

## Curriculum(Undergraduate Course)

Classification	Subject No.	Subject Code	Subject Name	Lecture:Lab.: Credit (Homework)	Semester	Remark
Elective Basic Course	IE101	31.101	Introduction to Operations Research	3:1:3(4)	Spring and Fall	
Mandatory Major Courses	IE241	31.241	Engineering Statistics II	3:0:3(6)	Spring	
	IE251	31.251	Manufacturing Process Innovation	3:1:3(4)	Spring	
	IE260	31.260	Data Structure and Analysis	3:1:3(6)	Spring	
	IE261	31.261	Information Technology for Industrial Engineering	3:1:3(6)	Fall	
	IE321	31.321	Production Management I	3:0:3(6)	Fall	
	IE331	31.331	Operations Research I	3:1:3(3)	Spring	
	IE332	31.332	Operations Research II	3:1:3(4)	Fall	
Elective Courses	IE341	31.341	Engineering Statistics II	3:0:3(6)	Fall	
	IE231	31.231	Applied Real Analysis and Probability	3:0:3	Spring	
	IE310	31.310	Work Study	2:3:3(5)	Fall	
	IE312	31.312	Introduction to Human Engineering	2:3:3(2)	Spring	
	IE322	31.322	Production Management II	3:0:3(6)	Spring	
	IE342	31.342	Regression Analysis and Experimental Designs	3:0:3(4)	Fall	
	IE343	31.343	Statistical Machine Learning	3:1:3(5)	Spring	
	IE353	31.353	Product Development and Product Information Management	3:1:3(6)	Spring	
	IE361	31.361	Human-Computer Interaction Design	3:1:3(4)	Spring	
	IE363	31.363	Introduction to Modeling and Simulation	3:1:3(5)	Fall	
	IE371	31.371	Service Systems Engineering	3:1:3	Spring	
	IE413	31.413	Aesthetic Engineering	2:3:3(3)	Fall	
	IE414	31.414	Cognitive Science and Systems	3:1:3(4)	Fall	
	IE421	31.421	Engineering Economy and Cost Analysis	3:0:3(6)	Spring	
	IE423	31.423	Logistics Management	3:1:3(5)	Fall	
	IE425	31.425	Project Management	3:1:3(4)	Spring	◎
	IE426	31.426	Supply Chain Management	3:1:3(5)	Spring	◎
	IE431	31.431	Introduction to Optimization Theory	3:0:3(3)	Spring	◎
	IE432	31.432	Decision Analysis and Risk Management	3:0:3(4)	Spring	◎
	IE434	31.434	Introduction to Telecommunication Service and Systems	3:1:3(3)	Spring	◎
IE435	31.435	Telecommunication Service and Policy	3:0:3(6)	Fall	◎	
IE436	31.436	Case Studies for Industrial & Systems Engineering	3:1:3(4)	Fall		
IE441	31.441	Quality Control	3:0:3(6)	Spring		

Classification	Subject No.	Subject Code	Subject Name	Lecture:Lab.: Credit (Homework)	Semester	Remark
	IE451	31.451	IT Service Engineering	3:1:3(6)	Spring	◎
	IE452	31.452	System Design Project	2:3:3(5)	Spring	
	IE453	31.453	Conceptual Design for Engineering Products	3:0:3	Spring	◎
	IE461	31.461	Business Process Engineering and Management	3:0:3(6)	Fall	◎
	IE463	31.463	Information Systems Engineering and Management	3:0:3	Spring	◎
	IE471	31.471	Introduction to Financial Engineering	3:0:3		◎
	IE472	31.472	Socio-Economic Systems Modeling)	3:0:3	Spring	◎
	IE473	31.473	Financial Economics	3:0:3	Fall	◎
	IE481	31.481	Special Topics in Industrial Engineering I	3:0:3		
	IE482	31.482	Special (Invited) Lecture I	1:0:1		
	IE483	31.483	Special (Invited) Lecture II	2:0:2		
Research	IE490	31.490	B.S. Thesis	0:6:3		
	IE495	31.495	Individual Study	0:6:1		
	IE496	31.496	Seminar in B.S.	1:0:1	Spring	

◎: stands for courses open to both undergraduate and graduate students

## Substitutable Course List

Substitutable subjects in Department of Industrial & Systems Engineering					
Classification	opened course		unopened course		
	Subject No.	Subject Name	Subject No.	Subject Name	Remark
Mandatory Major Courses	IE260	Data Structure and Analysis	IE362	Programming & practices for Industrial Information System	subject name was changed
				Applied Data Structures and Algorithms	
Elective Courses	IE343	Statistical Machine Learning	IE442	Statistical Data Analysis	subject name was changed
Elective Courses	IE541	Advanced Engineering Statistics	IE641	Mathematical Statistics	subject name was changed

Substitutable subjects from other departments					
Classification	IE courses		courses from other departments		
	Subject No.	Subject Name	Subject No.	Subject Name	Remark
Mandatory Major Courses	IE362	Applied Data Structures and Algorithms(unopened)	CS206	Data Structure	one-way substitution
Mandatory Major Courses	IE260	Data Structure and Analysis			
Elective Courses	IE231	Applied Real Analysis and Probability	FEP321	Analysis and Probability for Finance	Two-way substitution
Elective Courses	IE421	Engineering Economy and Cost Analysis	CC513	Engineering Economy and Cost Analysis	one-way substitution
Elective Courses	IE471	Introduction to Financial Engineering	FEP311	Introduction to Financial Engineering	Two-way substitution
Elective Courses	IE565	Information Security Policy and Management	IS532	Information Security policy and management	Two-way substitution
Elective Courses	IE566	Human-Computer Interaction: Theory and Design	KSE531	Human-Computer Interaction: Theory and Design	Two-way substitution
Elective Courses	IE577	Fundamentals of Systems Engineering	AE500	Synthetic Design of Aerospace Systems	one-way substitution
Elective Courses	IE636	Intelligent Systems & Soft Computing	KSE622	Soft-computing in Intelligent System Design	Two-way substitution
Elective Courses	IE646	Data Mining	KSE525	Data Mining and Knowledge Discovery	Two-way substitution
Elective Courses	IE761	Cognitive Engineering	KSE641	Cognitive Engineering	Two-way substitution

# Descriptions of Courses

## IE 231 Applied Real Analysis and Probability

This course introduces some basic concepts in mathematical analysis and probability for industrial engineering. Some topological ideas, differentiation, and integration of real functions, convergence of function sequences are covered. Finally, students learn martingales in finite sample space.

## IE 241 Engineering Statistics I

This course covers: Probabilistic and statistical methods for stochastic modeling and data analysis; Discrete and continuous random variables and the properties of their distributions.

## IE 251 Manufacturing process Innovation

This course introduces typical manufacturing processes and materials, as well as productivity and quality innovation methodology such as TPM (total productive maintenance) and six sigma. In addition, manufacturing automation will be covered including CNC, PLC programming and industrial robotics.

## IE 260 Data Structure and Analysis

This course teaches the basic of software programming and design, and the goal is nurturing the basic data analysis capability through programs. The major material is covering the storage and maintenance of data, and utilizing the data to solve the industrial engineering problems, i.e. production planning and SCM. Also, the course introduces simulations and heuristics in industrial engineering.

## IE 261 Information Technology for Industrial Engineering

This course reviews the application of information technology to various industrial engineering methods, providing the students an integrated perspective on problem solving paradigms in IE. IT application is studied in relation with such topics as O.R., statistics, stochastic systems, system simulation, and human-machine systems. The concepts and methods of artificial intelligence, HCI and UI design, and systems analysis / design are also introduced.

## IE 310 Work Study

This course covers the concepts and techniques of designing and improving work performance and productivity of man and man-machine systems. Topics include: productivity, methods study, value analysis, motion economy and analysis, work measurements, job analysis and evaluation, wage payments plan, etc. Laboratory work is also included.

## IE 312 Introduction to Human Engineering

This course deals with the consideration of human characteristics, expectations, and behaviors in the design of things people use in their work and of the environment.

## IE 321 Production Management I

This course covers a background and the development of production management, plus current concepts and controls applicable to production management functions.

## IE 322 Production Management II

This course is a continuation of IE 321. Emphasis is placed on capacity planning, facility location, line balancing and project planning.

## IE 331 Operations Research I

This course intends to cover basic materials in the areas of operations research that prove to be most effective in real world applications. Topics include Linear Programming, Nonlinear Programming, Transportation, Network Model, and Dynamic Programming. Special emphasis is placed on solving the problems drawn from real world situations.

## IE 332 Operations Research II

Stochastic OR models for performance evaluation and decision making are discussed. The topics include basic concepts of stochastic processes like Markov chains, Poisson processes, and renewal processes, and stochastic OR models like queueing models, inventory and reliability models, forecasting and time series analysis, decision analysis, Markov decision processes, and stochastic simulation. Modeling and basic concepts are emphasized. Related computer software is also introduced.

#### IE 341 Engineering Statistics II

This course is a continuation of Engineering Statistics I. Sampling distributions, parameter estimation, hypothesis testing, and simple regression analysis are covered.

#### IE 342 Regression Analysis and Experimental Designs

This course deals with basic theories of regression analysis and experimental design and their applications to industrial engineering problems. Major topics include: principles of least squares, regression model building, analysis of experimental data, and experimental designs for product and process optimization.

#### IE 343 Statistical Machine Learning

This course aims to provide both theoretical and practical understanding of modern statistical machine learning approaches. Topics include: linear regression, classification, sampling methods, model selection and regularization, decision tree, support vector machine, and unsupervised learning algorithms.

#### IE 353 Product Development and Product Information Management

The purpose of this course is to introduce the basic theories of product development and related information management issues. The theories include product development concept, processes, performance indices, factors and methodologies. The information issues cover information structure, information creation, information route and information representation in product development.

#### IE 361 Human-Computer Interaction Design

Students are exposed to both theory and practice of designing human-computer interfaces specifically in the context of human decision making. Human-machine cooperative problem solving that combines human capacity and industrial engineering techniques is emphasized. The techniques and tools for visualization of problem structures and information, aiding human cognitive tasks, and combining human and machine intelligence are acquired. Students work on a series of practical design exercises.

#### IE 363 Introduction to Modeling and Simulation

This course covers basic concepts and modern techniques of system modeling and simulation for the analysis & design of discrete event systems in manufacturing and service sectors. Case studies will be conducted using commercial simulation packages SIGMA®, IFS®, and ARENA®. There will be Lab sessions for practicing with simulation packages.

#### IE 371 Service System Engineering

The course introduces basic concepts for services and service systems, which have been growing in economic volume and making significant innovations. It focuses on engineering methods for modern technology-oriented service systems such as information system services, communication services, healthcare services, and financial services, and large complex service systems.

#### IE 413 Aesthetic Engineering

This course deals with the sensory and aesthetic aspects of man-machine interface design to enhance the system usability and image. Topics include Multidimensional Scaling, Semantic Differential Method, Human Sensation, Fuzzy Sets and Control, Neural Network, etc.

#### IE 414 Cognitive Science and Systems

This course is an introduction to cognitive issues in modern information-based systems such as human cognition and decision-making, computer modeling, and intelligent aiding approaches, with emphasis on application to systemic design and analysis of human-computer systems. Topics extends to general cognitive systems engineering concepts such as intelligent interface and joint cognitive systems that are essential in modern technologically complex environments.

#### IE 421 Engineering Economy and Cost Analysis

This course deals with economic analysis for decision making among alternative courses of action in engineering, business, government and personal finance. Use of compound interest calculations to compare the consequences of different alternative decisions is emphasized. Effects of depreciation accounting methods, national income taxes, simple risk and uncertainty, and the selection of appropriate minimum attractive rates of return are considered in problems relating to multiple alternatives, sunk cost, incremental cost, replacement, resource allocation and publicly financed projects.

#### IE 423 Logistics Management

This course deals with the material management, material flow, and physical distribution system. The topics include Systematic layout planning, quantitative facilities planning models, vehicle routing and scheduling and case studies.

#### IE 425 Project Management

The course deals with project management concepts, scheduling models and algorithms, work breakdown structure, project management processes, project management systems, and their applications to engineering projects and SW development / system integration projects.

#### IE 426 Supply Chain Management

This course deals with logistic processes improvements, including processes between enterprises and product design, inter-business processes integration by information sharing and transmission system, logistics system design, planning methods and systems, and partnerships and strategic alliance.

#### IE 431 Introduction to Optimization Theory

The purpose of this course is to introduce a variety of optimization techniques that are required for operations research. Topics include difference and differential method, piecewise concavity and convexity, Hessian matrix method, simplex algorithm, Gauss elimination, dynamic programming, gradient method, Lagrangean relaxation, branch-and-bound technique, combinatorial theory, and traveling salesman problem procedure. The associated problem complexities and heuristics procedures are also discussed.

#### IE 432 Decision Analysis and Risk Management

We depict decision problems under uncertainty via three approaches: 1) decision trees (dynamic programs and dynamic stochastic control), 2) optimization of Monte Carlo (policy) simulations, and 3) multi-stage stochastic programs.

#### IE 434 Introduction to Telecommunication Service and Systems

This course reviews current basic technical concepts and related telecommunications operations. Topics include basic terminology, voice networks signaling, modulation, multiplexing and voice digitization. This course also deals with transmission and switching systems, information theory and traffic analysis.

#### IE 435 Telecommunication Management and Policy

This course addresses the key non-technical aspects of telecommunications. Topics include aspects of regulation and deregulation, common carriers, tariffs, domestic and international standards and management. This course also reviews the development and future trends in telecommunications.

#### IE 436 Case Studies for Industrial & Systems Engineering

The course introduces the problem solving processes and methods for real R&D and consulting project cases from the faculty and the industry. A case study includes customer requirement identification, problem definition & design, problem solving methods and processes, implementation, evaluation and measurement, and proposal and report writing. Students hear lectures by the project managers and discuss with them.

#### IE 441 Quality Control

This course is an introduction to the theory and applications of quality control techniques. Topics include: total quality management; graphical methods for quality; Shewhart control charts and other process control techniques; lot-by-lot, continuous and other acceptance sampling plans; process improvement using designed experiments, Taguchi methods, and evolutionary operation (EVOP).

#### IE 451 IT Service Engineering

The course introduces modern IT service engineering principles and methodologies across the whole life cycle of information systems, including requirement engineering, process analysis and innovation, system design, development, implementation, operation, and after-service. We introduce not only baseline methods in IT service engineering but also best practices from leading system integrators (SI) covering various industries such as manufacturing industry, financial industry, logistics industry, and telecom-service industry.

#### IE 452 System Design Project

This is a capstone design course for designing systems including manufacturing systems and products, service systems and services, healthcare systems and services, communication systems and services, information systems, military systems, logistics/transportation systems, financial service systems and products, etc. Individual students or teams learn system design problems by performing problem definition, customer requirement identification, functional requirement definition, system architecture and function design, operation methods and operation system design, development and implementation, evaluation and improvement, etc.

#### IE 453 Conceptual Design for Engineering Products

In the world of design, it has been said that 80% of final design outcome quality is determined at the early, conceptual design stage. This is because the conceptual design phase is where a problem to be solved is unambiguously defined and creative solutions are explored. A conceptual design phase consists of a few key elements: understanding customers' and stakeholders' needs, defining requirements from the needs, generating solution concepts and identify superior set of alternatives, and conducting preliminary analysis. In this course, students learn about a conceptual design phase of product development. The course discusses various design methods and tools to understand how they facilitate creative but structured design thinking.

#### IE 461 Business Process Engineering and Management

In this course students learn business strategy planning methodologies, strategy-aligned process reengineering methodologies, process modeling techniques (using international standard notation), process implementation technologies, and enterprise-wide process architecture management and governance processes.

#### IE 463 Information Systems Engineering and Management

In this course students learn the state of art processes, methodologies and technologies to plan, analyze, design, implement and operate the enterprise architecture and the information systems to support dynamically changing business strategies.

#### IE 471 Introduction to Financial Engineering

This course aims to build up the basic knowledge on various financial instruments as well as quantitative models for investment management. We study equities, fixed-income securities, and derivatives and discuss about their pricing models and investment strategies.

#### IE 472 Socio-Economic Systems Modeling

Socio-economic systems are ubiquitous, and understanding them is integral to management, public policy, and decision-making. This course will provide the fundamentals of modeling socio-economic systems, such as how agents constitute socio-economic systems, and more importantly, how to model the interactions between the agents and the systems.

#### IE 473 Financial Economics

This goal of this course is twofold: (1) to provide an introduction into the workings of financial markets and (2) to analyze the role of financial markets for the broader macroeconomy.

#### IE 481 Special Topics in Industrial Engineering I

The course provides an overview of topics not included in regular undergraduate courses in Industrial Engineering. New developments in IE (*e.g.*, results of dissertation research) may be presented in the class as demand or interest warrants.

#### IE 482 Special(Invited) Lecture I

The course is provided for a short course, an invited lecture, a training and lab, etc., which requires effort equivalent to 1 credit unit.

#### IE 483 Special(Invited) Lecture II

The course is provided for a short course, an invited lecture, a training and lab, etc., which requires effort equivalent to 2 credit units.

#### IE 490 B.S. Thesis

This course includes research or project work leading to a B.S. thesis.

#### IE 495 Individual Study

This is an individual research in a specific topic in IE, which is carried out independently under the supervision of a faculty member.

#### IE 496 Seminar in BS

There will be a total of 7 seminar sessions, once every two weeks, in e-Business and manufacturing innovation related subjects. Graduates of the IE Department who are working in e-Business and manufacturing innovation areas will be invited as speakers.