. Maintenance material control. Computerized Maintenance Management Systems. Replacement studies. Case studies.

10- IEN 441 Industrial Safety Engineering

Accident: causes and costs. Appraising safety performance and risk assessment. Analysis of accident causes. Accident reports and records. Job safety analysis. Plant inspection. Accident investigation. Plant layout and arrangement. Plant housekeeping. Maintenance and safety. Material handling and safety. Machine guarding. Explosion and fire prevention. Personal protection. First aid. Planning for emergencies.

11- IEN 450 Marketing Management and Research

Study of marketing theory. Methods of marketing. Interrelationship of the different phases of marketing strategies. Consumer decision processes through behavioral sciences. Theories and techniques of planning, analyzing and presenting market studies. Methodologies of marketing research with emphasis on primary research including questionnaire design.

12- IEN 454 Engineering Cost Analysis

Importance of cost analysis in engineering. Cost terms and concepts. Cost estimation for decision making: cost-volume-profit analysis, measuring relevant costs and revenues, cost assignment and activity-based costing. Cost evaluation of engineering alternatives. Case studies.

13- IEN 455 Global Logistics Management

This course will provide an intensive and coordinated approach to study the flow of goods and services from raw material suppliers to the final customer. This product flow will be reviewed from a global perspective, providing a comprehensive understanding of the international business. Students will gain an insight into every step of the global logistics process, from order processing and purchasing to packaging and warehousing. Different functional aspects of the logistics system are discussed including customer service, materials handling, packaging, storage and transportation. The course will discuss the consequences of globalization for local logistics structures, management

concepts and strategies to control international networks as well as sustainability of supply chains.

14- IEN 456 Project Management

Introduction to engineering project management. Planning successful projects. Specifying, budgeting, implementing, executing, scheduling, delivery options, and closeout. Scheduling tasks and resources. Resource leveling. Common characteristics of projects. Network tools for project planning and monitoring. Cost optimization to meet project objectives. Project crashing, time-cost trade-offs. Risk analysis. Software for project planning and scheduling.

15- IEN 457 Supply Chain Management

Introduction to Supply Chains (SC). Flow across SC of products, information and revenue. SC operations: issues, opportunities, tools, approaches, inter-corporate relationships, incentives and risk factors. SC design: customer service, quality, logistics, inventory, business processes, system dynamics, control, design, and re-engineering. Integrated SC management: forecasting, global sourcing, and virtual integration. Technology as an SC tool: internet technologies and digital coordination of decisions and resources. Case studies.

16- IEN 458 Strategic Management

Overview of operations strategy for competitive advantage. Evaluation of a firm's external environment using Porter Five Forces Model. Evaluation of a firm's internal capabilities using the VRIO framework. Cost leadership versus product differentiation strategies. Vertical integration and corporate diversification. Strategic alliances, mergers and acquisitions. Real life examples and case studies from industry.

17- IEN 459 Operations Management

Concepts, problems and techniques applicable to the operations of a variety of business organizations – manufacturing/production and services. The emphasis is on decision making (to include business ethics) in operational areas such as: facility requirements and utilization, control and coordination of resource inputs and outputs, types of transformation/conversion processes, and performance measurements. The course will analyze operations from both the strategic and operational perspectives and highlight the competitive advantages that operations can provide for the organization.

18- IEN 461 CAD/CAM

Foundation of CAD/CAM. Fundamentals of CAM. Computer graphics software and data. Computer aided manufacturing: numerical control, NC part programming, NC, DNC and CNC systems. Industrial robots and applications. Computer Integrated manufacturing systems (CIMS).

19- IEN 462 Computer Integrated Mfg.

This course is designed to highlight the major automation-related subjects within the scope of manufacturing system. Special emphasis will be given on industrial robotics, robot programming and flexible manufacturing systems (FMS). Laboratory exercises will deal with robotic programming and experiment with FMS systems. The elements of a flexible manufacturing environment such as CNC machines, robots, conveyors are modeled and operated via OpenCIM software package.

20- IEN 463 Design for Mfg. and Assembly

Introduction to Product Development, Introduction to Design For Manufacture And Assembly (DFMA), Selection of Material and Process, Design For Manual Assembly, Design For Automated Assembly, Design For Machining, Design For Injection Moulding, Design For Sheet Metalworking, DFMA software.

21- IEN 464 Engineering Metrology

Basics of CAM; Process engineering, manufacturing process optimization; Group technology; Methods of group technology; Cellular manufacturing systems; Computer aided process planning; Industrial robots application and programming.

22- IEN 490 Special Topics in Industrial Engineering

In-depth study of relevant industrial engineering topics not covered in other courses of the program in order to enhance students' knowledge in the field of industrial engineering.