• Department of Industrial Engineering

0. Degrees offered
The department offers graduate programs leading to the Master of Engineering degree and the Doctor of Philosophy degree with a major in industrial engineering.

1. Educational Goal
Our goal is to provide quality education and meaningful career opportunities for graduate students so that they can solve problems by understanding, analyzing, designing, developing, installing and improving integrated systems of people, equipment, information, financial resources, software, materials, and energy.

2. Educational Objective
Upon graduation from our Industrial Engineering program, students will have

1) advanced knowledge in engineering, applied probability and statistics, data science, and information technology,

2) optimization skills for modeling, optimization, evaluation of integrated systems of man, machine, technology and information,

3) problem solving ability based on knowledge and skills to develop integrated solutions to large-scale problems,

4) professional behavior to be prepared for decision making and communications

• List of Full-time Faculty

Name	Position	Degree(University)	Field of Instruction	Area of Research
Hyun-Seung Oh	Professor Emeritus	Ph.D.(Iowa State U.)	Engineering Economy, Quality Control	Engineering Economy, Quality Control
Hahn-Kyou Rhee	Professor Emeritus	Ph.D.(U. of Florida)	Operations Research	Operations Research
Kyeong-Taek Kim	Professor	Ph.D.(North Carolina State U.)	Data Science	Data Science
Chong-Su Kim	Professor	Ph.D.(North Carolina State U.)	Computer Applciations	Computer Applciations
Sung-Ha ark	Professor	Ph.D.(Texas Tech U.)	Human Factors and Ergonomics	Human Factors and Ergonomics
Bong-Wan Choi	Professor	Ph.D.(Iowa State U.)	Modeling and Simulation	Modeling and Simulation
Ji-Hoon Kyung	Professor	Ph.D.(Hannam U.)	Data Science	Data Science

• Course Description

IE 602 Special Topics in Simulation 3 credits

This course deals with a discrete-event simulation to be exploited for the design and analysis of systems. In addition to simulation basics, important topics regarding modeling, experiments, and output analysis are included. Through the course, simulation project experiences using widely used simulation packages such as ProModel and AutoMod are emphasized.

IE 603 Occupational Biomechanics 3 credits

This course studies the following topics in occupational biomechanics: the historical development and theoretical fundamentals of body mechanics, the functional anatomy and physiology of the muscular skeletal system, the body link system and kinematic and kinetic aspects of body movement, and application of biomechanics to physical work systems.

IE 604 Graph and Network Algorithm 3 credits

This course deals with graph theory such as Eulerian circuit, Hamiltonian circuit, matching and covering as well as network algorithm such as street network problem, traveling salesman problem, shortest path, minimal spanning tree, maximal flow, assignment problem. Especially, the development and implement of network algorithms to solve diverse problems are emphasized.

IE 605 Supply Chain Planning 3 credits

This course deals with supply chain systems which consists of several organizations integrated by material, information and cost flows. To improve the competitiveness of supply chain systems and to satisfy customer needs, supply chain planning plays an important role. In this course, diverse supply chain planning systems to integrate several organizations, and coordinate material, information, cost flows will be extensively examined.

IE 606 Service Engineering 3 credits

Service industry is expanding in the economies of both developed and developing countries, and thus is considered the growth engine of the next generation. Service engineering aims to provide a science-based approach to service industry based on the methodologies which have been successfully applied to manufacturing industry. Issues and subjects of this course include the introduction of up-to-date service technology, the analysis of service-oriented organizations, strategies and the concept of service operations. Practical approaches such as best practice case study are used.

IE 611 Stochastic Process 3 credits

This course covers probabilistic Operations Research models used widely in engineering and management fields. Based on the probability theory, discrete-parameter Markov chain, continuous-parameter Markov chain, Poisson process, renewal theory, Non-Markovian queueing models and so on are discussed.

IE617 Financial Data Analysis 3 credits

In financial engineering, mathematical methods are applied to the areas of pricing, hedging, portfolio management and others. These days, this subject has been implemented and widely spread as a form of FinTech applications based on the mobile platforms and their related IT. This course provides methodologies for financial engineering practices of derivatives value estimation and pricing using big data-based programming and analysis. The scope includes data analysis programming such as R, derivatives evaluation, values at risk and FinTech concepts.

IE618 Digital Manufacturing 3 credits

Digital Manufacturing is a manufacturing practice in which production-related problems are identified before mass production using 3D product model-based simulation and optimal manufacturing processes are designed and implemented. This enables corporations to shorten the products development period, to enhance productivity, and to improve quality. In this course, students learn the history, basic concepts, and characteristics of digital manufacturing, practice the techniques and methodology, and study the implementation-related topics through case studies.

IE619 Analysis and Design of Experiment 3 credits

The course provides knowledge about experimental designs and analysis of data from experiments. Analysis of variance, randomized block designs, Latin-square designs, linear mixed models, split-plot designs, response surface methodology, mixture models and fractional 2k experiments are studied. Applications of experimental planning and analysis of variance play a prominent part. The course content is valuable when planning and carrying through experiments.

IE628 Operations Research 3 credits

This course covers deterministic Operations Research models used widely in engineering and management fields. In particular, the linear programming problems which have linear forms of objective function and constraints are mainly discussed. Topics included in this course are formulation of linear programming problems, methodologies to derive the optimal solutions of the decision variables such as graphical approach, simplex method and big-M method, dual theory, sensitivity analysis, transportation and assignment problems.

IE629 Data Analysis 3 credits

Data to be analyzed is rapidly evolving from numeric or text data to multimedia, spatial and temporal data. The topics covered in this course include spatial data mining and temporal data mining.

IE630 Engineering Economics 3 credits

This course aims not only to provide sound and comprehensive coverage of the concepts of engineering economics, but also to address the practical concerns of engineering economics. More specifically, to build a thorough understanding of the theoretical and conceptual basis upon which the practice of financial project analysis is built, to satisfy the very practical needs of the engineer toward making informed financial decisions when acting as a team member or project manager

for an engineering project and incorporate all critical decision-making tools, including the most contemporary, computer-oriented ones that engineers bring to task of making informed financial decisions. Also, the course emphasizes the full range of engineering disciplines, as well as an engineering technology.

IE631 Production Planning & Control 3 credits
This course is concentrated on operations research methodologies applied to problems in the production planning and control. A thorough coverage of basic models that have found extensive practical applications is provided. A logical organization to the various quantitative results that are useful in the field of production planning and control is presented. Important topics include Forecasting, Aggregate Production Planning, Classical Inventory Control and Scheduling, Material Requirement Planning(MRP), PERT & CPM, and Sequencing & Scheduling.

IE632 Data Science 3 credits
Data science is a technique to extract new unknown knowledge from enormous volume of data. Topics covered in this course include decision tree analysis, associations rules, clustering algorithm, and rough sets.

IE633 Safety Engineering 3 credits
The course covers principles of design for work and product safety, accident theory, accident and loss prevention, accident cost analysis, standards & regulations, human errors & hazards recognition, and advanced topics in workplace safety.

IE634 Quality Management and Analysis 3 credits
This course aims the use of statistical methods and other problem-solving techniques to improve the quality of products and services at the most economic levels which allow for full customer satisfaction. The topics include analysis of statistical data, probability distributions, design of quality, statistical process control, polices of quality, product liability, quality assurance, designs and applications of quality control systems, and analysis of quality information systems.

IE635 Probability and Statistics 3 credits
Major goal of this course is to provide basic knowledge related to the probability theory for mathematical interpretation of uncertainties in future events and the statistics for systematic collection of population information from sample data. The following topics are included: (1) concepts of random variable (2) definition of probability distribution functions (3) expectation and variance (4) conditional probability distribution and independent random variables (5) transform methods

(6) efficient usages of data (7) estimations (8) hypothesis test (9) simple/multiple regression and correlation analyses and so on.

IE 701 Systems Engineering 3 credits
This course deals with systematic, multidisciplinary approach in engineering design. Especially, it focuses to diverse decision making process required for developing systems. Topics include system analysis methodology, system optimization, system design process, feasibility study and life cycle costing.

IE 703 Engineering Valuation Practice 3 credits
This course aims to discuss various methods for analyzing both univariate and multivariate time series. The topics include many recent advances in univariate and multivariate time series methods such as inverse autocorrelation functions, vector ARIMA modes, regression analysis, moving average methods, exponential smoothing method, decomposition method, and many others.

IE 705 Special Topics in Economic Engineering 3 credits
This course aims to develop leading-edge skills in engineering economy and provide new information on financial engineering. The topics include a deterministic cash flow analysis, investment analysis, engineering valuation, a random cash flow analysis, and derivatives securities will be discussed.

IE 707 Stochastic System Analysis 3 credits
Rather than a single trial, successive random events are considered to develop fundamental concepts of stochastic processes based on the probability theory. In particular, various types of Poisson process, renewal process, branching process, queueing process and so on are discussed. In order to understand basic concepts of stochastic processes, theory of probability, transform methods including probability generating function and Laplace transform, and differential equations are required as prerequisites.

IE 708 Facility Layout and Design 3 credits
The issues associated with locating new facilities and methods for determining the best layout of operations in those facilities are discussed in depth. In addition to exploring the quantitative factors that should be taken into account, quantitative techniques to assist with such difficult decision are also discussed. In order to follow such developments, basic knowledges related to network theory and optimization theory are required.

IE 709 Special Topics in Quality Engineering 3 credits
This course aims to deal primarily with various types of control charts and with

various types of acceptance sampling systems and procedures which have been widely used in many industries and in many countries throughout the world to improve product quality and to reduce costs. The topics include readings of the latest papers by students and total quality management system and many other statistical quality control methods used in industries.

IE 711 Advanced Reliability Engineering 3 credits
Reliability engineering is the subject of prediction and enhancement of systems' life. For that purpose, mathematical modeling and analytical methods are needed. In this course, various topics of Reliability engineering are introduced, which include reliability design, preventive maintenance, and accelerated life test. The methods introduced here are practiced using statistical tools to furnish students with capability of applying methodologies to real situations.

IE 713 Advanced Topics in Ergonomics and Human Factors 3 credits
The course covers advanced topics in human factors and ergonomics, including design of workstation, displays & controls, human computer interface, and work environment design.

IE 714 Cognitive Engineering 3 credits
The course covers principles of design for work and product safety, accident theory, accident and loss prevention, accident cost analysis, standards & regulations, human errors & hazards recognition, and advanced topics in workplace safety.

IE 716 Advance Topics in Data Analysis 3 credits
There are several data types that are used for data analysis Numerical data, text data, temporal data, spatial data are among them. Data analysis techniques depending on data types are discussed.

IE 718 Advanced Topics in Artificial Intelligence 3 credits
Business intelligence (BI) is a category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions. The topics include measurement, analytics, reporting, collaboration platform, knowledge management.

IE 722 Weapon System Development Process 3 credits
This course covers the discussions of research and development(R&D) of the weapon system, research and development history, military science and technology policy in the defense acquisition process. In addition, provides interpretations of

research and development support tools, research and development methodology, etc, and also provides discussions of the economic value of R&D.

IE 723 Analysis & Evaluation Methodology 3 credits
This course covers the discussions of methods and techniques for combat testing, acquisition, analysis & evaluation, training based on industrial engineering (economic engineering, OR, M & S, reliability engineering, ergonomics, statistics, etc.). In addition, provides examples of analyzing the assessment techniques.

IE 724 Wargame Modeling 3 credits
This course covers the background of a historical perspective of WarGame. Also covers the status and future directions of WarGame, the technology-based war game model, and case studies WarGames in Korea. In addition, provides the tour and practices of WarGame Trainning Ceneter in the Joint Chiefs of Staff, Combined Forces Command, and Eulji wargaming.

IE 726 M&S Based R&D Methodology 3 credits
This course covers the discussion of Modeling & Simulation based research and development methodology of advanced weapons systems. In addition, this course provides the characteristics and strategies of M&S being used for weapons research and development, and also in particular, provides concept of M & S systems for the verification testing, simulation-based acquisition.

IE 727 Optimization Using Metaheuristics 3 credits
This course covers the requirements processes in terms of understanding the concept, the available means and procedures for utilizing Defense Planning. In addition, this course provides the method for efficient requirement process from requirement compatibility to final products.

IE729 Advance Topics in Smart Factory 3 credits
Smart factory is a plant with a production system in which information technology is applied to all stages of the product life cycle in order to increase productivity and flexibly adapt to the changes of the market. In current technology level, a smart factory is typically run through real-time big data analysis which are gathers by various sensors and IoT devices. This course provides students with the study of concepts and technological trends mainly through a wide variety of case studies.

IE730 Optimization Algorithm 3 credits

This course addresses several methodologies for solving non-linear optimization problems. The students will have hands on experience to program Python and/or R to get the solution of the problem.

IE731 Military M&S Theory & Application 3 credits

This course covers the fundamental M&S theory of Visual Model, Interaction Method, Fidelity of Model, HLA-RTI, LVC(Live-Virtual-Constructive) and specially provides application methodology for real military model such as Constructive, Engagement and Engineering Model etc.

IE732 Work Physiology 3 credits

This course covers the pulmonary, cardiovascular, and muscular responses and characteristics to work, including the energy costs of work endurance, fatigue, physical work capacity, and physiological modeling.

IE733 Applications of Operations Research 3 credits

Selective deterministic models involved in scientific problem solving procedures are discussed. One of the various types mathematical programming problems such as linear programming, nonlinear programming, integer programming and dynamic programming is studied deeply to develop capability to solve difficult industrial problems. To do so, concepts of matrices, differentiation and limit are required.

IE734 Sentiment Analysis-based Service Quality Management 3 credits

In the era of service-manufacturing integration, the key of service industry innovation is to achieve operational efficiency while maintaining good emotional perception. This course provides theoretical background and methodologies for the area of service science, service quality management. The main topic is the measurement of service quality for planning and evaluating service strategy using sentiment analysis. Other topics include preparation of strategy of service, service quality concept, etc.

IE735 Weapon System Engineering 3 credits

This course covers the understanding of system capability and system characteristics of advanced weapon system. In addition, This course provides the fundamental methodologies for evaluation and analysis of variety of advanced weapons systems.

IE736 Model based System Engineering 3 credits

This course covers the discussion of Model Based System Engineering for implementing high-quality & low-cost Complex System and Equipment, especially in commercial and military area.

In addition this course provide the concept and theory of MBSE being used for System development, also in particular, provides application methodology of MBSE for System Implementation.

IE737 M&S Based Acquisition 3 credits

This course covers the simulation-based acquisition system for implementing faster, better low-cost weapon system and equipment acquisition. In addition, provides the discussion of the M & S tools and methodologies used in the defense acquisition system.

IE738 Military M&S Based Case Study 3 credits

This course covers the discussion of M&S based case studies such as modeling and simulations process of Combat vehicles, weapon systems, acquisition system, training system and military technologies. In addition, this course provides the technical and operational views of Fighters (helicopters, UAVs, aircraft), battle ship(Aegis.) and weapons-related systems(Guided weapons systems) used in modeling and simulation. Also, this course has the discussions of systems engineering, effects, human engineering, survivability, stealth, unmanned technologies for supporting the M & S.