

# Bachelor of Industrial Engineering

**College of Engineering & Advance Computing, Alfaisal University**

*Effective: Fall 2024 with a track & a minor*

Website: <https://coe.alfaisal.edu/en/ie-home>

Catalog: <https://catalog.alfaisal.edu/college-of-engineering-degree-programs>

## Curriculum Structure and Study Plan

The Bachelor of Industrial Engineering curriculum is composed of **142** Credit Hours (CRHs) divided as follows:

- I. General Education Requirements (50 CRHs)**
  1. Mathematics & Statistics (21 CRHs)
  2. Basic Sciences (12 CRHs)
  3. Humanities (13 CRHs)
- II. Core Requirements (92 CRHs)**
  1. Industrial Engineering Courses (45 CRHs)
  2. College of Engineering Courses (38 CRHs)
  3. Technical Electives (9 CRHs)
  4. Summer Internship (0 CRHs)

### I. General Education Requirements (50 CRHs)

#### 1. Mathematics & Statistics (21 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
<b>MAT 101</b>	<b>Calculus I</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>		
<b>MAT 112</b>	<b>Calculus II</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>MAT 101</b>	
<b>MAT 211</b>	<b>Calculus III</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>MAT 112</b>	
<b>MAT 212</b>	<b>Linear Algebra</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>MAT 112</b>	
<b>MAT 213</b>	<b>Differential Equations</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>MAT 112</b>	<b>MAT 212</b>
<b>MAT 224</b>	<b>Numerical Methods</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>MAT 212</b>	
<b>STA 212</b>	<b>Probability and Statistics for Engineers</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>MAT 112</b>	

**2. Basic Sciences (12 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
CHM 102	Introduction to Chemistry	3	3	0	1		
CHM 102 L	Introduction to Chemistry Lab	1	0	2	0		CHEM 102
PHU 103	Mechanics and Waves for Engineers	3	3	0	1		MAT 101
PHU 103 L	Mechanics and Waves for Engineers Lab	1	0	2	0		PHU 103
PHU 124	Electromagnetism and Optics for Engineers	3	3	0	1	PHU 103, MAT 101	
PHU 124 L	Electromagnetism and Optics for Engineers Lab	1	0	2	0	PHU 103, MAT 101	PHU 124

**3. Humanities (13 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ENG 101	University Writing I	3	3	0	0		
ENG _ _ _	English Elective	3	3	0	0		
ENG 222	Technical Writing	3	3	0	0	ENG 101	
ISL 101	Islamic Studies I	2	2	0	0		
ARB 101	Arabic Literature I	2	2	0	0		

**II. Core Requirements (92 CRHs)**

**1. Industrial Engineering Courses (45 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
IE 301	Operations Research I	3	3	0	0	MAT 212	
IE 302	Operations Research II	3	3	0	0	IE 301, STA 212	
IE 304	Production and Service Systems Planning I	3	3	0	0	STA 212	IE 301
IE 305	Production and Service Systems Planning II	3	3	0	0	IE 304	
IE 307	Work System Analysis & Design	3	3	0	0	STA 212	
IE 307 L	Work System Analysis & Design Lab	1	0	2	0		IE 307
IE 309	Human Factors and Ergonomics	3	3	0	0	STA 212	IE 307
IE 309 L	Human Factors and Ergonomics Lab	1	0	2	0		IE 309
IE 315	Engineering Economy and Cost Analysis	3	3	0	0	STA 212	
IE 330	Simulation	3	3	0	0	SE 100, STA 212	
IE 330 L	Simulation Lab	1	0	2	0		IE 330
IE 401	Network Models and Project Management	3	3	0	0	IE 301	
IE 406	Quality Engineering	3	3	0	0	IE 305	
IE 415	Production Information Systems	3	3	0	0	IE 305	
IE 450	Management for Engineers	3	3	0	0	IE 305	
IE 495	Industrial Engineering Capstone Project I	3	0	6	0	IE 302, IE 305	
IE 496	Industrial Engineering Capstone Project II	3	0	6	0	IE 495	

### 2. College of Engineering Courses (38 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
EE 207	Foundations of Electrical Engineering	3	3	0	1	PHU 124	MAT 213
EE 207 L	Foundations of Electrical Engineering Lab	0	0	2	0	PHU 124	MAT 213, EE 207
SE 100	Programming for Engineers	3	3	0	0		
SE 100 L	Programming for Engineers Lab	0	0	2	0		SE 100
ME 201	Materials Science and Engineering	3	3	0	0	CHM 102	
ME 201 L	Materials Science and Engineering Lab	1	0	2	0	CHM 102	ME 201
ME 203	Applied Mechanics I: Statics	3	3	0	0	PHU 103, MAT 112	
ME 205	Introduction to Computer Aided Design	3	3	0	0		
ME 206	Thermal Fluids Engineering I	3	3	0	0	PHU 103	
ME 206 L	Thermal Fluids Engineering I Lab	1	0	2	0	PHU 103	ME 206
ME 208	Mechanics of Materials I	3	3	0	0	ME 201	
ME 208 L	Mechanics of Materials I Lab	1	0	2	0	ME 201	ME 208
ME 305	Manufacturing and Workshop Training	3	3	0	0	ME 201	
ME 305 L	Manufacturing and Workshop Training Lab	1	0	2	0	ME 201	ME 305
ME 306	Instrumentation and Control Engineering	3	3	0	0	EE 207	
ME 306 L	Instrumentation and Control Engineering Lab	1	0	2	0	EE 207	ME 306
ME 308	Advanced Manufacturing Processes	3	3	0	0	ME 305	
ME 308 L	Advanced Manufacturing Processes Lab	1	0	2	0	ME 305	ME 308

**3. Technical Electives (9 CRHs)**

Select from the following courses:

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
<b>IE 400</b>	<b>Special Topics in Industrial Engineering</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 305</b>	
<b>IE 420</b>	<b>Reliability and Maintenance Engineering</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 305</b>	
<b>IE 421</b>	<b>Product Design and Development</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>E 308</b>	
	<b>Advanced Visualization and Simulation</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 30</b>	
<b>IE 430</b>	<b>New Product Development</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 309</b>	
<b>IE 435</b>	<b>Undergraduate Research in Industrial Engineering</b>	<b>3</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>Department approval. A GPA of at least 3.0/4.0, and a signed research contract</b>	
<b>IE 440</b>	<b>Heuristic Methods for Optimization</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 302</b>	
<b>IE 445</b>	<b>Cognitive Ergonomics</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 309</b>	
<b>IE 455</b>	<b>Data Mining and Application in Engineering</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 330</b>	
<b>IE 460</b>	<b>Industrial IoT</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>IE 330</b>	

**4. Summer Internship (0 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)	Pre-Requisite Course Code	Co-Requisite Course Code
<b>IE 390</b>	<b>Industrial Engineering Summer Internship</b>	<b>0</b>	<b>Department Approval</b>	

**Typical Study Plan-Industrial Engineering Program**

**4-Year Curriculum: 142 Credit Hours Total**

Each course below follows the following format:

Course Code, Course Title, and Course Credit Hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)

<i>1<sup>st</sup> Year</i>			
<b>Fall</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	CHM 102	Introduction to Chemistry	3 (3-0-1)
	CHM 102 L	Introduction to Chemistry Lab	1 (0-2-0)
	MAT 101	Calculus I	3 (3-0-0)
	PHU 103	Mechanics and Waves for Engineers	3 (3-0-1)
	PHU 103 L	Mechanics and Waves for Engineers Lab	1 (0-2-0)
	ENG 101	University Writing I	3 (3-0-0)
	ARB 101	Arabic Language I	2 (3-0-0)
<b>Total</b>			<b>16</b>
<b>Spring</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	SE 100	Programming for Engineers	3 (3-0-0)
	SE 100 L	Programming for Engineers Lab	1 (0-2-0)
	ME 201	Materials Science and Engineering	3 (3-1-0)
	ME 201 L	Materials Science and Engineering Lab.	1 (0-2-0)
	MAT 112	Calculus II	3 (3-0-0)
	PHU 124	Electromagnetism and Optics for Engineers	3 (3-2-1)
	PHU 124 L	Electromagnetism and Optics for Engineers Lab	1 (0-2-0)
	ENG ___	English Elective	3 (3-0-0)
<b>Total</b>			<b>18</b>

<i>2<sup>nd</sup> Year</i>			
<b>Fall</b>	Course Code	Course-Title	CRHs
	ME 203	Applied Mechanics I: Statics	3 (3-0-0)
	ME 205	Introduction to Computer Aided Design	3 (3-0-0)
	ME 305	Manufacturing and Workshop Training	3 (3-0-0)
	ME 305 L	Manufacturing and Workshop Training Lab	1 (0-2-0)
	MAT 211	Calculus III	3 (3-0-0)
	MAT 212	Linear Algebra	3 (3-0-0)
	MAT 213	Differential Equations	3 (3-0-0)
<b>Total</b>			<b>19</b>
<b>Spring</b>	Course Code	Course-Title	CRHs
	EE 207	Foundations of Electrical Engineering	3 (3-0-1)
	EE 207 L	Foundations of Electrical Engineering Lab	1 (0-2-0)
	ME 206	Thermal Fluids Engineering I	3 (3-0-0)
	ME 206 L	Thermal Fluids Engineering I Lab	1 (0-2-0)
	ME 208	Mechanics of Materials I	3 (3-0-0)
	ME 208 L	Mechanics of Materials I Lab	1 (0-2-0)
	MAT 224	Numerical Methods	3 (3-0-0)
STA 212	Probability and Statistics for Engineers	3 (3-0-0)	
<b>Total</b>			<b>18</b>



<i>3<sup>rd</sup> Year</i>			
<b>Fall</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 301</b>	<b>Operations Research I</b>	<b>3 (3-0-0)</b>
	<b>IE 304</b>	<b>Production and Service Systems Planning I</b>	<b>3 (3-0-0)</b>
	<b>IE 307</b>	<b>Work Systems Analysis &amp; Design</b>	<b>3 (3-0-0)</b>
	<b>IE 307 L</b>	<b>Work Systems Analysis &amp; Design Lab</b>	<b>1 (0-2-0)</b>
	<b>IE 309</b>	<b>Human Factors and Ergonomics</b>	<b>3 (3-0-0)</b>
	<b>IE 309 L</b>	<b>Human Factors and Ergonomics Lab</b>	<b>1 (0-2-0)</b>
	<b>ENG 222</b>	<b>Technical Writing</b>	<b>3 (3-0-0)</b>
	<b>ISL 101</b>	<b>Islamic Studies I</b>	<b>2 (2-0-0)</b>
<b>Total</b>			<b>19</b>
<b>Spring</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 302</b>	<b>Operations Research II</b>	<b>3 (3-0-0)</b>
	<b>IE 305</b>	<b>Production and Service Systems Planning II</b>	<b>3 (3-0-0)</b>
	<b>IE 315</b>	<b>Engineering Economy and Cost Analysis</b>	<b>3 (3-0-0)</b>
	<b>IE 330</b>	<b>Simulation</b>	<b>3 (3-0-0)</b>
	<b>IE 330 L</b>	<b>Simulation Lab</b>	<b>1 (0-2-0)</b>
	<b>ME 308</b>	<b>Advanced Manufacturing Processes</b>	<b>3 (3-0-0)</b>
	<b>ME 308 L</b>	<b>Advanced Manufacturing Processes Lab</b>	<b>1 (0-2-0)</b>
<b>Total</b>			<b>17</b>
<b>Summer</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 390</b>	<b>Industrial Engineering Summer Internship</b>	<b>0 (0-0-0)</b>
<b>Total</b>			<b>0</b>

<b>4<sup>th</sup> Year</b>			
<b>Fall</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 401</b>	<b>Network Models and Project Management</b>	<b>3 (3-0-0)</b>
	<b>IE 415</b>	<b>Production Information Systems</b>	<b>3 (3-0-0)</b>
	<b>IE 4**</b>	<b>Technical Elective</b>	<b>3 (3-0-0)</b>
	<b>IE 4**</b>	<b>Technical Elective</b>	<b>3 (3-0-0)</b>
	<b>IE 495</b>	<b>Industrial Engineering Capstone Project I</b>	<b>3 (0-6-0)</b>
	<b>---</b>	<b>General Education Elective I</b>	<b>2 (2-0-0)</b>
<b>Total</b>			<b>17</b>
<b>Spring</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 406</b>	<b>Quality Engineering</b>	<b>3 (3-0-0)</b>
	<b>IE 450</b>	<b>Management for Engineers</b>	<b>3 (3-0-0)</b>
	<b>IE 4**</b>	<b>Technical Elective</b>	<b>3 (3-0-0)</b>
	<b>IE 496</b>	<b>Industrial Engineering Capstone Project II</b>	<b>3 (0-6-0)</b>
	<b>ME 306</b>	<b>Instrumentation and Control Engineering</b>	<b>3 (3-0-0)</b>
	<b>ME 306 L</b>	<b>Instrumentation and Control Engineering Lab</b>	<b>1 (0-2-0)</b>
<b>----</b>	<b>General Education Elective II</b>	<b>2 (2-0-0)</b>	
<b>Total</b>			<b>18</b>

## **Industrial Engineering Track: Digital Design and Manufacturing**

Industrial Engineering (IE) students have the option to select electives in the fourth year according to their desired academic objective in consultation with their academic advisor. Regular non-track students select any three of the offered IE electives in the fourth year. IE students also have the option to follow the Digital Design and Manufacturing track in the program. Irrespective of whether a student opts for the Digital Design and Manufacturing track or not, the total credits for electives must be 9 CRHs. All offered technical electives are available for regular non-track students, whether they opt for the track or not.

In summary, all IE students follow the same curriculum and take the same required courses, with the difference being the designation of the electives in the fourth year.

A regular non-track student would have the following electives distribution in the fourth year.

<b><i>4th Year Electives</i></b>			
<b>Fall</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 4**</b>	<b>Technical Elective</b>	<b>3 (3-0-0)</b>
	<b>IE 4**</b>	<b>Technical Elective</b>	<b>3 (3-0-0)</b>
<b>Total</b>			<b>6</b>
<b>Spring</b>	<b>Course Code</b>	<b>Course-Title</b>	<b>CRHs</b>
	<b>IE 4***</b>	<b>Technical Elective</b>	<b>3 (3-0-0)</b>
<b>Total</b>			<b>3</b>

Per standing policy, and with the approval of the department chair, a student may opt to take one of the 3 CRH technical electives from another engineering program.

### Digital Design and Manufacturing track

The industrial and information revolutions made tremendous impact on manufacturing and communication systems of today. Technologies developed in those revolutions are fusing into a new industrial revolution now known as Industry 4.0 where digital information is inherent in manufacturing activities. Industry 4.0 changes the way products are designed and manufactured today and will revolutionize product development in future.

Industrial Engineering (IE) department, in conjunction with the Mechanical Engineering (ME) department, offers the Digital Design and Manufacturing track to prepare students for Industry 4.0. Students opting for this track will gain focused knowledge by taking electives offered by ME and IE departments in this interdisciplinary area.

#### Course Requirements for Digital Design and Manufacturing track

Students must complete the following (6 CRHs) core courses:

- ME 308 Advanced Manufacturing Processes (3 CRHs)
- IE 315 Engineering Economy and Cost Analysis (3 CRHs)

In addition, students will need to complete three courses (9 CRHs) from the list below:

- ME 419 Product Design and Development (3 CRHs) (To be offered in Spring semester)
- ME 420 Advanced Visualization and Simulation (3 CRHs) (To be offered in Spring semester)
- IE 455 Data Mining and Application in Engineering (3 CRHs)
- IE 460 Industrial IoT (3 CRHs)

A student opting for the Digital Design and Manufacturing track can take two and one electives in the Fall and Spring semesters, respectively or vice versa based on electives distribution in the fourth year.

### **Minor in Industrial Engineering (for ME students)**

IE department offers a minor in Industrial Engineering which is open to ME students only. Students opting for this minor will gain concentrated knowledge by taking advanced IE courses.

Students taking the IE minor are expected to take additional 15 CRHs on top of their existing ME study plan courses from the following list of existing ME courses:

#### **Required Courses (6 CRHs)**

- IE 301 Operations Research I (3 CHRs).
- IE 304 Production and Service Systems Planning I (3 CHRs).

#### **Optional Courses (select 9 CRHs)**

- IE 307 Work System Analysis & Design (3 CHRs).
- IE 307 L Work System Analysis & Design Lab (1 CHRs).
- IE 315 Engineering Economy and Cost Analysis (3 CHRs).
- IE 330 Simulation (3 CHRs).
- IE 330 L Simulation Lab (1 CHR).
- IE 406 Quality Engineering (3 CHRs).
- IE 450 Management for Engineers (3 CHRs).

#### **General Guidelines**

1. The student must complete a total of additional 15 CRHs from IE department
2. Entry Point: Nominally before or at end of Year 2 (sophomore-level) to allow for sufficient time to complete all the courses.
3. The student must have a minimum GPA of 3.25. Admission to the minor is subject to the approval of the ME and IE departments.
4. The student should complete the main degree requirements before starting the minor.
5. Any of the pre-approved courses can be taken whenever the course is offered by IE department and subject to prevailing academic regulations.
6. Lab courses cannot be taken on their own. A Lab course has to be taken with or after the corresponding course has been taken.
7. Completion of a minor program is posted on the transcript alongside the main major. Minor programs are not noted on diplomas.

## Course Descriptions

In this section we give the course descriptions of Industrial Engineering courses of the program.

Each course below follows the following format:

**Course Code Course Title Course Credit Hours (Lecture contact hours–Lab contact hours–Tutorial contact hours)**

Course Description

*Pre-requisites*

*Co-requisites*

### **IE 301 Operations Research I**

**3 (3-0-0)**

The course includes deterministic operations research modelling concepts; linear programming modelling, simplex theory, duality and sensitivity analysis with economic interpretation; transportation and assignment problems; integer programming; branch and bound techniques; nonlinear optimization problems; multi-criteria decision making.

*Pre-requisites: MAT 212*

*Co-requisites: none*

### **IE 302 Operations Research II**

**3 (3-0-0)**

This course introduces probability models used to investigate the behavior of industrial systems. It teaches decision making under uncertainty, elementary counting processes, Markov chains and Markov processes. Stochastic programming and applications. Stochastic models in queuing systems, inventories, and equipment reliability are also addressed.

*Pre-requisites: IE 301, STA 212*

*Co-requisites: none*

### **IE 304 Production and Service Systems Planning I**

**3 (3-0-0)**

The course teaches theory and concepts involved in model formulation for the analysis and control of production processes, including systems for planning and controlling production and service systems to achieve productivity and efficiency. The course addresses the basic issues in production planning, including aggregate production planning, master production schedule, materials requirement planning, and capacity planning. Flexible manufacturing systems, lean manufacturing, Just-in-time (JIT), and new concepts in manufacturing are addressed. Various production systems are described, including job shops, flow shop, cellular manufacturing covering scheduling and optimization.

*Pre-requisites: STA 212*

*Co-requisites: IE 301*

### **IE 305 Production and Service Systems Planning II**

**3 (3-0-0)**

The course teaches aspects of planning and design of logistics and inventory management in production and service systems. Optimization issues in supply chain management, distribution systems and routing, inventory control and warehousing, distributed networks, centralized and decentralized networks, facility location and layout, supply chain and strategic partnerships are addressed.

*Pre-requisites: IE 304*

*Co-requisites: none*

### **IE 307 Work Systems Analysis and Design**

**3 (3-0-0)**

The course teaches survey of methods for assessing and improving performance of individuals and groups in organizations. Techniques include various basic industrial engineering tools, work analysis, data acquisition and application, performance evaluation and appraisal, work measurement procedures and motion study. Layout design of work environments will include material handling systems and warehousing.

*Pre-requisites: STA 212*

*Co-requisites: none*

### **IE 307 L Work Systems Analysis and Design Lab**

**1 (0-2-0)**

Laboratory experiments dealing with work systems analysis and design.

*Pre-requisites: none*

*Co-requisites: IE 307*

- IE 309 Human Factors and Ergonomics** **3 (3-0-0)**  
The course teaches analysis of tools, work spaces and activities to achieve efficiency in modern work environments are introduced. The effects of vibration, noise, illumination, control display design, age and shift work on the performance of workers are discussed. Physiological and psychological capabilities and limitations in human factors, ergonomic measurement methods and analytical techniques, design of tools and the working ergonomic environment are addressed.  
*Pre-requisites: STA 212*  
*Co-requisites: IE 307*
- IE 309 L Human Factors and Ergonomics Lab** **1 (0-2-0)**  
Laboratory experiments dealing with human factors and ergonomics.  
*Pre-requisites: none*  
*Co-requisites: IE 309*
- IE 315 Engineering Economy and Cost Analysis** **3 (3-0-0)**  
The course teaches economic analysis in an engineering environment considering the time value of money. Methods for evaluation of alternatives: present worth, annual equivalent worth, rate of return, payback method and benefit-cost ratio method. Replacement analysis, depreciation, inflation and cost estimation. Sensitivity and risk analysis are also considered.  
*Pre-requisites: STA 212*  
*Co-requisites: none*
- IE 330 Simulation** **3 (3-0-0)**  
This course teaches simulation modelling and analysis of production and service systems, including simulation methodology, model building in a computer environment, analysing performance measures and assessment of different policies. It also teaches simulation languages, basic and advanced modules, and statistical aspects of simulation such as fitting of input and output distributions. Validation and verification of simulation models are also covered.  
*Pre-requisites: SE 100, STA 212*  
*Co-requisites: none*
- IE 330 L Simulation Lab** **1 (0-2-0)**  
Laboratory experiments dealing with the implantation of discrete-event simulation models.  
*Pre-requisites: none*  
*Co-requisites: IE 330*
- IE 400 Special Topics in Industrial Engineering** **3 (3-0-0)**  
This course provides instruction and experience in timely topics related to Industrial Engineering major.  
*Pre-requisites: IE 305*  
*Co-requisites: none*
- IE 401 Network Models and Project Management** **3 (3-0-0)**  
The course teaches the terminology of graphs and networks, network flow problems, algorithms and solutions. Project management, defining the project, scheduling issues in projects, project duration optimization, resources planning, evaluation and progress, estimating times and costs, critical processes in the projects, applications of project-planning and software in the strategy of projects, integration of organization with projects and probability issues in project planning are addressed.  
*Pre-requisites: IE 301*  
*Co-requisites: none*
- IE 406 Quality Engineering** **3 (3-0-0)**  
The course teaches Quality Assurance in an industrial system and compares it with the existing standards and protocols, including an introduction to quality engineering, quality standards ISO 9000 and QS 9000, TQM, quality cost analysis, process modeling and hypothesis testing, statistical process control for long and short production runs, process capability analysis, capability indexes, Weibull analysis, Six sigma acceptance sampling and design of experiments.  
*Pre-requisites: IE 305*  
*Co-requisites: none*

### **IE 415 Production Information Systems**

**3 (3-0-0)**

The course teaches the design and analysis of production information systems, critical success factors for companies, effectiveness and efficiency through information systems usage in production and service systems, success cases in industry. Investigation of data modelling, storage, acquisition and utilization in Industrial Engineering via manual and computerized methods. Development of effective spreadsheet applications, design and implementation of relational databases via E-R modelling, relational schema, normalization, SQL (Standard Query Language), web-based database applications, interface design, the system development life cycle applied to data management applications, ERP (Enterprise Resource Planning) software and decision support systems are addressed.

*Pre-requisites: IE 305*

*Co-requisites: none*

### **IE 420 Reliability and Maintenance Engineering**

**3 (3-0-0)**

This course provides an introduction to the life-cycle costing concept for equipment maintenance and replacement. Emphasis will be on the development of mathematical and simulation models for determining optimal maintenance and replacement policies for both capital equipment and components.

*Pre-requisites: IE 305*

*Co-requisites: none*

### **IE 430 New Product Development**

**3 (3-0-0)**

This course presents state-of-the-art Product Development techniques focusing on the interdisciplinary nature of the product design activities.

*Pre-requisites: IE 309*

*Co-requisites: none*

### **IE 435 Undergraduate Research in Industrial Engineering**

**3 (0-6-0)**

Students participate in supervised research with a faculty member. Supervised research can be: 1) independent research undertaken by the student (thesis, independent study), or 2) assistance on a faculty member's research project. Students must find a faculty member who is willing to supervise him/her as an assistant on an existing project or as the author of an individual project. The student and the faculty supervisor will complete and sign a research contract which will be turned in to the chair of the Industrial and Mechanical Engineering Department. Drafting the contract will allow the student to develop ideas about what should be accomplished and what the faculty supervisor's expectations are. All academic requirements are at the discretion of the supervising faculty member. Students should agree on a plan for the semester with the faculty mentor before the research begins. The plan should include academic requirements, the basis for grading the experience, and a plan for student/professor meetings for the semester. It is the student's responsibility to report progress and seek guidance when needed. Students are expected to be active and reliable participants in the research experience.

*Pre-requisites: GPA of at least 3.0/4.0, a signed research contract, and consent of the departmental chair.*

*Co-requisites: none*

### **IE 450 Management for Engineers**

**3 (3-0-0)**

The course focuses on learning to see and understand the fundamental activities of businesses as practiced worldwide and how to manage them. Successfully performing these activities requires vision, passion, leadership, teamwork, and integrating the many functional disciplines of business.

*Pre-requisites: IE 305*

*Co-requisites: none*

### **IE 495 Industrial Engineering Capstone Project I**

**3 (0-6-0)**

Students work in teams as professional engineering consultants on an independent engineering project under the supervision of a project advisor. The design process is emphasized, encompassing project definition, feasibility analysis, evaluation of alternative designs, and design computations. For each project, the scope of work is developed and negotiated between client and student consultants. The scope of work may also include fabrication, device testing, and field-testing. Projects are arranged by the students with approval of the instructor. Progress reports and a final written report are submitted to the student's project advisor. Oral presentations of reports are made before the faculty and students. A student who selects a project suggested by industry has the opportunity of working with an industry sponsor in an actual engineering experience.

*Pre-requisites: IE 302, IE 305*

*Co-requisites: none*



### **IE 496 Industrial Engineering Capstone Project II**

**3 (0-6-0)**

Students work in teams as professional engineering consultants on an independent engineering project under the supervision of a project advisor. The design process is emphasized, encompassing project definition, feasibility analysis, evaluation of alternative designs, and design computations. For each project, the scope of work is developed and negotiated between client and student consultants. The scope of work may also include fabrication, device testing, and field-testing. Projects are arranged by the students with approval of the instructor. Progress reports and a final written report are submitted to the student's project advisor. Oral presentations of reports are made before the faculty and students. A student who selects a project suggested by industry has the opportunity of working with an industry sponsor in an actual engineering experience.

*Pre-requisites: IE 495*

*Co-requisites: none*