SE - SYSTEMS ENGINEERING AND DESIGN

SE Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/SE/)

Courses

SE 100   Introduction to ISE   credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/SE/100/)
Overview of the engineering profession, the Industrial & Enterprise Systems Engineering Department, and the curricula in Industrial Engineering and Systems Engineering and Design.

SE 101   Engineering Graphics & Design   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/101/)
[IAI Code: EGR941] Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques. Team design project. Credit is not given toward graduation for: Credit is not given towards graduation for both SE 101 and ME 170.

SE 199   Undergraduate Open Seminar   credit: 1 to 5 Hours. (https://courses.illinois.edu/schedule/terms/SE/199/)
Undergraduate Open Seminar. May be repeated.

SE 261   Business Side of Engineering   credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/SE/261/)
Important elements and metrics of business and contemporary engineering economics: wealth creation, cash flow diagrams, internal rate of return, net present value, breakeven analysis, companies, corporations, profits, prices, balance sheets, income statements, and the basics of business plan writing. Particular emphasis is given to preparation for the economic analysis component of engineering practice.

SE 290   ISE Undergraduate Seminar   credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/SE/290/)
Lecture-discussion series by department faculty and visiting professional engineers addressing ethics, professional registration, the role of technical societies, and the relation of engineering to such disciplines as economics, sociology, and government. Approved for S/U grading only.

SE 297   Independent Study   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/297/)
Individual investigations of any phase of Systems Engineering and Design selected by the students and approved by the department. May be repeated. Prerequisite: Consent of instructor.

SE 298   Special Topics   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/298/)
Subject offerings of new and developing areas of knowledge in general engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites.

SE 310   Design of Structures and Mechanisms   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/310/)
Fundamental concepts in the classical and computer-based analysis and design of structural and machine components and assemblies. External loads, internal forces, and displacements in statically determinate and indeterminate configurations: kinematics of linkages, gears, and cams; static forces in machines. Prerequisite: CS 101 or CS 124, TAM 212, and TAM 251. Credit or concurrent enrollment in MATH 257 or MATH 415.

SE 311   Engineering Design Analysis   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/311/)
Stress-strain conditions; analytical and numerical (CAD) solution techniques; analysis of various engineering materials and configurations as applied to the development and application of design analysis criteria. Prerequisite: SE 310; concurrent registration in SE 312.

SE 312   Instrumentation and Test Lab   credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/SE/312/)
Preparation for experimental projects; mechanical and electrical instruments; mechanical testing of materials; experimental stress analysis and photoelastic methods. Prerequisite: SE 310; concurrent registration in SE 311.

SE 320   Control Systems   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/320/)
Fundamental control systems and control systems technology. Sensors, actuators, modeling of physical systems, design and implementation of feedback controllers; operational techniques used in describing, analyzing and designing linear continuous systems; Laplace transforms; response via transfer functions; stability; performance specifications; controller design via transfer functions; frequency response; simple nonlinearities. Credit is not given toward graduation for SE 320 and either AE 353 or ME 340. Prerequisite: CS 101 or CS 124, MATH 285, and TAM 212; credit or concurrent registration in ECE 211.

SE 361   Emotional Intelligence Skills   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/361/)
Understanding emotions in ourselves and others. Assessment and improvement of interpersonal skills and emotional intelligence competencies including self-regulation, motivation, empathetic listening, communication, influence collaboration and cooperation, conflict management, leadership, teamwork, and managing change. Includes one Saturday laboratory session.

SE 397   Independent Study   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/397/)
Individual investigations or studies of any phase of Systems Engineering and Design selected by the students and approved by the department. May be repeated in same term. Prerequisite: Consent of instructor.

SE 398   Special Topics   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/398/)
Subject offerings of new and developing areas of knowledge in Systems Engineering and Design intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites.

SE 400   Engineering Law   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/400/)
Nature and development of the legal system; legal rights and duties important to engineers in their professions; contracts, uniform commercial code and sales of goods, torts, agency, worker's compensation, labor law, property, environmental law, intellectual property. 3 undergraduate hours. 4 graduate hours. Prerequisite: RHET 105.

SE 402   Comp-Aided Product Realization   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/402/)
Computer-aided design, analysis, and prototyping tools used in the produce development process. Principles of computer graphics and geometric modeling, including transformations, coordinate systems, parametric solid modeling, spline curves, and surface modeling. Finite element and kinematics analyses. Rapid prototyping, product dissection, CAD-CAM-CAE operability issues, and CAD collaboration tools. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: SE 101 and SE 311.

SE 410   Component Design   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/410/)
Design of basic engineering components: structural members, machine parts, and connections. Principles applied include: material failure (yield, fracture, fatigue); buckling and other instabilities; design reliability; analytical simulation. 3 undergraduate hours. 3 graduate hours. This course is an approved Design Elective in the SE Undergraduate curriculum. Prerequisite: SE 311 and SE 320.

SE 411   Reliability Engineering   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/411/)
Concepts in engineering design, testing, and management for highly reliable components and systems. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 300.

SE 412   Nondestructive Evaluation   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/412/)
Nondestructive Evaluation (NDE) principles and the role of NDE in design, manufacturing, and maintenance. Primary Nondestructive Testing and Evaluation (NDT&E) techniques, introduced from the fundamental laws of physics, including visual, ultrasonic, acoustic emission, acousto-ultrasonic, radiology, electro-magnetic, eddy-current, penetrant, thermal, and holographic. Industrial applications of probability of flaw detection, material properties characterization, impact and fatigue damage evaluation, adhesion, etc. Current literature. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CEE 300.

SE 413   Engineering Design Optimization   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/413/)
Application of optimization techniques to engineering design problems. Emphasis on problem formulation, including applications in structural, mechanical, and other design domains. Important theoretical results and numerical optimization methods. Matlab programming assignments to develop software for solving nonlinear mathematical programming problems. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Prerequisite: MATH 241 and MATH 257 or MATH 415.

SE 420   Digital Control Systems   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/420/)
Theory and techniques for control of dynamic processes by digital computer; linear discrete systems, digital filters, sampling signal reconstruction, digital design, state space methods, computers, state estimators, and laboratory techniques. 4 undergraduate hours. 4 graduate hours. Prerequisite: SE 320.

SE 422   Robot Dynamics and Control   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/422/)
Fundamental concepts and analytical methods for analysis and design of robot systems. Laboratory experiments complement theoretical development. Same as ECE 489 and ME 446. 4 undergraduate hours. 4 graduate hours. Prerequisite: SE 320. Recommended: ECE 470.

SE 423   Mechatronics   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/423/)
Mechatronics concepts and practice: computer interfacing of physical devices (sensors, actuators); data acquisition; real time programming and real time control; human-machine interfaces; design principles of mechatronics in manufacturing systems and in consumer systems. 3 undergraduate hours. 3 graduate hours. Prerequisite: SE 320.

SE 424   State Space Design for Control   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/424/)
Design methods; time domain modeling; trajectories and phase plane analysis; similarity transforms; controllability and observability; pole placement and observers; linear quadratic optimal control; Lyapunov stability and describing functions; simulation. 3 undergraduate hours. 3 graduate hours. Prerequisite: SE 320 and MATH 257 or MATH 415.

SE 450   Decision Analysis I   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/450/)
Rules of thought that transform complex decision situations into simpler ones where the course of action is clear. Practical application of decision analysis in large organizations; methods to generate insights into real-life decision problems, avoid the common pitfalls in decision processes, and overcome the possible barriers to implementing a high-quality decision-making process for individual and organizational decision making; graphical representations of decision problems such as decision diagrams and utility diagrams. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 300.

SE 494   Senior Engineering Project I   credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/SE/494/)
Senior engineering project - team component. Student teams of three or four, guided by faculty advisors, develop solutions to real-world engineering problems provided by industry-partnering companies, subject to realistic constraints and supported by economic analyses and recommendations for implementation. Prototype solutions fabricated where practical. Multiple reports and presentations throughout the term. Several trips to company typical. Common project grade for all team members. 3 undergraduate hours. No graduate credit. Prerequisite: SE 311, TAM 335, and credit or concurrent enrollment in SE Design Elective; or IE Technical Elective. Must enroll concurrently in SE 495. Must enroll concurrently in SE 495.
This course satisfies the General Education Criteria for:
Advanced Composition

SE 495   Senior Engineering Project II   credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/SE/495/)
Adjunct to SE 494. Senior engineering project -- individual component. Individual grade for each team member. 2 undergraduate hours. No graduate credit. Prerequisite: SE 261, SE 290, IE 300, IE 310, and concurrent registration in SE 494. Must enroll concurrently in SE 494.

SE 497   Independent Study   credit: 0 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/497/)
Advanced problems related to Systems Engineering and Design. 0 to 4 undergraduate hours. 0 to 4 graduate hours. Approved for Letter and S/U grading. May be repeated in same term. Prerequisite: Consent of instructor.

SE 498   Special Topics   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/498/)
Subject offerings of new and developing areas of knowledge in Systems Engineering and Design intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. 1 to 4 undergraduate hours. 1 to 4 graduate hours.

SE 520   Analysis of Nonlinear Systems   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/520/)
Same as ECE 528 and ME 546. See ECE 528.

SE 521   Multivariable Control Design   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/521/)
Same as AE 555. See AE 555.

SE 522   Control System Theory & Design   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/522/)
Same as ECE 515 and ME 540. See ECE 515.

SE 523   Discrete Event Dynamic Systems   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/523/)
Modeling, analysis, control, and performance evaluation of discrete event dynamic systems (DEDS), which are characterized by state changes only at discrete points in time in response to the occurrence of particular events. Discrete-state and discrete-event models decidability, computational issues, forbidden-state problems, forbidden-string problems, enforcing safety and liveness properties via supervision, generalized semi-Markov processes, sensitivity analysis via likelihood ratio and infinitesimal perturbation methods. Prerequisite: CS 173 or MATH 213; CS 225; MATH 415; MATH 461.

SE 524   Data-Based Systems Modeling   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/524/)
Identification and building of mathematical and computational models directly from data. Systems and model types, such as state-space and distributed-parameter; parametric estimation methods, such as regression and least-squares recent subspace identification methods; data preprocessing techniques; model validation methods. Assignment applications to a wide range of dynamical systems, including biological, electro-mechanical, and economic. Prerequisite: SE 424 and IE 300.

SE 525   Control of Complex Systems   credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/525/)
Control methodologies for complex (i.e., interconnected) dynamic systems. A unified framework based on the vector Liapunov functions concept is used to examine various methodologies: decentralized overlapping control; optimal control of interconnected systems; multi-player differential game theory; decentralized optimization and its link with the multi-criteria optimization. Illustrative examples in areas such as control of groups of unmanned vehicles, control of power systems, and coverage control. Prerequisite: SE 424.

SE 550   Decision Analysis II   credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/550/)
Continuation of SE 450. Fundamental requirements of a decision-making system; comparison of different decision-making methods; "paradoxes" in decision making; foundations and history of probability as a degree of belief; Bayesian vs. classical statistics; entropy of a random variable; experimentation and optimal stopping; invariance formulations in utility and probability; one-switch preferences; graph-based methods to incorporate dependence in multiattribute utility functions. Prerequisite: SE 450.

SE 590   Seminar   credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/SE/590/)
Presentations by graduate students, staff, and guest lecturers of current topics in research and development in Systems and Entrepreneurial Engineering. Approved for Letter and S/U grading. May be repeated. Prerequisite: Required of all graduate students each term.

SE 594   Project Design   credit: 1 to 8 Hours. (https://courses.illinois.edu/schedule/terms/SE/594/)
Engineering design projects emphasizing advanced engineering analysis, synthesis, optimization, and engineering economics. May be repeated to a maximum of 8 hours for credit toward the Master's degree.

SE 597   Independent Study   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/597/)
Advanced problems related to Systems and Entrepreneurial Engineering. May be repeated. Prerequisite: Consent of instructor.

SE 598   Special Topics   credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/SE/598/)
Subject offerings of new and developing areas of knowledge in general engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary to a maximum of 12 hours.

SE 599   Thesis Research   credit: 0 to 16 Hours. (https://courses.illinois.edu/schedule/terms/SE/599/)
Thesis Research. Approved for S/U grading only. May be repeated in the same term or in separate terms up to a maximum of 16 hours.