• **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-tie Faculty**

Name	Position	Degree(University)	Field of Instruction	Area of Research
Sung-Ha Park	Professor	Ph.D.(Texas Tech Univ.)	Human Factors and Ergonomics	Human Factors and Ergonomics
Chong-Su Kim	Professor	Ph.D.(North Carolina State Univ.)	Computer Applciations	Computer Applciations
Bong-Whan Choi	Distinguished Professor	Ph.D.(Iowa State Univ.)	M&S	M&S
Joo-Young Lee	Assistant Professor	Ph.D.(KAIST)	Mobility system and AI	Mobility system and AI
Ji-Hoon Kyung	Assistant Professor	Ph.D.(Hannam Univ.)	Data Science	Data Science

• Course Description

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, feasibility study, system design process, system optimization and life cycle cost estimation methodology.

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

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.

Simulation 3 credits
This course deals with a discrete-event simulation to be exploited for the design and analysis of diverse systems. In addition to simulation basics, important topics regarding modeling, experiments, and output analysis are included. Throughout the course, simulation project experiences using widely used simulation packages such as ProModel and AutoMod are emphasized.

Weapon System Engineering 3 credits
This course deals with analysis of various advanced weapon systems used in modern warfare. This course also focuses on devloping a total understanding of the system capability and system characteristics and provides the ability and technology strategy considering the main combat situation of the Army, Navy and Airforce. Also This course investigates and analyzes the detailed core technology and discuss the dirction of future weaponsystem reasearch and development

Model based System Engineering 3 credits
This course understand and discuss the theory and process of applying the system engineering methodology for system implementation. This course also deals with definitions, history, case studies and recent modeling & simulations of modeling -based systems engineering.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.

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.

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, and (9) simple/multiple regression and correlation analyses and so on.

Introduction to Financial Engineering 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.

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.

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.

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.

Big Data Analysis 3 credits

Data to be analyzed is rapidly evolving from numeric or text data to multimedia, spatial and temporal data. The purpose of the course is to enhance the student's basic programming capabilities, such as Python or R, used to analyze the data.

Smart Mobility 3 credits

Smart Mobility focuses on the efficient and intelligent management strategies of the emerging mobility and new transportation sectors. This course explores not only the optimization of traffic flow through sensors, communication technologies, and data analysis but also investigates the connection with the principles of systems analysis and design in industrial engineering. By integrating sustainable development of transportation systems with industrial engineering, this course studies integrated transportation management solutions for modern cities and analyzes real-world application cases.

Data Visualization 3 credits

This course is concentrated on methodologies for analyzing and visualizing different types of data, including numeric data. The objectives, advantages, disadvantages, and algorithms of the most commonly used analytical techniques based on data type will be explored, followed by topics for further research.

Artificial Intelligence 3 credits

This course addresses topics in new trends of artificial Intelligence. The topics may include but are not limited to: search, knowledge representation, algorithm, machine learning, social network analysis, robotics, etc

Machine Learning 3 credits
Machine Learning studies algorithms and techniques that enable computers to learn from data. This course focuses on key learning methodologies such as supervised learning, unsupervised learning, and reinforcement learning, and emphasizes their practical application to solve real problems.

Mathematics for Artificial Intelligence 3 credits
Mathematics for Artificial Intelligence covers the mathematical foundations of artificial intelligence algorithms. This course emphasizes improving the understanding and design capabilities of AI models through subjects such as probability, statistics, linear algebra, and optimization.

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.

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.

Advanced Topics in Quality Management 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 latest papers are reviewed by students and the professor, and topics include total quality management system and many other statistical quality control methods used in industries.

Statistical Quality Control 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.

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.

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.

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.

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.

Advanced Topics in 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.

Advanced Topics in Ergonomics 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.

Cognitive Engineering 3 credits
Cognitive Engineering covers the fundamentals of human information processing and implications of human perceptual, cognitive, and psycho-motor capabilities for the design of systems for effective human use and control.

Work Physiology 3 credits
Work Physiology 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.