



# TEXAS A&M INTERNATIONAL UNIVERSITY

## College of Arts and Sciences School of Engineering Student Learning Outcomes (SLOs)

Courses included in this document:

- **Computer Science**
  - COSC 1136 Fundamentals of Programming Laboratory
  - COSC 1336 Fundamentals of Programming
  
- **Engineering**
  - ENGR 1201 Foundations of Engineering I
  - ENGR 1202 Foundations of Engineering II
  - ENGR 1204 Engineering Graphics
  - ENGR 2103 Engineering Mechanics-Statics and Dynamics Laboratory
  - ENGR 2303 Engineering Mechanics-Statics and Dynamics
  - ENGR 2105 Principles of Electrical Engineering Laboratory
  - ENGR 2305 Principles of Electrical Engineering
  - ENGR 2372 Engineering Statistics
  - ENGR 2376 Conservation Principles in Thermal Engineering
  - SENG 3300 Engineering Economics
  - SENG 3310 Introduction to Control Systems
  - SENG 3320 Engineering Modeling and Design
  - SENG 3330 Operations Research I
  - SENG 3337 Software Development
  - SENG 3340 Robotics and Automation
  - SENG 3370 Computer Integrated Manufacturing
  - SENG 3380 Measurements and Devices
  - SENG 4152-4352 Internship in Systems Engineering
  - SENG 4195-4395 Undergraduate Research
  - SENG 4301 Engineering Project Management and Proposals
  - SENG 4315 Embedded Systems
  - SENG 4330 Operations Research II
  - SENG 4350 Facilities Design & Logistics
  - SENG 4360 Systems Simulation
  - SENG 4390 Systems Engineering Senior Project

## **School of Engineering**

### **COSC 1136**

### **Fundamentals of Programming Laboratory**

#### **COURSE DESCRIPTION**

Laboratory course to accompany COSC 1336. Laboratory exercises reinforce the particular paradigms that are stressed in COSC 1336. Students will develop and run functional programs that solve elementary algorithmic problems. Students will also gain experience with compiling, finding, correcting syntax errors, and executing programs. This course places importance on scientific communication and collaboration methods. Co-requisite: COSC 1336.

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of the course, the student will be able to:

- demonstrate the skills of editing, running and debugging programs;
- apply the syntax rules of the programming language to recognize and correct various programming errors;
- distinguish programming approaches and constructs best suited to practical problems;
- design and create easily readable and understandable programs that are syntactically and logically correct;
- use computers and software tools to examine syntax and concepts of the programming language, which can be a foundation for more advanced computer science or computer science-related studies.

**School of Engineering**  
**COSC 1336**  
**Fundamentals of Programming**

**COURSE DESCRIPTION**

This course introduces fundamentals of a high-level programming language. Students, applying rules of syntax and semantics, develop the skills in program design, implementation and debugging to solve computational problems in the programming language. No programming or computer science experience is required. High school BCIS as well as basic Algebra abilities are helpful. Co-requisite: COSC 1136.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of the course, the student will be able to:

- utilize the basic elements of programming character-based I/O, assignment, loops, conditionals, vectors, functions and parameter-passing in programming practice such as reading, writing and debugging a program;
- apply techniques for expression evaluation, and role of operator precedence and associativity in expression evaluation in programming practice;
- demonstrate the understanding of the importance of structured programming concepts as well as good programming practice;
- demonstrate the understanding of the role of primary data structures and algorithms and perform operations involving various data structures, and implement some simple examples of them;
- apply syntax of the programming language to design, implement, test and debug a non-trivial program that solves a practical problem.

**School of Engineering**  
**ENGR 1201**  
**Foundations of Engineering I**

**COURSE DESCRIPTION**

This course introduces you to the engineering professions through multidisciplinary, societally relevant content. You will learn how to develop approaches for comprehending engineering systems and generating and exploring creative ideas and alternatives. You will be introduced to engineering fundamentals, problem solving methodologies, creativity and innovation. You will learn, through experience, the process of design and analysis in engineering including how to work effectively on a team. Finally, you will develop skills in oral communication, logical thinking, and usage of modern engineering tools such as LabVIEW and MATLAB. Co-requisite: MATH 2413.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- describe the engineering disciplines and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do;
- individually, or as a member of a technical team, understand and apply a structured engineering problem solving using a design process;
- develop algorithmic thinking by implementing simple algorithmic forms of engineering models/problems using MATLAB;
- communicate technical information via written, oral, and visual communication tools;
- recognize the advantages and challenges of problem solving using a team.

**School of Engineering**  
**ENGR 1202**  
**Foundations of Engineering II**

**COURSE DESCRIPTION**

Introduction to engineering ethics and professional responsibilities, development of skills in problem solving, analysis, estimation, design, and teamwork; introduction to systems engineering; computational analysis, computer programming applications; students work in teams on an engineering design project, including construction, testing, and reporting. Prerequisite: ENGR 1201 and MATH 2413.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- discuss engineering ethics and professional responsibilities;
- apply the engineering design process;
- describe the basic principles of Systems Engineering;
- identify engineering projects and propose possible solutions;
- apply teamwork skills to resolve engineering issues in the real world;
- use software packages (such as LabVIEW and MATLAB) to solve basic engineering problems; and
- prepare and deliver professional presentations.

## **School of Engineering**

### **ENGR 1204 Engineering Graphics**

#### **COURSE DESCRIPTION**

This course provides the fundamentals of reading and developing engineering drawings of systems in mechanical, electrical and welding applications. The course covers 2D construction, sketching, orthographic projection, vector graphics, tolerance, sectional and auxiliary drawings. Further topics include 3D drawings and constructions. Prerequisite: ENGR 1201 (Foundations of Engineering I).

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Develop design solutions through sketching and computer graphics software using standard graphical representation methods.
- Solve auxiliary view problems using graphical geometry, projection theory, visualization methods, and pictorial sketching.
- Demonstrate proficiency in geometric modeling and computer aided drafting and design.
- Apply the standard dimensioning and tolerance practice for mechanical drawings.
- Demonstrate proper documentation and data reporting practices.

## **School of Engineering**

### **ENGR 2103**

#### **Engineering Mechanics-Statics and Dynamics Laboratory**

#### **COURSE DESCRIPTION**

This laboratory course is design to accompany ENGR 2303. The course reinforces the theoretical material covered in ENGR 2303 through laboratory exercises, while also emphasizing the scientific communication and collaboration between students. Co-requisite: ENGR 2303.

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Perform a variety of laboratory experiments, including forces in equilibrium, friction forces in an incline plane, single and two-stage gear systems, and relative and constant velocity.
- Conduct laboratory experiments and properly interpret the results.
- State the relationships between theory and experiments.
- Perform statics and dynamics theory in Engineering applications problems.
- Adapt to teamwork and collaboration.
- Write scientific reports.

## **School of Engineering**

### **ENGR 2303**

## **Engineering Mechanics-Statics and Dynamics**

### **COURSE DESCRIPTION**

Application of the fundamental principles of Newtonian mechanics to the statics and dynamics of particles and the equilibrium of trusses, frames, beams and other rigid bodies. Prerequisites: PHYS 2325/2125 and MATH 2414. Co-requisite: ENGR 2103.

### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- conduct free-body diagrams and apply the basic principles of static equilibrium of rigid bodies. Investigate forces and reactions for frames and beams. Determine the resultant force, equivalent force/couple systems, and distributed loads;
- calculate centroids and moments of inertia;
- apply Newton's laws of motion to particles and rigid bodies;
- use the energy and momentum methods for particles, systems of particles and rigid bodies; and
- use methodical approaches to solve statics and dynamics problems.



**School of Engineering**  
**ENGR 2105**  
**Principles of Electrical Engineering Laboratory**

**COURSE DESCRIPTION**

Laboratory course to accompany ENGR 2305. Laboratory exercises reinforce ENGR 2305 lecture material and place importance on scientific collaboration. Co-requisite: ENGR 2305.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- conduct laboratory experiments and properly interpret the results;
- state the relationships between theory and experiments;
- use laboratory equipment such as oscilloscopes, power supplies, multimeters, and function generators, to carry out electrical experiments;
- work in groups with other students; and
- use software packages to simulate electrical engineering circuits.

**School of Engineering**  
**ENGR 2305**  
**Principles of Electrical Engineering**

**COURSE DESCRIPTION**

Fundamentals of electrical circuit analysis, digital logic and semiconductor devices; intended as a terminal course in these areas for most engineering disciplines. Prerequisites: ENGR 1202 and MATH 2414. Co-requisite: ENGR 2105.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- use Kirchhoff's Laws for circuit analysis;
- use loop and node analysis techniques to analyze series-parallel networks;
- apply network theorems such as superposition, Thevenin's and Norton's to electrical circuits;
- perform transient analysis in RC and RL circuits;
- design simple transformer circuits;
- use common semiconductor components/devices such as transistors, diodes, voltage regulators, waveform generators, op-amps, etc. to design electronic circuits;
- analyze and design signal conditioning circuits using op-amps; and
- design digital logic using AND, OR, NOT, NAND, NOR gates.

## **School of Engineering**

### **ENGR 2372 Engineering Statistics**

#### **COURSE DESCRIPTION**

This course will cover a variety of important topics in probability and statistics such as pictorial and tabular methods in descriptive statistics, measures of location, measures of variability, samples spaces and events, axioms and properties of probability, counting techniques, conditional probability, independence, discrete random variables and probability distributions, continuous random variables and probability distributions, joint probability distributions and random samples. The course will also demonstrate how Microsoft Excel can be used to conduct statistical analysis such as basic simple and multiple regression. Prerequisite: MATH 2414.

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Interpret descriptive statistics and measures of location and variability for samples and populations
- Calculate the probability of events using axioms and properties of probability
- Analyze discrete and continuous probability distributions
- Evaluate results of basic simple and multiple linear regression problems
- Analyze joint probability distributions
- Explain the implications of statistical concepts such as covariance and correlation

**School of Engineering**  
**ENGR 2376**  
**Conservation Principles in Thermal Engineering**

**COURSE DESCRIPTION**

Theory and application of energy methods in engineering; conservation of mass and energy; energy transfer by heat, work and mass; thermodynamic properties; analysis of open and closed systems; the second law of thermodynamics and entropy; gas, vapor and refrigeration cycles; and applications. Pre-requisite: ENGR 2303, and MATH 2415 or registration therein.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of the course, the student will be able to:

- Look up thermodynamic properties in tables.
- Construct pressure-temperature, pressure-volume, or temperature-volume phase diagrams for pure substances.
- Indicate a process on an appropriate phase diagram.
- Use compressibility charts.
- Calculate expansion/compression work in a closed system.
- Apply conservation of energy to a closed system to determine heat transfer, work, or property changes.
- Use conservation of mass to determine change in mass of a system.
- Apply conservation of energy to an open system to determine heat transfer, work, or property changes.
- Analyze first law performance of simple engineering devices (valves, turbines, boilers, etc.).
- Determine maximum performance of cycles using the Carnot cycle.
- Identify sources of entropy generation in a system.
- Calculate work for isentropic processes.
- Calculate isentropic efficiencies of simple engineering devices: turbines, compressors, pumps, etc.
- Identify work/heat processes in any arbitrary cycle.
- Estimate work and efficiency for the Otto, Diesel, and Brayton cycles.
- Estimate work and efficiency for the Rankine power cycle.
- Team with other students to solve thermodynamic problems and write a technical paper.

**School of Engineering**  
**SENG 3300**  
**Engineering Economics**

**COURSE DESCRIPTION**

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. Prerequisites: MATH 2414.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- identify what is needed to successfully perform an engineering economy study;
- solve engineering economics problems that involve interest rates, rate of return, cash flows, and time value of money;
- evaluate alternatives using present worth analysis, capitalized cost analysis, annual worth analysis, and future worth analysis;
- use the benefit/cost ratio to evaluate projects;
- perform breakeven computations and analysis;
- apply cost estimation and depreciation methods to solve engineering economy problems;
- use a spreadsheet, such as Microsoft Excel, to solve engineering economy problems.

**School of Engineering**  
**SENG 3310**  
**Introduction to Control Systems**

**COURSE DESCRIPTION**

Analysis and synthesis of controlled, dynamic, linear mechanical, electrical, fluid and/or thermal systems; introduction to concepts of stability, controllability, observability, and to discrete time, sampled data control systems, optimal control systems and nonlinear control theory. Prerequisites: ENGR 2305, MATH 3310, MATH 3330, COSC 1336 and COSC 1136.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of the course, the student will be able to:

- define a feedback control system and describe the function of its major components;
- mathematically model a feedback control system using the transfer function;
- derive the Laplace transform of a time-domain function and use the inverse Laplace transform to determine the time-domain of a transfer function;
- use the state variable method to model and analyze control systems;
- analyze second-order systems and determine pole locations, percent overshoot, settling time, rise time and time to peak;
- employ the Routh-Hurwitz stability criterion to determine stability of a system;
- plot Root locus and use it in control system design and sensitivity analysis; and
- use Bode plots to analyze control systems and examine system stability.

**School of Engineering**  
**SENG 3320**  
**Engineering Modeling and Design**

**COURSE DESCRIPTION**

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. Prerequisite: Junior Standing

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Describe the fundamentals of systems science, engineering, and design;
- Explain critical design steps such as conceptual system design, preliminary system design, and detail design and development;
- Analyze relevant systems' design requirements in terms of human factors and ergonomics, maintainability, and reliability;
- Analyze an existing or new system in terms of need identification, data collection and analysis, assumptions, validation, selection of modeling tools, and performance improvement;
- Evaluate design and project proposals through the application of profitability-based and multi-criteria decision-making tools;
- Apply basic project management techniques in the organization and management of design and project proposals; and
- Write and present a team research paper covering a real-world systems engineering problem.

## **School of Engineering**

### **SENG 3330**

## **Operations Research I**

### **COURSE DESCRIPTION**

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. Prerequisite: MATH 3310, SENG 3320.

### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Describe the origins of operations research and how it came into being;
- Explain the concept of optimization as it relates to modern industrial and systems engineering applications;
- Develop the ability to formulate models for different operations research techniques, interpret their results, and analyze their long term implications;
- Identify the most appropriate operations research technique to use depending on the nature of the problem under study;
- Apply operations research techniques in a variety of interest areas such as manufacturing, logistics and supply chain management, transportation, healthcare, inventory management, and finance;
- Apply sensitivity analyses to evaluate “what-if” scenarios encountered in real-world situations;
- Implement operations research techniques on computer software packages; and analyze peer-reviewed research articles and summarize how they applied operations research techniques, conceptualize ways to improve their results, and suggest other alternative techniques that might have been appropriate



## **School of Engineering**

### **SENG 3337**

## **Software Development**

### **COURSE DESCRIPTION**

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: COSC 1336, COSC 1136.

### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- explain the basic concepts of object-oriented programming;
- implement source code to include advanced programming techniques such as file access, recursion, and functional overloading;
- design data structures based on linked lists;
- design basic graph theory algorithms; and
- implement parsing algorithms using finite-state machines.

**School of Engineering**  
**SENG 3340**  
**Robotics and Automation**

**COURSE DESCRIPTION**

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.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- perform homogeneous transformations and produce forward and inverse kinematic equations of a robot using the standard Denavit-Hartenberg representation;
- perform differential motions and velocity analysis;
- perform dynamic force control analysis;
- explain the functionality of actuators and sensors related to autonomous robotic systems;
- explain the functionality of Programmable Logic Controllers and its use in automation;
- perform fundamental computer vision and image processing operations to support automation; and
- design the hardware and software to produce a simple autonomous system including robotic arms and its appropriate path planning.

**School of Engineering**  
**SENG 3370**  
**Computer Integrated Manufacturing**

**COURSE DESCRIPTION**

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: SENG 3310 (Introduction to Control Systems)

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Evaluate different actuators, sensors, and converters related to automated manufacturing systems
- Analyze NC positioning systems and explain the concept of numerical control and computer numerical control
- Compare the different industrial robots including the end effectors and select the appropriate one for a manufacturing problem
- Program an industrial robotic arm
- Program a Programmable Logic Controller using ladder logic and other methods
- Explain the use of material handling and identification systems
- Distinguish between the different types of manufacturing systems including single station, manual and automated, cellular and flexible manufacturing systems
- Explain the different inspection principles, practices, and technologies
- Use computer aided design (CAD) tools to design a product

**School of Engineering**  
**SENG 3380**  
**Measurements and Devices**

**COURSE DESCRIPTION**

Basic concepts and principles of measurement methods; operational amplifiers; transducers and sensors; oscillators; wave shaping circuits; active filters; rectifiers; voltage regulators; power supplies; measurements of temperature, pressure, velocity, flow, and strain; signal conditioning; data acquisition and processing; Prerequisites: ENGR 2305.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- explain the principles of engineering measurement and modern instruments;
- describe the function and operation of analog and digital devices, electrical devices, signal conditioning, sampling, and data acquisition systems;
- identify and state the operational principles of sensors and instrumentation, and their use within measurements of physical properties (e.g. temperature, pressure, velocity, flow, and strain);
- work in teams to design and conduct measurement experiments and interpret the results; and
- install and configure data acquisition and signal conditioning running with computer software (LabVIEW).

**School of Engineering**  
**SENG 4152-4352**  
**Internship in Systems Engineering**

**COURSE DESCRIPTION**

A directed internship in an organization appropriate to the student's career objectives. May be repeated. Evaluation of performance is on a CR/NC basis. Prerequisite: Permission of instructor.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- apply professional judgment in the work environment;
- explain the legal, professional, and ethical issues in engineering;
- identify, analyze and solve technical problems;
- prepare and submit progress reports;
- prepare and submit a final project report; and
- deliver oral presentations with appropriate audio-visual materials.

**School of Engineering**  
**SENG 4195-4395**  
**Undergraduate Research**

**COURSE DESCRIPTION**

Work on an engineering research project related to Systems, Industrial, Electrical, Electronic, Mechanical, or Computer Engineering. This course may be repeated for credit. Prerequisite: Permission of instructor.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Identify current trends in systems engineering and use judgment to select a research topic;
- Analyze research requirements and design experimentation.
- Carry out experimentation and collect results.
- Prepare and submit progress reports for research.
- Prepare and submit final report for research that meets the requirements.
- Deliver oral presentation of the conducted research

**School of Engineering**  
**SENG 4301**  
**Project management and Proposals-WIN**

**COURSE DESCRIPTION**

Principles of project management; planning, scheduling, and control. Engineering proposals; Technical reports. Students prepare proposals, including specifications, timelines, schedule, and budget, for projects to be implemented in SENG4390. Prerequisites: ENGL 2311 and senior standing. This course should be taken the semester preceding SENG 4390.

This is a WIN course, which means that the writing component of this course is significantly more intense compared to other engineering courses of the same level. Writing assignments include presentations and a detailed project proposal. In this course you will:

1. Write through your homework on topics related to project management.
2. Write a project proposal, for which you will have to turn in two drafts before the main proposal is due.
3. Write on topics including team work and ethics.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Explain the project life cycle and state the general characteristics of a project;
- Apply checklists, scoring, and financial methods to screen and select projects;
- Construct scheduling network diagrams and determine the critical path of a project;
- Develop GANTT charts and apply resource leveling;
- Interpret project management diagrams and charts;
- Write and submit a formal senior project proposal, including a project plan and cost analysis; and
- Deliver oral presentations with appropriate audio-visual materials.

## **School of Engineering**

### **SENG 4315 Embedded Systems**

#### **COURSE DESCRIPTION**

Characteristics of embedded systems, microprocessors and microcontrollers, system design, modular programming, interface devices, memory management, interrupts, input/output applications, multitasking, and simulation. Prerequisites: ENGR 2305 and COSC 1336.

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Identify all the components of a typical embedded system;
- Design the necessary hardware and interface for embedded systems;
- Design the necessary software elements for embedded systems;
- Integrate and test the hardware and software;
- Use a development environment to implement embedded systems; and
- Design and implement simple hardware on Field Programmable Gate Array (FPGA).



## **School of Engineering**

### **SENG 4330 Operations Research II**

#### **COURSE DESCRIPTION**

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. Prerequisite: ENG 2372, SENG 3330.

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Describe the fundamentals of advanced operations research techniques
- Demonstrate knowledge of advanced statistical techniques such as ANOVA and Regression
- Analyze systems using serious gaming
- Study “memoryless” systems which follow a chain of linked events using Markov Chains
- Develop decision models based on multiple criteria

**School of Engineering**  
**SENG 4350**  
**Facilities Design & Logistics**

**COURSE DESCRIPTION**

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 3300.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- explain the various facility design and planning problems encountered in manufacturing and/or service systems;
- analyze the process and material flow involved in various facilities design;
- develop mathematical models and algorithms for the analysis and control of manufacturing and logistics systems;
- apply the techniques to vehicle routing, inventory, scheduling, and integrated distribution models and algorithms;
- apply solution techniques to single-facility and multi-facility location, facility layout, and material handling, warehouse design and operational problems;
- develop and analyze the supply chain and integrated logistics using discrete optimization techniques; and
- work in groups of 2-3 students to design and conduct experiments and write reports based on their findings.

## **School of Engineering**

### **SENG 4360 Systems Simulation**

#### **COURSE DESCRIPTION**

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

#### **STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- manually replicate the execution of a Discrete-Event Simulation Engine;
- summarize the various tasks outlined in a Simulation Project Methodology;
- describe issues associated with establishing a discrete-event simulation capability within any system;
- design a computer-based discrete-event simulation model to represent a complex industrial/business/service system;
- analyze the output of a simulation model in order to verify the appropriateness of the model's performance;
- evaluate various system configurations to determine the most appropriate system design and/or justify proposed changes to a given system; and
- work in teams of 2-3 students to develop the simulation models of an actual system using ARENA, analyze the simulated results, and recommend the possible modification that is required to improve the system.

**School of Engineering**  
**SENG 4390**  
**Systems Engineering Senior Project**

**COURSE DESCRIPTION**

This capstone 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. To be taken during the semester of graduation.

This is a WIN course, which means that the writing component of this course is significantly more intense compared to other engineering courses of the same level. Writing assignments include presentations and a detailed project proposal. In this course you will:

1. Write through your homework on topics related to project management.
2. Write a project proposal, for which you will have to turn in two drafts before the main proposal is due.
3. Write on topics including team work and ethics.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, the student will be able to:

- Apply knowledge of mathematics, science, and engineering
- Design and conduct experiments, as well as analyze and interpret data
- Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Function on multidisciplinary teams
- Identify, formulate, and solve engineering problems
- Communicate effectively (both orally and in writing)
- Use the techniques, skills, and modern engineering tools necessary for engineering practice
- WIN outcome: Review report drafts and incorporate changes as necessary
- WIN outcome: Complete writing assignments and technical reports