

# ISEN - INDUST & SYSTEMS ENGR (ISEN)

## ISEN 101 Introduction to Industrial Engineering

**Credits 1. 1 Lecture Hour.** Introduction to industrial engineering; overview of the curriculum; presentations by faculty and industry to familiarize with the department and the scope of industrial engineering applications.

## ISEN 210 Fundamentals of Industrial Engineering Design

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Engineering design for product development, problem definition and need identification, information gathering and concept generation, decision making and concept selection; industrial engineering concepts including design for manufacturing, assembly, sustainability and environment; economic decision making and cost evaluation; risk, reliability and safety; quality; robust design and optimization. **Prerequisite:** Grade of C or better in ENGR 102.

## ISEN 230 Informatics for Industrial Engineers

**Credits 3. 3 Lecture Hours.** Structured programming concepts for implementing mathematical and statistical models in industrial engineering problems; emphasis on introductory production and service system problems and computer-based approaches to solve the problems; engineering applications of probability and statistics concepts. **Prerequisite:** CSCE 206, CSCE 111, CSCE 121, or CSCE 110 or equivalent; concurrent enrollment in STAT 211.

## ISEN 281 Essentials of Modern Manufacturing Methods for Engineering Design

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Fundamental basis from materials and manufacturing methods selection in engineering design; basic elements and theory of a range of materials manufacturing methods, with specific emphasis on recent developments in the field including rapid prototyping 3D, computer control of machines - tools, automation robotics micro-fabrication and metrology. **Prerequisite:** Grade of C or better in ENGR 217/PHYS 217 or PHYS 217/ENGR 217, or concurrent enrollment.

## ISEN 285 Directed Studies

**Credits 1 to 4. 1 to 4 Other Hours.** Problems of limited scope in industrial engineering approved on an individual basis intended to promote independent study. **Prerequisite:** Approval of department head.

## ISEN 289 Special Topics in...

**Credits 1 to 5. 1 to 5 Other Hours.** Selected topics in an identified area of Industrial Engineering. May be repeated for credit. **Prerequisites:** Approval of instructor.

## ISEN 291 Research

**Credits 1 to 4. 1 to 4 Other Hours.** Research conducted under the direction of faculty member in industrial and systems engineering. May be taken four times for credit. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

## ISEN 302 Economic Analysis of Engineering Projects

**Credits 2. 2 Lecture Hours.** Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and after-tax analysis of economic projects. **Prerequisites:** Grade of C or better in MATH 152 or MATH 172; also taught at Qatar campus.

## ISEN 303 Engineering Economic Analysis

**Credits 3. 3 Lecture Hours.** Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and tax implications; certainty; uncertainty; risk analysis; public sector analysis and break-even concepts. **Prerequisite:** MATH 152.

## ISEN 310 Uncertainty Modeling for Industrial Engineering

**Credits 3. 3 Lecture Hours.** Models and methods based on probability and statistics for industrial engineering applications; random variables, expectation, distribution fitting, reliability of systems, central limit theorem and interval estimates in the context of production and service systems. **Prerequisites:** Grade of C or better in ISEN 230 or concurrent enrollment; grade of C or better in STAT 211.

## ISEN 311 Introduction to Data Analytics and Engineering

**Credits 3. 3 Lecture Hours.** Basic concepts in data engineering, including data acquisition, data management and models for learning with associated algorithms; iterative algorithms; tree-based and regression-based classification; graphs and graph-based methods; clustering; neural networks basics and their training; data structures for storing and processing data; introduction to databases. **Prerequisites:** Grade of C or better in CSCE 206, CSCE 111, or CSCE 110; grade of C or better in STAT 211.

## ISEN 320 Operations Research I

**Credits 3. 3 Lecture Hours.** Development and application of fundamental deterministic optimization models and solution methods; focus on quantitative modeling and formulation of linear, integer, and network flow problems; use of computer optimization software to model and solve real-life problems. **Prerequisites:** Grade of C or better in MATH 304 or MATH 323.

## ISEN 330 Human Systems Interaction

**Credits 3. 3 Lecture Hours.** Principles of human factors and ergonomics; emphasis on design to support human capabilities, limitations, and interaction tendencies in sociotechnical work systems; topics include human information processing, physiological and biomechanical functioning, and implications for design of the workplace and jobs; case studies in manufacturing, medicine, aerospace, ground transportation, and computer interaction. **Prerequisite:** Grade of C or better in ISEN 210 or concurrent enrollment.

## ISEN 340 Operations Research II

**Credits 3. 3 Lecture Hours.** Probabilistic methods for industrial and service systems; stochastic processes used in industrial engineering, including Poisson processes and discrete and continuous-time Markov chains; applications to production operations, inventory control, revenue management, quality control, reliability, digital simulation and finance. **Prerequisites:** MATH 304 and ISEN 310; junior or senior classification.

## ISEN 350 Quality Engineering

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Strategic approach to implementing quality, process and business improvement methods using data analysis tools; total quality management and six sigma approaches to define, measure, analyze, improve and control processes; principles of lean engineering; control charts; process capability analysis; basic metrology, applied statistics, lean principles and process capability. **Prerequisites:** Grade of C or better in ISEN 310 and ISEN 230.

## ISEN 355 System Simulation

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Systems simulation structure, logic and methodologies; development of simulation models; data handling methods; analysis of simulation data; verification and validation; system simulation languages, models and analysis; applications to industrial situations. **Prerequisites:** Grade of C or better in ISEN 230 and ISEN 310.

## ISEN 360 Lean Thinking and Lean Engineering

**Credits 3. 3 Lecture Hours.** Philosophical, managerial, and operational principles of lean thinking within the context, tools, and practices of lean engineering; focuses on principles and practices of lean engineering that are applicable across industry types; includes design of lean systems, lean cell design, modeling of lean manufacturing systems and operation of manufacturing cells; queuing network theory for the analysis of lean systems. **Prerequisite:** Grade of C or better in STAT 211; junior or senior classification.

## ISEN 370 Production Systems Engineering

**Credits 3. 3 Lecture Hours.** Principles, models, and techniques for planning and analysis of production and distribution systems; application of linear, integer, and nonlinear optimization models and solution methods for aggregate planning, supply chain planning, push (MRP) and pull (JIT) material flow management, inventory control under deterministic and stochastic demands, operations scheduling, and production scheduling. **Prerequisites:** Grade of C or better in ISEN 230 and ISEN 320.

## ISEN 399 Professional Development

**Credits 0. 0 Other Hours.** Participation in an approved high-impact learning practice; reflection on professional outcomes from engineering body of knowledge; documentation and self-assessment of learning experience at mid-curriculum point. **Prerequisites:** Grade of C or better in ISEN 210 and ISEN 230; senior classification.

## ISEN 405 Facilities Design and Material Handling

**Credits 3. 3 Lecture Hours.** Principles of facilities location, layout, and material handling systems and to practice designing facilities; modeling, design, and analysis techniques; methodologies in facilities location, layout, and material handling; integration of ergonomics analysis techniques and their implications on design, layout, safety and quality. **Prerequisites:** Grade of C or better in ISEN 210 and ISEN 320; junior or senior classification.

## ISEN 408 Supply Chain and Logistics

**Credits 3. 3 Lecture Hours.** Principles, models and techniques for planning, analysis and design of supply chain systems; optimization principles, including linear and integer programming, applied to supply chain planning and operations; information technology, design models, databases, and strategic and tactical decision making. **Prerequisites:** Grade of C or better in ISEN 320, ISEN 340, and ISEN 370; junior or senior classification.

## ISEN 410 Advanced Engineering Economy

**Credits 3. 3 Lecture Hours.** Principles of economic equivalence; borrowing, lending, and investing; establishing minimum attractive rate of return; replacement analysis; capital budgeting; uncertainty analysis; decision trees. **Prerequisites:** Grade of C or better in ISEN 210 or ISEN 302; junior or senior classification.

## ISEN 411 Engineering Management Techniques

**Credits 3. 3 Lecture Hours.** Techniques relating to managing engineering activities; engineer's transition into management; engineering managerial functions; motivation of individual and group behavior; productivity assessment/improvement; managing the quality function and communications. **Prerequisite:** Grade of C or better in ISEN 350; senior classification.

## ISEN 413 Advanced Data Analytics for Industry

**Credits 3. 3 Lecture Hours.** Data mining; linear discriminant analysis (LDA), principal component analysis (PCA) and other methods; classification, clustering, and mining, information extraction; dealing with uncertainty, Bayesian inference; neural models, regression and feature selection. **Prerequisites:** Grade of C or better in ISEN 310 and ISEN 350; junior or senior classification.

## ISEN 414 Total Quality Engineering

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Principles of total quality engineering; total quality management philosophy, engineering approaches for designing quality into products and processes; off-line experimentation methods for the robust design; emphasis on teamwork and continuous quality improvement. **Prerequisite:** Grade of C or better in STAT 211; junior or senior classification.

## ISEN 416 Facilities Location, Layout and Material Handling

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Analytical treatment of facilities location, physical layout, material flow and handling, combined with heuristic algorithms to assist in the design of production/service facilities; fundamental concepts applied through a sequence of design projects. **Prerequisites:** ISEN 315; ISEN 316 or registration therein.

## ISEN 425 Design and Analysis of Industrial Systems with Simulation

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** In-depth study into the design-modeling and subsequent analysis of contemporary production/service systems; factory/service systems are modeled using the ARENA/SIMAN V simulation-animation language; emphasis is placed on the critical analysis of alternative flow designs of modeled systems using flow and economic parameters to assess system improvement. **Prerequisites:** Grade of C or better in ISEN 210 and ISEN 355.

## ISEN 427/DAEN 427 Decision and Risk Analysis

**Credits 3. 3 Lecture Hours.** Overview of the state of the art in descriptive and prescriptive theories of decision making under uncertainty with emphasis on the ways in which human decisions depart from normative models of rationality; analytical foundations stemming from several disciplines, economics, psychology, management science; application in engineering systems will be considered. **Prerequisite:** Grade of C or better in ISEN 310, DAEN 321, or STAT 212. **Cross Listing:** DAEN 427/ISEN 427.

## ISEN 433 Biomechanics of Work

**Credits 3. 3 Lecture Hours.** Mechanical behavior of the human musculoskeletal system and component tissues during physical activity; fundamental biomechanical concepts, principles, tools and methods for the measurement of human physical attributes, evaluation of human mechanical capabilities and modeling of human musculoskeletal system; application of concepts to improve performance or prevent injuries during daily activities. **Prerequisite:** Grade of C or better in ISEN 330; junior or senior classification.

## ISEN 434 Human Error and Resilient System Design

**Credits 3. 3 Lecture Hours.** Human error from a sociotechnical systems perspective; role of error in complex system failures; human behavioral modes and system design factors; analytical methods for defining the roles and impact of errors in large-scale system accidents; real-world case studies. **Prerequisites:** Grade of C or better in ISEN 330; junior or senior classification.

## ISEN 440 Systems Thinking

**Credits 3. 3 Lecture Hours.** Systems thinking process, systems of systems and the fundamental considerations associated with the engineering of large-scale systems, or systems engineering including systems modeling, design and the system development process. **Prerequisites:** Grade of C or better in MATH 304; junior or senior classification.

## ISEN 442 Organizational Systems

**Credits 3. 3 Lecture Hours.** Role of people and organizations in the design and development of complex engineered systems; providing engineers with the skills needed to effectively manage large-scale system development programs. **Prerequisites:** Grade of C or better in ISEN 330; junior or senior classification.

## ISEN 450 Healthcare Systems Engineering

**Credits 3. 3 Lecture Hours.** Explores components of healthcare system, existing problems in healthcare systems; need for engineering to analyze healthcare system problems; application of industrial engineering tools in improving healthcare system; role of industrial engineering in addressing healthcare policy issues. **Prerequisites:** Grade of C or better in ISEN 340 and ISEN 355; junior or senior classification.

## ISEN 453 Manufacturing Operations

**Credits 3. 3 Lecture Hours.** Analytical principles of manufacturing systems design, analysis and control; emphasis placed on stochastic analysis; role of variability and impact on cycle time; push versus pull production strategies including Kanban and constant WIP control; probability, queuing theory, Little's Law, heavy traffic approximations, and queuing networks. **Prerequisites:** ISEN 340; junior or senior classification.

## ISEN 460 Capstone Senior Design

**Credits 3. 1 Lecture Hour. 6 Lab Hours.** Engineering design including identification of a problem; development, analysis and evaluation of alternative solutions; and recommendations for and, where possible, development of systems improvement tools; application of experience and training to provide a product or solution that helps company clients; balancing client needs with academic requirements. **Prerequisite:** Grade of C or better in ISEN 210, ISEN 330, ISEN 340, ISEN 350, ISEN 355 and ISEN 370; junior or senior classification.

## ISEN 485 Directed Studies

**Credits 1 to 6. 1 to 6 Other Hours.** Permits work on special project in industrial engineering; project must be approved by department head. **Prerequisite:** Senior classification in industrial engineering.

## ISEN 489 Special Topics in...

**Credits 1 to 5. 1 to 5 Lecture Hours. 0 to 5 Lab Hours.** In-depth study of areas of current student interest and recent advances; normally used for first time offering of new courses. **Prerequisite:** Approval of instructor.

## ISEN 491 Research

**Credits 1 to 4. 1 to 4 Other Hours.** Research conducted under the direction of faculty member in industrial and systems engineering. May be taken three times for credit. **Prerequisites:** Junior or senior classification and approval of instructor.