

Industrial and Systems Engineering (ISE)

Course information contained within the Bulletin is accurate at the time of publication in August 2023 but is subject to change. For the most up-to-date course information, please refer to the Course Catalog.

ISE 2101. Applied Statistical Methods for Industrial and System Engineers. 3 Credit Hours.

Statistical analysis techniques and their applications in the field of industrial and systems engineering are presented. Topics include the statistical measures describing data, frequency distributions, probability distributions, sampling parameter estimation, hypothesis testing, regression analyses, and analyses of variance. Special emphasis on their application to field of industrial and systems engineering.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1042 (may be taken concurrently), MATH 1942 (may be taken concurrently), MATH 1951 (may be taken concurrently), MATH 1031 (may be taken concurrently), 'Y' in MA07, 'Y' in MATW, or 'Y' in METW)

ISE 2102. Production Process Design and Laboratory. 4 Credit Hours.

Introduction to the theory and practice of manufacturing processes. Study covers the fabrication of metallic, plastic, and electrical products, operation of NC and other automatic equipment, and economics of the design and production process. Topics to be covered include introduction to manufacturing processes, metal forming processes, metal cutting processes and machine tools, metal finishing processes, introduction to AutoCAD, numerical control (NC) machining, processing of plastic products and an introduction to automated manufacturing processes. Lectures will be complemented by a laboratory.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ENGR 1117.

ISE 2103. Deterministic Models in Operations Research. 3 Credit Hours.

The deterministic techniques of operations research. Topics include the applications of linear, nonlinear, integer, and dynamic programming methods and network flows analysis to solve industrial and systems engineering problems. Other topics include an introduction and overview of deterministic models, preliminaries of Linear Programming (LP), graphical solution of linear programming and introduction to simplex method, sensitivity analysis, marginal utility, computer applications and LP packages, transportation and assignment problems, network and graph theory introduction, spanning trees shortest route algorithm, Dijkstra's algorithm, formulation of shortest path as LP, maximum flow algorithms, nonlinear programming, classical optimization, integer programming introduction, Gomory's cutting plane, branch and bound method, complete methods, Dynamic Programming (DP), and recursive relationship of DP.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1042 (may be taken concurrently), MATH 1942 (may be taken concurrently), or 'Y' in METW)

ISE 3101. Product Quality Assurance. 3 Credit Hours.

Methods used to achieve higher product quality, to prevent defects, to locate chronic sources of trouble, to measure process capability, and to use inspection data to regulate manufacturing processes are emphasized. Preparation of statistical control charts and selection of suitable sampling plans. Topics include review of probability distributions, control chart principles, control charts for variables (X, R charts), control charts for attributes (p, c, u charts), specifications and tolerances, fundamentals of acceptance sampling, acceptance sampling by attributes, special attribute sampling procedures, reliability, graphic methods for quality control, and TQM and ISO standards.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2101.

ISE 3102. Stochastic Models in Operations Research. 3 Credit Hours.

Probabilistic techniques of operations research. Topics include the applications of Markov chains, queueing and inventory control models to analyze and evaluate systems performance. Other topics include introduction to stochastic processes, review of probability, Markov chains and classification of their states, long-run Markov chains and applications, introduction to queueing theory, birth and death process, applications of queueing theory, introduction to inventory theory, components of inventory models, deterministic inventory models, stochastic inventory models, and introduction to forecasting.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2103.

ISE 3103. Systems Thinking and Modeling. 3 Credit Hours.

Utilizing a systems thinking approach in engineering design and development is necessary to understand the connections and dependencies that exist within the system. This course introduces the concept of systems thinking and computer modeling via system dynamics. Computer modeling can aid in understanding the complex feedback dynamics possible emergent behavior which can be found in the human, technological and organization systems. In addition, policy interventions and their effect on the behavior and structure of the system will also be addressed.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2101 and (MATH 2041, MATH 2941, MATH 3041, MATH 3941, or 'Y' in METW)

ISE 3185. Industrial and Systems Engineering Internship Experience. 1 to 3 Credit Hour.

The course provides industrial and systems engineering experience in an engineering service, industrial, or research setting. The internship should allow the student to apply knowledge learned, build upon that knowledge and assess outcomes.

Class Restrictions: May not be enrolled in one of the following Classes: Freshman 0 to 29 Credits.

Repeatability: This course may be repeated for additional credit.

ISE 4101. Human Factors (Ergonomics). 3 Credit Hours.

This course covers Human-machine systems analysis. The study of workplace layout, measurement of employee efficiency and productivity, criteria for tool and fixture design or selection, industrial fatigue, environmental influences on performance including the effects of illumination, noise, vibration, thermal, and other atmospheric factors. The basic ideas of industrial hygiene; the impact of OSHA; and special techniques for experimenting with human subjects, via demonstrations and supervised experiments are explored. Additional topics include human factor definitions, human factor research methodologies, human information processing, visual presentation - static and dynamic information, auditory and other displays; speech communication, motor skills, human control systems, data entry devices, physical work and manual materials handling, applied anthropometry, workplace environment; illumination and atmospheric conditions, noise, vibration and motion, human error, accidents and warnings, and usability and human-computer interaction.

Class Restrictions: Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

Repeatability: This course may not be repeated for additional credits.

ISE 4102. Industrial Simulation. 3 Credit Hours.

Introduction to the application of simulation modeling for the analysis of complex industrial and manufacturing service systems. Examples are chosen from real-life situations such as warehousing, material handling, robotics, transportation, and hospital emergency rooms. Verification/validation as well as statistical analysis of both input/output data are introduced. Topics include Verification and validation, calibration of models, face validity, validity of assumptions, Turing/Delphi test, comparison and evaluation of alternative systems, simulation examples, queueing systems, inventory systems, object oriented programming, ARENA simulation software, random number generation, Input modeling and Output analysis, confidence intervals, and variance reduction.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2103.

ISE 4103. Engineering Cost Analysis. 3 Credit Hours.

This course introduces the tools and techniques applicable for cost analysis and control including standard costs, variance analysis, cost volume relationships, cost estimation, and utilization of accounting data for control of operations. Topics include basics of financial/cost management; elements of financial accounting and development of income statements and balance sheets; cash flow statements, inventory valuation methods; cost-volume relationships, cost drivers; methods of measurement, application of regression analysis; product addition or deletion, target costing, pricing decision; cost allocation; activity based costing, job order cost systems and process cost systems and overhead, cost allocation, analysis and control.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ACCT 2501.

ISE 4104. Production Planning and Control. 3 Credit Hours.

This course introduces the study of the components and functioning of integrated production, planning, and control systems; forecasting, aggregate planning, scheduling, and recent models of production and inventory control for optimizing continuous and intermittent manufacturing operations. MRP basics and introduction to using a computer to apply scheduling models will be covered. Topics include functional modules in the control of a manufacturing organization, forecasting methods, aggregate planning and master scheduling, linear programming based methods, capacity requirements planning; machine scheduling, job sequencing and line balancing; job shop and flow shop models; material requirements planning and just-in-time production control.

Class Restrictions: Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2103 (may be taken concurrently)

ISE 4105. Facility Planning. 3 Credit Hours.

This course will study strategic planning of production facilities including location, planning, design and maintenance. Emphasis on production systems, machine selection, automation, material handling, storage and warehousing, quality, retrofitting and preventative maintenance.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2101, ISE 2102, and ISE 2103.

ISE 4106. Service Systems Engineering. 3 Credit Hours.

Services play a vital role in modern economies. In many economies they surpass their manufacturing counterparts in terms of contribution to the Gross Domestic Product, yet they cannot be handled in the exact same manner. The fundamentals of this sector as an engineering field will be discussed as well as the operations of service systems as a customer-centric environment. Topics will include service quality, strategies, operations, electronic services, queuing, service supply chains and managing service projects. Various projects will be handled during the course of the semester focusing on various aspects of the service industry.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2101 and ISE 4104.

ISE 4107. Systems Engineering Fundamentals. 3 Credit Hours.

Complex system development requires both hard and soft skills to address the challenges in modern engineering. Systems engineering includes human, organization and technical variables that all must be considered in complex system development. This course will cover the foundations of systems science and systems thinking, as well as an overview of the methodology that systems engineers use to bring these systems to fruition. Topics in the methodology that will be covered include identification of needs, requirements development, design and design integration, verification and validation as well as tools used to perform these functions such as technical management, life cycle costing and risk analysis and management. This course will show the breadth of knowledge that is required of a systems engineer to address engineering challenges.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ISE 2101 and ISE 3103.

ISE 4176. Industrial and Systems Engineering Senior Design Project I. 3 Credit Hours.

Your undergraduate career culminates with the Senior Design Project and integrates the Industrial and Systems engineering concepts with a major design experience. Through this experience you will demonstrate your skills for managing and executing a design project in a team setting. Skills you will need include problem identification, constraint specification, alternative analysis selection, design development, analysis and recommendations. In addition, you will have practice learning how to manage impediments that arise in the project development. Through this culminating experience you will integrate knowledge and further your technical, critical thinking, writing and teamwork skills.

Field of Study Restrictions: Must be enrolled in one of the following Fields of study: Industrial + Sys Engineering.

College Restrictions: Must be enrolled in one of the following Colleges: Engineering.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in ENGR 2196 and Complete 2 of the following: ISE 3102, ISE 3103, and ISE 4104.