SYSTEMS ENGINEERING (SENG)

SENG 3300 Engineering Economics

Principles of engineering economics including 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. Interchangeable with ENGR 3300.

Prerequisites: MATH 2414.

SENG 3310 Intro to Control Systems

Analysis and synthesis of controlled, dynamic, linear mechanical, electrical, fluid and/or thermal systems; introduction to concepts of stability, controllability, and observability. Optimal control systems and nonlinear control theory.

Prerequisites: CSCE 1336, CSCE 1136, ENGR 2305, MATH 3310 and MATH 3330.

SENG 3320 Engineering Modeling & Design

This course will cover the fundamentals of modeling and design, introduce students to engineering design criteria such as human factors and ergonomics, maintainability, and reliability. The course will also introduce students to project management topics such as project scheduling, schedule reduction, design and project selection models, and multi-criteria decision making. Contemporary case studies of failures in modeling and design will be analyzed to identify lessons learned.

Prerequisites: ENGR 2372

SENG 3330 Operations Research I

Introduction to the fundamental deterministic analytical methods and their applications to the industrial and systems engineering. Modeling and decision making. Methods include linear programming, the simplex method, integer programming, distribution and network models (transportation, transshipment, and assignment problems), nonlinear programming, queuing analysis, simulation, and forecasting.

Prerequisites: MATH 3310 and SENG 3320.

SENG 3337 Software Development

This course will cover advanced software development techniques including object-oriented programming, inheritance, polymorphism, formatted file access, recursion, functional and operator overloading, parsing using a FSM, stacks and queues using linked list, search algorithms using binary search trees, and shortest path algorithms.

Prerequisites: CSCE 1336 and CSCE 1136.

SENG 3340 Robotics and Automation

Study of the use, design, and deployment of industrial automation and robotics technologies in high-precision, multi-product manufacturing environments. Robot manipulators, kinematics and dynamics, robot automation and control, integrated robotic systems for manufacturing, automation in manufacturing, programmable logic controllers, applications to industrial systems. Interchangeable with CSCE 3345. Prerequisites: ENGR 2305, ENGR 2105, and MATH 3310

SENG 3345 Microprocessor Systems

Introduces basic computer structure, the instruction set, addressing modes, assembly language programming, assembly language subroutines, arithmetic operations, programming in C, implementation of C procedures, elementary data structures, input and output, and a survey of microprocessor-based design. This course is interchangeable with CSCE 3340. Prerequisites: CSCE 2330

SENG 3370 Computer Int Manufacturing

Programmable automation applied to manufacturing systems. Sensors and data acquisition. Continuous and discrete control system design and analysis. Computer control of manufacturing processes and integration. Communications through local areas networks.

Prerequisites: Junior or Senior standing.

SENG 3380 Measurements and Devices

Basic concepts and principles of measurement methods; characteristics of signals; signal conditioning; data acquisition and processing; transducers and sensors, analog and digital devices, voltage regulators; power supplies; measurements of temperature, pressure, velocity, flow, and strain. Prerequisites: ENGR 2305/2105.

SENG 4152 Internship in Systems Engr

A directed internship in an organization appropriate to the student's career objectives. May be repeated for credit. Evaluation of performance is on a Pass or Fail basis.

Prerequisites: Permission of instructor.

SENG 4185 Special Topics in Systems Engr

Topics may be from any area of Systems Engineering. May be repeated when topic changes.

Prerequisites: Senior standing or permission of instructor

SENG 4195 Undergraduate Research

Permits work on a research engineering project. May be repeated for credit. Prerequisites: Permission of instructor.

SENG 4199 Directed Study in SENG

A directed study course. Topics selected from contemporary developments in the field of systems engineering. May be repeated for credit. Prerequisites: Permission of instructor.

SENG 4252 Internship in Systems Engr

A directed internship in an organization appropriate to the student's career objectives. Evaluation of performance is on a Pass or Fail basis. Prerequisites: Permission of instructor.

SENG 4285 Special Topics in Systems Engr

Topics may be from any area of Systems Engineering. Prerequisites: Senior standing or permission of instructor

SENG 4295 Undergraduate Research

Permits work on a research engineering project. Prerequisites: Permission of instructor.

SENG 4299 Directed Study in SENG

A directed study course. Topics selected from contemporary developments in the field of systems engineering. Prerequisites: Permission of instructor.



SENG 4301 Senior Design I

This course is the first in the senior design sequence. It will cover principles of project management; planning, scheduling, and control; engineering proposals; and technical reports. Students prepare proposals, including specifications, timelines, schedule, and budget, for projects to be implemented in SENG 4390. This course should be taken the semester preceding SENG 4390. (Formerly SENG 3301).

Prerequisites: ENGL 2311 and senior standing

SENG 4315 Embedded Systems

Characteristics of embedded systems, microprocessors and microcontrollers, system design, modular programming, interface devices, memory management, interrupts, input/output applications, multitasking, and simulation. Interchangeable with CSCE 4315.

Prerequisites: ENGR 2305, ENGR 2105, CSCE 1336, and CSCE 1136.

SENG 4330 Operations Research II

This course will present mathematical models for inventory management. It also covers a variety of statistics topics such as analysis of variance (One Factor and Two Factors), simple and advanced multiple linear regression. Techniques to deal with collinearity in datasets such as stepwise regression and best subsets are presented. Other topics include game theory, Markov chains, and multicriteria decision-making through goal programming Prerequisites: ENGR 2372 and SENG 3330.

SENG 4340 Intelligent Systems

Introduction to methods for the analysis and design of intelligent engineering systems. Topics include reinforcement learning, optimal estimation, Bayesian networks, expert systems, neural networks, and genetic algorithms. Applications emphasize control and decision-making in engineering, finance, and computer science. Interchangeable with CSCE 4340.

Prerequisites: SENG 3340.

SENG 4350 Facilities Design & Logistics

Design and analysis of models and algorithms for facility location, vehicle routing, and facility layout problems. Emphasis will be placed on both the use of computers and the theoretical analysis of models and algorithms in the design of production/service facilities, sequencing, and scheduling. Fundamental concepts applied through a sequence of design projects. Prerequisites: SENG 3330.

SENG 4352 Internship in Systems Engr

A directed internship in an organization appropriate to the student's career objectives.

Prerequisites: Permission of instructor.

SENG 4360 Systems Simulation

Study the structure, logic, methodologies, and computer techniques for simulating systems. Topics include fundamentals of discrete simulation, designmodeling and subsequent analysis, model verification and validation, and understanding and predicting the behavior of systems. Prerequisites: SENG 3330.

SENG 4370 Intro to Virtual Manufacturing

Introduction to virtual manufacturing, virtual reality applications in manufacturing systems design, networked manufacturing applications, and modeling of occupational safety engineering. Prerequisites: SENG 3370.

SENG 4385 Special Topics in Systems Engr

Topics may be from any area of systems engineering. May be repeated when topic changes.

Prerequisites: Senior standing or permission of instructor.

SENG 4390 Senior Design II

This course is the second and final course in the senior design sequence. This course provides students the experience of implementing (including building, testing, and documenting) the approved project in SENG 4301, within budget and on schedule. Requires integration of knowledge from required systems engineering courses. Course requirements include a written report and oral presentation.

Prerequisites: SENG 4301.

SENG 4395 Undergraduate Research

Permits work on research engineering project. Prerequisites: Permission of instructor.

SENG 4399 Directed Study in SENG

A directed study course. Topics selected from contemporary developments in the field of systems engineering.

Prerequisites: Permission of instructor.

SENG 5200 Concepts in Numerical Methods

This course provides the foundation in numerical methods necessary for admission to the Master of Science in Systems Engineering program. Grading for the course is on a Pass/Fail basis.

SENG 5201 Concepts in Prgrm & Comp Tools

This course provides the foundation in programming and computational tools necessary for admission to the Master of Science in Systems Engineering program. Grading for the course is on a Pass/Fail basis.

SENG 5202 Concepts in Engineering

This course provides the foundation in automation necessary for admission to the Master of Science in Systems Engineering program. Grading for the course is on a Pass/Fail basis.

SENG 5300 Systems Engineering Management

This foundational course aims to develop a vital set of skills by exposing students to: (1) technical topics in systems engineering, such as optimization, simulation, Markov chains, and game theory; (2) managerial skills in areas like project management, inventory control, and multicriteria decision-making and support systems; and (3) soft skills related to communication (oral, technical, virtual), teamwork, conflict resolution, and governance.

SENG 5310 Engr Computational Tools

This course covers critical concepts, skills, and platforms related to scientific computing on high performance architectures. The principal objective is to enable use of high-performance computers to support data management applications for data analytics and automation. The course will leverage a wide range of computational tools and software platforms to support students' proficiency in data-driven decision-making and process automation. By the end of this course, students will have the knowledge and hands-on experience to design and implement efficient algorithms for high performance computing, analyze the performance of codes via stochastic methods, FFTs, finite element and finite difference methods, and more, as a means to excel in data analytic roles and automation-driven projects.

SENG 5320 Logistics & Quality Ctrl Engr

This course provides students with problem-solving and analytical skills, particularly regarding transportation of material, inventory management, production planning, and distribution network optimization within complex supply chain systems. The course covers topics such as deals with the distribution, transportation, and storage of goods and services, as well as approaches for engineering quality into systems design.



SENG 5330 Advanced Systems M&S

This course focuses on the principles, methodologies, and tools used in modeling and simulation of complex systems. Students in this course will explore advanced modeling techniques (predictive modeling, validation, design, etc.), simulation methodologies (stochastic processes, terminating and non-terminating simulations, discrete/continuous object-based simulation modeling, etc.) and tools. Students will develop skills necessary to address real world challenges and optimize system performance across various industries. Application areas include: manufacturing, transportation, computer microarchitecture, oil & gas, and healthcare.

SENG 5340 Applied Multivariate Stats

The course will cover the study of sparsely correlated data. Topics include the theory and application of advanced testing of correlations and analysis of varied aggregate data techniques such as cluster and discriminant analysis, factor analysis, graphical display of multivariate data, sample correlations, inference, conditional distribution and partial correlation, principal component analysis, and multivariate analysis of variance.

SENG 5342 Data Analytics Foundations

This course provides an overview of modern data analytics techniques including foundations of the three types of analytics: descriptive, prescriptive, and predictive analytics. These techniques have grown from the fields of statistics, machine learning, and information theory. Decision trees, covering algorithms, association mining, statistical modeling, linear models, and instance-based learning are some of the basic methods covered in this course.

SENG 5344 Machine Learning Algorithms

This course covers concepts, techniques, and algorithms in machine learning for the development of real-world applications. Students will focus on developing both supervised and unsupervised algorithms, with an emphasis on optimizing these models. Students will gain hands-on experience in creating and refining their own algorithms, utilizing techniques like supervised optimization and unsupervised learning.

SENG 5346 Big Data

This course covers essential concepts related to the design, implementation, and optimization of big data systems within complex engineering environments. This course focuses on supporting data management, processing, and analytics at scale. This course also emphasizes the application of advanced algorithms and tools for handling big datasets, ensuring efficient data integration, analysis, and real-time decision-making in dynamic engineering systems.

SENG 5360 Intelligent Control

This course offers a solid foundation in the design, modeling, and control of intelligent systems, focusing on both theoretical principles and real-world applications. Key topics include intelligent system modeling, control strategies, decision-making processes, and AI-driven applications. Students will develop the skills needed to design and implement intelligent systems that integrate advanced modeling techniques, control algorithms, and AI-based decision-making for diverse practical scenarios.

SENG 5362 Advanced CAD/CAM Systems

This course will cover the theory and applications of CAD/CAM systems, modeling, data exchange and integration, mechanical assembly, process planning, integration of CAD/CAM with the production systems, and computer control of machines and processes in manufacturing systems.

SENG 5364 Adaptive & Autonomous Systems

The course aims to introduce the design of autonomous and adaptive systems in theoretical and practical setups. Topics will include principles of autonomous system design and implementations, reinforcement learning, game-theoretic approaches to cooperation and coordination, bio-inspired systems, mobility dynamics and control, sensors and perception, cognition and decision, action, and commands, computer communications and integration, and complex adaptive systems.

SENG 5366 Signal and Image Processing

This course introduces fundamental concepts of image processing and computer vision. Topics to be covered include image formation, image filtering, edge detection and segmentation, morphological processing, object recognition, object detection, and vision systems.

SENG 5380 Information Security

This course explores fundamental concepts and practices of securing systems and data. Topics include confidentiality, integrity, and authentication models, as well as protection models and security kernels. Students will explore key aspects of operational security, including intrusion detection, audit processes, physical security issues, and personnel security. The course also covers the security system life cycle, risk and vulnerability assessment, and the development of policies for effective security management.

SENG 5381 High-Performance Computing

This course will introduce parallel and high-performance computer (HPC) systems and their corresponding architectural designs and programming models, distributed and shared memory systems, as well as their respective programming paradigms. Furthermore, the application of scaling current programming solutions to HPC systems will be discussed extensively, along with the challenges that emerging applications represent such as machine learning applications.

SENG 5382 Renewable Energy Systems

This course provides an understanding of the principles of energy conversion and the science behind various renewable energy sources. In particular, it will focus on photovoltaic and thermoelectric systems. The course will also explore the challenges involved in integrating different renewable energy sources, as well as their economic implications for heating, power, and transportation. Sustainability challenges and future outlooks for each energy source and system will also be examined.

SENG 5383 Advanced Software Engineering

This course covers software engineering principles and their applications with the aim of developing a software product. Students will learn and apply stateof-the-art software engineering processes in a team-based environment, where they will determine project requirements, and design, implement, and test engineered solutions.

SENG 5384 Cloud Computing

This course will cover topics such as cloud infrastructures, virtualization, software-defined networks and storage, and programming models. It will explore the virtualization of CPU, memory, and I/O resources, along with concepts like cloud computing, cloud systems, parallel processing, data distribution, cloud security, and multicore operating systems. Additionally, the course will discuss the services offered by current state-of-the-art cloud platforms.



SENG 5385 Semiconductor Testing

This course will cover the types of faults that occur in semiconductor logic circuits and the methods used to detect such faults and their location, in both combinational and sequential circuits. Furthermore, the design decisions needed to improve testability will be discussed, as well as the creation of built-in self-tests for integrated circuits and boards.

SENG 5386 Mechatronics Systems

This course covers the integration of electronic/electrical engineering, computer technology, and control engineering with mechanical engineering to provide a self-contained, modern treatment of mixed systems along with their computer simulation and applications. This course introduces students to the design of mechatronic systems with topics such as electronics, sensors, actuators, and microprocessor implementation, system identification, implementation of feedback control, advanced sensors, and advanced actuators, fundamentals of micro-robot technology, and micro-scale engineering devices.

SENG 5387 Advanced Seminar

The seminar offers an exploration of ongoing cutting-edge research projects through presentations from the program's thesis/capstone design students, faculty, and/or invited scholars from other institutions. The goal of this seminar is to promote and develop student research while encouraging collaboration amongst students, faculty, and/or external scholars.

SENG 5388 Special Topics

An intensive examination of emergent topics in systems engineering, data analytics, automation, and/or other related areas.

SENG 5397 Capstone Project

The program capstone project will be selected by the student based on her/his industry and/or professional interests and must be approved by the program capstone adviser. The deliverables for this course will consist of a comprehensive technical report and oral presentation that detail the problem-solving approach executed and the outcomes that were achieved.

Prerequisites: Approval of program capstone adviser and completion of a minimum of 21 SCH.

SENG 5398 Thesis I

This course is the first step in the MS SENG thesis, and includes, at a minimum, the completion of the Introduction, Literature Review, and the Methodology sections of the thesis. The evaluation of this course is on a CR/NC basis. The student will receive credit (CR) when the thesis proposal is approved by the student's thesis committee. If the proposal is not completed, then a grade of IP is received and the student must enroll again for credit.

SENG 5399 Thesis II

This course is the final step in the MS SENG thesis and includes the implementation of the methodology outlined in Thesis I and the completion of the Results, Discussion, and Conclusion sections of the thesis. The course is to be scheduled by the student in consultation with the student's thesis adviser. The student will receive credit when the thesis has been written and defended successfully. Evaluation of performance in this course is on a CR/NC basis. If a grade of IP is received, the student must enroll again for credit. Prerequisites: SENG 5398 and the Approval of the thesis advisor and the department chair.