2013

King Fahd University of Petroleum and Minerals
Systems Engineering Department

# Industrial and Systems Engineering (ISE) Student Guide

# SYSTEMS ENGINEERING DEPARTMENT

The Systems Engineering department offers two programs; Control and Instrumentation Systems Engineering (**CISE**) and Industrial and Systems Engineering (**ISE**). The first program covers analysis, design, and control of engineering systems. The second program focuses on the science and technology of industrial systems. It emphasizes the analysis and design of systems to produce goods and services efficiently. Particular attention is devoted to both the physical processes involved and the environment.

Both programs are offered in two options: the summer training option or Coop option. Coop programs are implemented in many technical universities worldwide. The student usually leaves the school for one or more semesters and joins a relevant industry, where he is exposed to real life applications of what has been taught in the school. This exposure provides the student with a more mature outlook and has a significant effect on his understanding of his role as a practicing engineer.

**Vision of the Systems Engineering Department**

**Regional:** To be the leader in the Arab region in the areas of Automation and Control, Industrial Engineering and Operations Research.

**Global :** To be recognized worldwide as a center of excellence in education and research in the areas of Automation and Control, Industrial Engineering and Operations Research.

## *Employment Opportunities*

In Saudi Arabia, there is an abundance of capital but limited human resources. Automation provides ways of reducing manpower requirements in industry, agriculture, and other services. In fact, the leading petrochemical and related industries, desalination plants, and power systems within the Kingdom are already using modern automation techniques. Furthermore, Industrial Engineering and Operations Research are essential to any country embarked on an ambitious industrialization plan. Indeed, the effectiveness of an enterprise is heavily influenced by the physical arrangement of people, equipment, and materials. The industrial engineer designs many types of systems, from material handling systems to the layout of factories and offices; he determines storage needs and space requirements for manufacturing systems, provides work measurement services, calculates labor requirements, estimates the performance of proposed systems, and measures and improves the effectiveness of existing systems.

Graduates of both programs in the Systems Engineering Department are trained to use engineering principles in the solution of problems encountered in environments and situations where a quantitative basis for decision making is desirable.

Both programs provide the preparation necessary for admission to graduate programs in highly respected universities. Details of the two programs are given below.

## *Industrial and Systems Engineering Program*

This program is concerned with the design, improvement, and installation of integrated systems of people, materials, and equipment; it draws upon specialized knowledge and skill in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design; its goals are specifying, predicting, and evaluating the results to be obtained from such systems.

**Mission**

The mission of the Industrial and Systems Engineering program is to provide high-quality education, research and community services in the areas of industrial and systems engineering. Specific components of the mission are:

- To provide a high-quality, state-of-the-art education in Industrial and Systems Engineering that produces professionals capable of performing jobs in their fields of specialization at the highest level of quality, competitiveness and professionalism.
- To conduct research that expands knowledge in the areas of Industrial and Systems Engineering and to provide a high-quality graduate program that gives students a solid foundation in their areas of specialty.

- To provide industry with a high-quality professional training, applied projects, and consultation services in the area of Industrial and Systems Engineering that is up-to-date and competitive worldwide.

### *ISE Program Educational Objectives (PEOs)*

ISE graduates are expected to be, within a few years of graduation:

**Objective 1**: Successful professionals in ISE related areas
**Objective 2:** Leaders in their organizations
**Objective 3:** Pursuers of new knowledge to ever changing environment .

### *ISE Program Outcomes*

The graduates of the program should be able to:

PO_a. apply knowledge of mathematics, science, and engineering;
PO_b. design and conduct experiments, as well as analyze and interpret data;
PO_c. design and improve integrated systems of people, materials, information, facilities, and technology;
PO_d. function as a member of a multi-disciplinary team;
PO_e. identify, formulate, and solve industrial and Systems engineering problems;
PO_f. understand and respect professional and ethical responsibilities;
PO_g. communicate effectively both orally and in writing;
PO_h. understand the impact of engineering solutions in a global and societal contexts;
PO_i. recognize the need for life-long learning, and an ability to engage in it;
PO_j. have a knowledge of contemporary issues;
PO_k. use up to date techniques, skills and tools of Industrial and Systems Engineering throughout their professional careers.

The main study areas involved are:

**Operations Research and Statistics**

| | |
|---|---|
| Optimization Methods | ISE 305 |
| Queuing Systems | ISE 425 |
| Decision Making | ISE 447 |
| Design of Experiments | ISE 455 |
| Theory of Stochastic Systems | ISE 463 |
| Special Topics in Operations Research | ISE 491 |

**Production and Quality control**

| | |
|---|---|
| Sequencing & Scheduling | ISE 448 |
| Computer Aided Manufacturing and Robotics | ISE 461 |
| Supply Chain Systems Modeling | ISE 470 |
| Industrial Information Systems | ISE 464 |
| Advanced Quality Methods | ISE 420 |
| Special Topics in Production and Quality Control | ISE 492 |

**Reliability and Maintenance**

| | |
|---|---|
| Maintenance Planning and Control | ISE 429 |
| Reliability and Maintainability | ISE 480 |
| Industrial Safety | ISE 465 |
| Special Topics in Reliability and Maintenance | ISE 493 |

**Productivity and Process Improvement**

| | |
|---|---|
| Human Factors Engineering | ISE 443 |
| Industrial Safety | ISE 465 |
| Productivity Engineering and Management | ISE 411 |
| Process Reengineering | ISE 495 |
| Industrial Strategic Planning | ISE 496 |
| Special Topics in IE/OR | ISE 494 |

**Automation and Control**

| | |
|---|---|
| Design of Digital Systems | CISE 204 |
| Computer Control Systems | CISE 318 |
| Industrial Automation | CISE 431 |
| Computer Numerical Control | CISE 434 |
| Special Topics in Automation and Control | CISE 449 |

**Degree requirements for the ISE program**

The degree requirements for the ISE program can be grouped into five broad sets of requirements as shown below.

**(a) General Education Requirements: 49 credit hours**

| | | |
|---|---|---|
| Arabic Studies | IAS 101, 201, 301 | 6 |
| English Language | ENGL 101, 102, 214 | 9 |
| Islamic Studies | IAS 111, 212, 322 | 6 |
| Mathematics | MATH 101, 102, 201, 260 | 14 |
| Chemistry | CHEM 10 1 | 4 |
| Physics | PHYS 101, 102 | 8 |
| Physical Education | PE 101, 102 | 2 |

**(b) General Engineering Fundamentals: 30 credit hours**

| | |
|---|---|
| CE 101 Engineering Graphics | 2 |
| ICS 103 Computer Programming in C | 3 |
| EE 201 Electrical Circuits | 4 |
| ISE 205 Probability and Statistics | 3 |
| ME 206 Manufacturing Technology | 4 |
| ME 215 Material Science | 4 |
| CISE 301Numerical Methods | 3 |
| CISE 302 Linear Control Systems | 4 |
| ISE 307 Engineering Economic Analysis | 3 |

**(c) Industrial and Systems Engineering Core Courses: 36 credit hours**

| | |
|---|---|
| ISE 201 Introduction to ISE | 1 |
| ISE 303 Operations Research I | 3 |
| ISE 304 Industrial Costing | 3 |
| ISE 323 Work Systems and Methods | 3 |
| ISE 320 Industrial Quality Control | 3 |
| ISE 325 Engineering Statistics | 3 |
| ISE 361 Data Base Design | 3 |
| ISE 390 Seminar | 0 |
| ISE 391 Industrial Engineering Design | 2 |
| ISE 402 Production Systems | 3 |
| ISE 405 Stochastic Systems Simulation | 3 |
| ISE 421 Operations Research II | 3 |
| ISE 422 Facility Layout and Location | 3 |
| ISE 490 Senior Project (for summer training option) | 3 |

**(d) Electives:**

Students opting for the summer training stream are required to take 12 credit hours of ISE electives and 6 credit hours form KFUPM offering at large. Students opting for the cooperative training stream are required to take 9 credit hours of ISE electives and 3 credit hours form KFUPM offering at large.

ISE Elective Courses

ISE 411 Productivity Engineering and Management
ISE 420 Quality Improvement Methods
ISE 425 Queuing Systems
ISE 429 Maintenance Planning and Control
ISE 443 Human Factors Engineering
ISE 447 Decision Making
ISE 448 Sequencing and Scheduling
ISE 461 Computer Aided Manufacturing and Robotics
ISE 463 Theory of Stochastic processes
ISE 464 Industrial information Systems
ISE 465 Industrial Safety
ISE 470 Supply Chain Systems Modeling
ISE 480 Reliability and Maintainability

ISE 492 Special Topics in production and Quality Control
ISE 493 Special Topics in Reliability and Maintenance
ISE 496 Industrial Strategic Planning & Balanced Scorecards

**(e) Summer Training or Coop Training**

Students taking the summer training option must spend 8 weeks of training in a in a facility approved by the department. This can be done in a summer term after completing a minimum of 85 credit hours. Each student needs to submit a report and make an oral presentation. The ISE 399 (Summer training ) is a zero credit pass/fail course.

For coop option, students must register the Coop training course ISE350 after completing a minimum of 85 credit hours, and have a minimum cumulative and major GPA of 2.0. Students are required to join a 28-week long industrial training program approved by the department. A total of 9 credit hours is allocated to ISE 351 as it replaces three courses namely, Senior Project ISE 490, one ISE elective and one free elective.

# INDUSTRIAL AND SYSTEMS ENGINEERING CURRICULUM
## (Summer Training Option)

| COURSE | | TITLE | LT | LB | CR | COURSE | | TITLE | LT | LB | CR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Preparatory Year** | | | | | | | | | | | |
| ENGL | 001 | Preparatory English I | 15 | 5 | 8 | ENGL | 002 | Preparatory English II | 15 | 5 | 8 |
| MATH | 001 | Preparatory Math I | 3 | 1 | 4 | MATH | 002 | Preparatory Math II | 3 | 1 | 4 |
| PYP | 001 | Prep. Physical Sciences | 2 | 0 | 2 | PYP | 002 | Prep. Computer Sciences | 0 | 2 | 1 |
| PYP | 003 | University Study Skills | 0 | 2 | 1 | ME | 003 | Prep. Eng. Technology | 0 | 2 | 1 |
| PE | 001 | Prep. Physical Educ. I | 0 | 2 | 1 | PE | 002 | Prep Physical Educ II | 0 | 2 | 1 |
| | | | 20 | 10 | 16 | | | | 18 | 12 | 15 |
| **Total Credits required in Preparatory Program: 31** | | | | | | | | | | | |
| **First Year (Freshman)** | | | | | | | | | | | |
| MATH | 101 | Calculus I | 4 | 0 | 4 | MATH | 102 | Calculus II | 4 | 0 | 4 |
| PHYS | 101 | General Physics I | 3 | 3 | 4 | PHYS | 102 | General Physics II | 3 | 3 | 4 |
| ENGL | 101 | Intro. to Acad. Discourse | 3 | 0 | 3 | ICS | 103 | Computer Programming in C | 2 | 3 | 3 |
| CHEM | 101 | General Chemistry I | 3 | 4 | 4 | ENGL | 102 | Intro. to Report Writing | 3 | 0 | 3 |
| IAS | 101 | Practical Grammar | 2 | 0 | 2 | IAS | 111 | Belief & its Consequences | 2 | 0 | 2 |
| | | | | | | PE | 101 | Physical Education I | 0 | 2 | 1 |
| | | | 15 | 7 | 17 | | | | 14 | 8 | 17 |
| **Second Year (Sophomore)** | | | | | | | | | | | |
| MATH | 201 | Calculus III | 3 | 0 | 3 | ISE | 205 | Engineering Prob .& Stats. | 3 | 0 | 3 |
| MATH | 260 | Introduction to DE and LA. | 3 | 0 | 3 | ME | 322 | Manufacturing Processes | 3 | 0 | 3 |
| ISE | 201 | Introduction to ISE | 1 | 0 | 1 | ME | 323 | Manufacturing Lab | 0 | 3 | 1 |
| CE | 101 | Engineering Graphics | 1 | 3 | 2 | EE | 202 | Electric Circuit I | 3 | 0 | 3 |
| ME | 216 | Materials Science and Eng. | 3 | 0 | 3 | EE | 212 | Electric Circuit Lab | 0 | 3 | 1 |
| ME | 217 | Material Lab | 0 | 3 | 1 | ENGL | 214 | Acad. & Prof. Comm | 3 | 0 | 3 |
| IAS | 201 | Objective Writing | 2 | 0 | 2 | IAS | 212 | Professional Ethics | 2 | 0 | 2 |
| | | | 13 | 6 | 15 | PE | 102 | Physical Education II | 0 | 2 | 1 |
| | | | | | | | | | 14 | 8 | 17 |
| **Third Year (Junior)** | | | | | | | | | | | |
| ISE | 303 | Operations Research I | 3 | 0 | 3 | ISE | 304 | Principles of Industrial Cost | 3 | 0 | 3 |
| ISE | 323 | Work and Process Improve. | 2 | 3 | 3 | ISE | 307 | Engineering Economic Anal. | 3 | 0 | 3 |
| I SE | 325 | Engineering Statistics | 3 | 0 | 3 | ISE | 320 | Quality Control & Ind Stat. | 3 | 0 | 3 |
| CISE | 301 | Numerical Methods | 3 | 0 | 3 | ISE | 391 | Industrial Eng. Design | 1 | 3 | 2 |
| IAS | 301 | Language Communication Skill | 2 | 0 | 2 | IAS | 322 | Human Rights in Islam | 2 | 0 | 2 |
| ISE | 361 | Fund. of Data Base Systems | 2 | 3 | 3 | CISE | 302 | Linear Control Systems | 3 | 3 | 4 |
| | | | | | | ISE | 390 | Seminars | 0 | 0 | 0 |
| | | | 15 | 6 | 17 | | | | 15 | 6 | 17 |
| **Summer Session** | | | | | | **I**SE | 399 | **Summer Training** | 0 | 0 | 0 |
| **Fourth Year (Senior)** | | | | | | | | | | | |
| ISE | 402 | Production Systems & Inven. | 3 | 0 | 3 | ISE | 421 | Operations Research II | 3 | 0 | 3 |
| I SE | 405 | Stochastic System Sim. | 2 | 3 | 3 | I SE | 422 | Facility Layout and Location | 3 | 0 | 3 |
| I SE | 490 | Senior Design Project | 0 | 6 | 3 | I SE | 4xx | ISE Elective III | x | x | 3 |
| I SE | 4xx | ISE Elective I | x | x | 3 | I SE | 4xx | ISE Elective IV | x | x | 3 |
| I SE | 4xx | ISE Elective II | x | x | 3 | XXX | xxx | Free Elective II | x | x | 3 |
| XXX | xxx | Free Elective I | x | x | 3 | | | | | | |
| | | | 5 | 9 | 18 | | | | 6 | 0 | 15 |

**Total credit hours required in Degree Program: 133**

# INDUSTRIAL AND SYSTEMS ENGINEERING CURRICULUM
# (CO-OP Option)

| COURSE | | TITLE | LT | LB | CR | COURSE | | TITLE | LT | LB | CR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Preparatory Year** | | | | | | | | | | | |
| ENGL | 001 | Preparatory English I | 15 | 5 | 8 | ENGL | 002 | Preparatory English II | 15 | 5 | 8 |
| MATH | 001 | Preparatory Math I | 3 | 1 | 4 | MATH | 002 | Preparatory Math II | 3 | 1 | 4 |
| PYP | 001 | Prep. Physical Sciences | 2 | 0 | 2 | PYP | 002 | Prep. Computer Sciences | 0 | 2 | 1 |
| PYP | 003 | University Study Skills | 0 | 2 | 1 | ME | 003 | Prep. Eng. Technology | 0 | 2 | 1 |
| PE | 001 | Prep. Physical Educ. I | 0 | 2 | 1 | PE | 002 | Prep Physical Educ II | 0 | 2 | 1 |
| | | | 20 | 10 | 16 | | | | 18 | 12 | 15 |
| **Total Credits required in Preparatory Program: 31** | | | | | | | | | | | |
| **First Year (Freshman)** | | | | | | | | | | | |
| MATH | 101 | Calculus I | 4 | 0 | 4 | MATH | 102 | Calculus II | 4 | 0 | 4 |
| PHYS | 101 | General Physics I | 3 | 3 | 4 | PHYS | 102 | General Physics II | 3 | 3 | 4 |
| ENGL | 101 | Intro. to Acad. Discourse | 3 | 0 | 3 | ICS | 103 | Computer Programming in C | 2 | 3 | 3 |
| CHEM | 101 | General Chemistry I | 3 | 4 | 4 | ENGL | 102 | Intro. to Report Writing | 3 | 0 | 3 |
| IAS | 101 | Practical Grammar | 2 | 0 | 2 | IAS | 111 | Belief & its Consequences | 2 | 0 | 2 |
| | | | | | | PE | 101 | Physical Education I | 0 | 2 | 1 |
| | | | 15 | 7 | 17 | | | | 14 | 8 | 17 |
| **Second Year (Sophomore)** | | | | | | | | | | | |
| MATH | 201 | Calculus III | 3 | 0 | 3 | MATH | 260 | Introduction to DE and LA. | 3 | 0 | 3 |
| ME | 216 | Materials Science and Eng. | 3 | 0 | 3 | ISE | 205 | Engineering Prob .& Stats. | 3 | 0 | 3 |
| ME | 217 | Material Lab | 0 | 3 | 1 | ME | 322 | Manufacturing Processes | 3 | 0 | 3 |
| ISE | 201 | Introduction to ISE | 1 | 0 | 1 | ME | 323 | Manufacturing Lab | 0 | 3 | 1 |
| EE | 202 | Electric Circuit I | 3 | 0 | 3 | ENGL | 214 | Acad. & Prof. Comm | 3 | 0 | 3 |
| EE | 212 | Electric Circuit Lab | 0 | 3 | 1 | CISE | 301 | Numerical Methods | 3 | 0 | 3 |
| CE | 101 | Engineering Graphics | 1 | 3 | 2 | IAS | 301 | Language Comm. Skill | 2 | 0 | 2 |
| IAS | 201 | Objective Writing | 2 | 0 | 2 | PE | 102 | Physical Education II | 0 | 2 | 1 |
| IAS | 212 | Professional Ethics | 2 | 0 | 2 | | | | 17 | 5 | 19 |
| | | | 15 | 9 | 18 | | | | | | |
| **Third Year (Junior)** | | | | | | | | | | | |
| ISE | 303 | Operations Research I | 3 | 0 | 3 | ISE | 304 | Principles of Industrial Cost | 3 | 0 | 3 |
| ISE | 307 | Engineering Economic Anal. | 3 | 0 | 3 | ISE | 320 | Quality Control & Ind Stat. | 3 | 0 | 3 |
| ISE | 323 | Work and Process Improve. | 2 | 3 | 3 | ISE | 391 | Industrial Eng. Design | 1 | 3 | 2 |
| ISE | 325 | Engineering Statistics | 3 | 0 | 3 | ISE | 402 | Production Systems & Inven. | 3 | 0 | 3 |
| ISE | 361 | Fund. of Data Base Systems | 2 | 3 | 3 | ISE | 405 | Stochastic System Sim. | 2 | 3 | 3 |
| CI SE | 302 | Linear Control Systems | 3 | 3 | 4 | IAS | 322 | Human Rights in Islam | 2 | 0 | 2 |
| | | | | | | ISE | 390 | Seminars | 0 | 0 | 0 |
| | | | 16 | 9 | 19 | | | | 14 | 6 | 16 |
| **Summer Session** | | | | | | **I**SE | 350 | **Cooperative Work Program** | **0** | **0** | **0** |
| **Fourth Year (Senior)** | | | | | | | | | | | |
| ISE | 351 | **Cooperative Work Program** | 0 | 0 | 9 | ISE | 421 | Operations Research II | 3 | 0 | 3 |
| | | | | | | ISE | 422 | Facility Layout and Location | 3 | 0 | 3 |
| | | | | | | ISE | 4xx | ISE Elective I | x | x | 3 |
| | | | | | | ISE | 4xx | ISE Elective II | x | x | 3 |
| | | | | | | ISE | 4xx | ISE Elective III | x | x | 3 |
| | | | | | | XXX | xxx | Free Elective | x | x | 3 |
| | | | 0 | 0 | 9 | | | | 6 | 0 | 18 |

**Total credit hours required in Degree Program: 133**

## List of Industrial and Systems Engineering Courses

**ISE 201 Introduction to Industrial and Systems Engineering (1-0-1)**

An introduction to and overview of the profession, including career planning, professionalism, ethics and teamwork Nature of the Industrial Engineer job, Selected areas of IE such as quality, optimization, productivity, process improvement. Industry site visits, industrial speakers, Case studies from IE applications.

**Prerequisites** : MATH 102.

**ISE 205 Engineering Probability and Statistics (3-0-3)**

Data description and presentation. Basic concepts in probability. Random variables and probability distributions. Sampling distribution. Point estimation of parameters. Statistical intervals for a single sample. Statistical intervals for two samples. Laboratory projects consisting of selected applications.

**Prerequisite**: MATH 201

**ISE 303 Operations Research I (3-0-3)**
Modeling in Operations Research. Linear Programming: Simplex Method, Duality, Sensitivity Analysis. Network Models; Shortest-Route Problem, PERT/CPM, Maximum Flow Problem, Minimal Spanning Tree Problem, Transportation and Assignment Problems. Goal Programming.

**Prerequisite**: ISE 201, ISE 205

**ISE 304 Principles of Industrial Costing (3-0-3)**

Introduction to basic costing concepts and behavior, with emphasis on manufacturing optimization through labor and materials cost analysis, operation and overhead cost calculations, product cost estimating, and finally setting product selling price. Study of the principles of costing systems and techniques of analysis and cost control. Emphasis on interpretation and use of costing principles for decision making.
**Prerequisite**: ISE 205

**ISE 305 Optimization Methods (2-3-3)**

Unconstrained optimization, necessary and sufficient conditions for unconstrained minima. Derivative-free algorithm. The steepest decent and Newton algorithms. Conjugate gradient and Quasi-Newton methods. Constrained optimization: Karush-Kuhn-Tucker conditions for optimality, algorithms for constrained optimization including SUMT, approximation and methods of feasible directions. Case studies in different engineering discipline.
**Prerequisite**: ISE 303

**ISE 307 Engineering Economic Analysis ( 3-0-3)**

Introduction to concepts of economic decision-making from a cash flow view point. It includes present worth analysis, cash flow equivalence, rates of return, replacement analysis, benefit-cost analysis, depreciation and taxes, and projects break-even point, selection, and sensitivity analysis.

**Prerequisite :** Third Year

**ISE 320 Quality Control and Industrial Statistics ( 3-0-3)**

Introduction to quality control and process improvement. Cost of quality and the effects of quality on productivity. Concepts of variation. Statistical process control (SPC tools). Control charts for variables and attributes and their applications in process control. Process capability studies. Acceptance sampling. Case studies in applied quality control.

**Prerequisite**: ISE 205

**ISE 323 Work and Process Improvements (2-3-3)**

History of Methods Design & Work Measurement Methods design. Process analysis. Operation analysis. Introduction to human engineering. Standardization. Work measurement Predetermined motion-time systems. Standard data. Work sampling. Term project

**Prerequisites**: ISE 205

**ISE 325 Engineering Statistics (3-0-3)**

Review for estimation. Test of hypothesis for single and two samples. Applications of test of hypothesis in engineering. Simple and multiple linear regression and their applications. Design and analysis of single-factor experiments: analysis of variance. Design of experiments with several factors. Case studies in engineering statistics.

**Prerequisite**: ISE 205

**ISE 350 Beginning Coop Program (0-0-0)**
**ISE 351 Cooperative Work Program (0-0-9)**

The Cooperative Work Program accounts for nine (9) credit hours, involves either a team based or a single student based project that is geared toward an integrated application of several pieces of Systems Engineering knowledge learned by the student in his undergraduate education thus far. The co-op project must address technical aspects of the practice of Systems Engineering, including analysis, experimentation and design, by utilizing the problem-solving techniques covered in the various required (core) and elective courses offered at the Systems Engineering Department.

**Prerequisite**: Completion of 85 Credit Hours, and fulfillment of departmental requirements

**ISE 361 Fundamentals of Data Base Systems (2-3-3)**

This is a first course in database management systems, teaching database concepts, data modeling and database design. Fundamental database concepts, Relational Data Manipulation, Data modeling, Capturing Business Rules, Normalization, Database system development process, Transaction, Processing, Distributed Processing, Data Warehouses, and Databases on the Web. Concepts and tools will be integrated in a small-group term project by designing and implementing an actual information system.

**Prerequisites:** Junior standing

**ISE 390 Seminar (0-0-0)**

The purpose of this course is to raise students' awareness of contemporary issues in their discipline and otherwise. The student has to attend a required number of seminars, workshops, professional societal meetings or governmental agency conferences; at least half of these should address issues in his discipline. The student has to attend a required number of industrial visits.

**Prerequisites:** Junior standing

**ISE 391 Industrial Engineering Design (1-3-2)**

Introduction to engineering design, formulation of design problems, the design process, design phases, IE and the design process, Quality function deployment for specifying design requirements, design strategies, generating alternatives, probabilistic consideration in design, communication issues, design evaluation, selection and implementation. Discussion of case studies including operations systems, manufacturing, quality, ergonomics, layout and scheduling. Includes team project with an application in manufacturing or service industry.

**Prerequisites:** ISE 205, ENGL 214, and junior standing.

**ISE 399 Summer Training (0-0-0)**
Students spend eight weeks in the industry, and submit a report and a presentation at the end of his summer training work.
**Prerequisites :** Junior standing

**ISE 402 Production Systems and Inventory Control (3-0-3)**

Element of functional organization. Forecasting in production systems. Product and process design considerations. Deterministic and stochastic inventory systems. Production scheduling and line balancing. Capacity planning. Material requirement planning (MRP). Computer applications in production control. Case studies and applications.

**Prerequisite**: ISE 205

**ISE 405 Stochastic Systems Simulation (2-3-3)**

Basic discrete-event simulation modeling, queuing models, simulation languages, review of basic probability and statistics, random-number generators, generating random variables, output data analysis, validation of simulation models. A simulation language is used in the lab to illustrate simulation models on real case studies.

**Prerequisites**: ISE 205

**ISE 411 Productivity engineering and Management (3-0-3)**

Introduction to productivity, productivity factors, measurement of productivity, planning for productivity, total productivity model, product base productivity improvement, employer based productivity improvement, productivity improvement programs, case studies and class project.

**Prerequisite:** Junior standing

**ISE 420 Quality Improvement Methods (3-0-3)**

Introduction to principles and philosophies of total quality management, advance methods for process control, six sigma approach to quality, Quality function deployment (QFD) and Taguchi approach to quality and parameter optimization.

**Prerequisite :** ISE 320

**ISE 421 Operation Research II (3-0-3)**

Following topics from operations research with an emphasis on modeling and implementation are provided; integer programming, dynamic programming and nonlinear programming. Implementation using modeling software and spreadsheet is demonstrated on examples and case studies.

**Prerequisites**: ISE 303

**ISE 422 Facility Layout and Location (3-0-3)**

Introduction to facility planning issues. Material handling. Facility location and layout and computer-aided techniques and packages. Storage and warehousing functions, emphasizing quantitative and simulation techniques.

**Prerequisite:** ISE 303

**1SE 425 Queuing Systems (3-0-3)**

Introduction to Queuing Models and Their Applications, Elements and Characteristics of Queuing Models, Single Server queue, Birth Death Processes, M/M/1, M/M/s, M/G/l, Little Law, Priority Queues, Network of Queues.

**Prerequisite** : **Senior standing**

**ISE 429 Maintenance Planning and Control (3-0-3)**

Maintenance Organization, Maintenance strategy, Forecasting maintenance work, Maintenance capacity planning, Component replacement decision models, Maintenance Measurement and Standards, Scheduling of maintenance, Maintenance material control, Quality of maintenance jobs, Maintenance productivity, Maintenance audit, Maintenance management information systems, Case Studies.

**Prerequisite**: Senior standing

**ISE 443 Human Factors Engineering (2-3-3)**

Study of human response into man-machine systems. Study of visual displays as a medium of input. Auditory and tactual displays. Human control of systems. Control tools and related devices. Applied anthropometry and workplace design. Physical space arrangement, Environment, Illumination, Atmospheric conditions and noise.

**Prerequisite**: ISE 205

**ISE 447 Decision Making (3-0-3)**

Basic, decision-making model under certainty with multiple criteria as well as under pure Uncertainty, Risk, Risk with information and conflict with single criteria, Structuring decision problems as well as applications in systems engineering are emphasized through problem sets, case studies and term project.

**Prerequisite**: ISE 205 and Junior Standing.

**ISE 448 Sequencing and Scheduling (3-0-3)**

Scheduling problems, optimality of schedules, processing, basic single; machine results, precedence constraints and efficiency, constructive algorithms for flow-shops and job-shops, dynamic programming approaches, branch and bound methods, integer, programming formulations, hard problems and NP-completeness. Heuristic methods: general approaches and worst-case bounds, simulated annealing approach.

**Prerequisite**: ISE 303

**ISE 460 Industrial Process Re-Engineering (3-0-3)**

Introduction to function and Process Organization, strategy plan and business context, stockholder analysis, value and non value activities, process identification, process architect & align, understanding of existing process, mapping and process evaluation, measures and target setting, process visioning, process renew and re-engineering, element for essential and sustainability, continues improvements.

**Prerequisite:** ISE 323

**ISE 461 Computer Aided Manufacturing and Robotics** (3-0-3)

High volume discrete parts production systems. Fundamentals of CAD/CAM. Computers in manufacturing. Computer process monitoring. Systems for manufacturing support. Group technology and integrated manufacturing systems. Case studies for robots in industry. CAD/CAM using computer graphics laboratory.
**Prerequisite:** ME **206**

**ISE 463 Theory of Stochastic Processes (3-0-3)**

Basic review of probability, statistical independence, conditional expectation and characteristic function. Introduction to stochastic processes, stationarity and ergodicity. Markov chains and Poisson processes. Linear models of continuous- and discrete- time stochastic processes. Engineering applications.

**Prerequisite:** ISE 325

**ISE 464 Industrial Information Systems (3-3-4)**

Design of industrial information systems. Focus on the planning, control of the flow of engineering and industrial information. Information systems requirements, analysis, and design. Students are required to work on a project of applied nature.

**Prerequisite:** ISE 361

**ISE 465 Industrial Safety (3-0-3)**

The scope of occupational safety: Human safety, Environmental safety, Setting safety standard: Safety administration, Legal aspect of industrial safety.

**Prerequisites:** Junior standing.

**ISE 470 Supply Chain Systems Modeling (3-0-3)**

This course adopts a modeling approach to supply chains that is designed to study trade-offs between system costs and customer service. Topics covered include supply chain design, multi-location inventory-distribution models, bullwhip effect, delayed differentiation, and e-commerce and supply chain. The key insights provided by such system-wide models will be illustrated through the use of software packages, real cases discussion and presentations and term projects. In addition, the course will highlight the role of information technology in supporting supply chain operations.

**Co-requisite**: ISE 402 or approval of Department

**ISE 480 Reliability and Maintainability (3-0-3)**

Introduction to Reliability Engineering, hazard and reliability functions, analyzing reliability data, reliability prediction and modeling, fault tress construction and decision tables, maintainability, maintenance and availability, reliability improvement.

**Prerequisite:** ISE 325

**ISE 490 Senior Design Project (0-0-3)**

A design course that draws upon various components of the undergraduate curriculum. The project typically contains problem definition, analysis, evaluation and selection of alternatives. Real life applications are emphasized where appropriate constraints are considered. Oral presentation and a report are essential for course completion. The work should be supervised by faculty member(s). Team projects are acceptable wherever appropriate.
**Prerequisite**: ISE 390

**ISE 491 Special Topics in Operations Research (3-0-3)**

A course in an area of operations research reflecting current theory and practice.

**Prerequisite**: Approval of the Department

**ISE 492 Special Topics in Production and Quality Control (3-0-3)**

A course in an area of production and quality control reflecting current theory and practice.

**Prerequisite**: Approval of the Department.

**ISE 493 Special Topics in Reliability and Maintenance (3-0-3)**

A course in an area of reliability and maintenance reflecting current theory and practice.

**Prerequisite:** Approval of the Department

**ISE 496 Industrial Strategic Planning & Balanced Scorecard (3-0-3)**

Introduction to Strategic Planning and BSC, development of strategy plans, Creating the Strategy Focused Organization, Building Strategy Map, Building Strategy Map for Private sectors, Building Strategy Map for non-profit organizations, Develop Balanced Scorecard Cooperate, Creating Business Unit Synergy (Department BSC), Individual BSC (Defining Personal and Team Objectives).

**Prerequisite**: Senior standing or instructor approval