

SYSTEMS AND INDUSTRIAL ENGINEERING GRADUATE COURSES

SIE 500A -- Introduction to SIE Methods: Probability and Statistics (1)

Axioms of probability, discrete and continuous distributions, sampling distributions. Applications of statistical estimation, hypothesis testing, confidence intervals. P, MATH 129. Special course fee required.

SIE 500B -- Introduction to SIE Methods: Stochastic Processes (1)

Introduction to probabilistic models commonly used in systems and industrial engineering and related disciplines. Markov chains, Poisson processes, queuing models. Special course fee required.

SIE 500C -- Introduction to SIE Methods: Linear Programming

(1) Linear programming models, solution techniques, and duality. P, SIE 270 and SIE 265, or ECON 210. Special course fee required.

SIE 506 -- Quality Engineering (3)

Quality, improvement and control methods with applications in design, development, manufacturing, delivery and service. Topics include modern quality management philosophies, engineering/statistical methods (including process control, control charts, process capability studies, loss functions, experimentation for improvement) and TQM topics (customer driven quality, teaming, Malcolm Baldrige and ISO 9000). Grading: [Regular grades](#) are awarded for this course: A B C D E. May be convened with: SIE 406. Usually offered: Spring.

SIE 508 -- Reliability Engineering (3)

Determine the probability that a component or system, whether simple or complex, will function as intended. Scope includes Root cause analysis of critical failures, reliability models of components and systems, development of statistical methods for estimating the reliability of a product. May be convened with SIE 408.

SIE 514 -- Law for Engineers and Scientists (3)

Topics covered in this course include patents, trade secrets, trademarks, copyrights, product liability contracts, business entities, employment relations and other legal matters important to engineers and scientists. Graduate-level requirements include an in-depth research paper on a current topic. Usually offered Spring.

SIE 515 -- Technical Sales and Marketing (3)

Principles of the engineering sales process in technology-oriented enterprises; selling strategy, needs analysis, proposals, technical communications, electronic media, time management and ethics; practical application of concepts through study of real-world examples. Graduate-level requirements include a term paper on a course topic selected from a short list of topics, other graded components of the course and creation of a PowerPoint presentation to the class. Usually offered: Spring

SIE 520 -- Stochastic Modeling I (3)

Modeling of stochastic processes from an applied viewpoint. *Markov chains* in discrete and continuous time, renewal theory, applications to engineering processes. P, SIE 321.

SIE 522 -- Engineering Decision Making Under Uncertainty (3)

Application of principles of probability and statistics to the design and control of engineering systems in a random or uncertain environment. Emphasis is placed on Bayesian decision analysis. Graduate-level requirements include a semester research project. May be convened with SIE 422.

SIE 525 -- Queuing Theory (3)

Application of the theory of stochastic processes to queuing phenomena; introduction to semi-Markov processes; steady-state analysis of birth-death, Markovian, and general single- and multiple-channel queuing systems. P, SIE 520.

SIE 530 -- Engineering Statistics (3)

Statistical methodology of estimation, testing hypotheses, goodness-of-fit, nonparametric methods and decision theory as it relates to engineering practice. Significant emphasis on the underlying statistical modeling and assumptions. Grading: Graduate-level requirements include additionally more difficult homework assignments. May be convened with SIE 430.

SIE 531 -- Simulation Modeling and Analysis (3) D

Discrete event simulation, model development, statistical design and analysis of simulation experiments, variance reduction, random variate generation, Monte Carlo simulation. Grading: [Regular grades](#) are awarded for this course: A B C D E. May be convened with: SIE 431. Usually offered: Fall, Spring.

SIE 536 -- Experiment Design and Regression (3)

Planning and designing experiments with an emphasis on factorial layout. Includes analysis of experimental and observational data with multiple linear regression and analysis of variance. P, SIE 530.

SIE 540 -- Survey of Optimization Methods (3)

Survey of methods including network flows, integer programming, nonlinear programming, and dynamic programming. Model development and solution algorithms are covered. Grading: [Regular grades](#) are awarded for this course: A B C D E. May be convened with SIE 440.

SIE 544 -- Linear Programming (3)

Linear and integer programming formulations, simplex method, geometry of the simplex method, sensitivity and duality, projective transformation methods. P, SIE 340.

SIE 545 -- Nonlinear Programming (3)

Unconstrained and constrained optimization problems from a numerical standpoint. Topics include variable metric methods, optimality conditions, quadratic programming, penalty and barrier function methods, interior point methods, successive quadratic programming methods. P, SIE 340.

SIE 546 -- Algorithms, Graphs, and Networks (3)

Model formulation and solution of problems on graphs and networks. Topics include heuristics and optimization algorithms on shortest paths, min-cost flow, matching and traveling salesman problems. P, SIE 340. Credit allowed for only one of these courses: SIE 546, MIS 546.

SIE 550 -- Theory of Linear Systems (3)

An intensive study of continuous and discrete linear systems from the state-space viewpoint, including criteria for observability, controllability, and minimal realizations; and optionally, aspects of optimal control, state feedback, and observer theory. P, SIE 350.

SIE 552 -- Space Systems Engineering (3)

Fundamentals of space systems engineering; The system engineering process for space missions; Model-based design for spacecrafts and space flight systems; Elements of mission analysis and design; Elements of analysis and design for spacecraft subsystems (structure and mechanisms, thermal control; attitude control and orbit determination; command and data handling; propulsion; communication; power).. Usually offered Spring

SYSTEMS AND INDUSTRIAL ENGINEERING GRADUATE COURSES

SIE 554A Systems Engineering Process. (3)

Process and Tools for Systems Engineering of large-scale, complex systems: requirements, performance measures, concept exploration, multi-criteria tradeoff studies, life cycle models, system modeling, etc. Graduate-level requirements include extensive sensitivity analysis of their final projects. May be convened with: SIE 454A.

SIE 556 – Fundamental of Guidance for Aerospace Systems (3)

The main objective of the course is to introduce the students with the fundamental principles behind the development of guidance laws for aerospace systems. More specifically, the course will introduce basic and more advanced guidance concepts for aerospace vehicles and discuss their practical implementation on missiles, planetary landers, reentry and launch vehicles. Usually offered: Fall

SIE 557 -- Project Management (3)

Processes and tools used to plan and control large scale projects. Topics include organizational design alternatives, formation and management of teams, construction and control of project schedules, risk assessment, and issues specific to global ventures and software development. 2ES, 1ED, P, 305, 340.
Grading: Regular grades are awarded for this course: A B C D E.
Prerequisite(s): SIE 305, SIE 340. Usually offered: Fall.

SIE 561 -- Traffic Modeling & Simulation (3)

The course will cover various modeling and simulation approaches used in studying traffic dynamics and control in a transportation network. The model-based simulation tools discussed include dynamic macroscopic and microscopic traffic flow simulation and assignment models. Models will be analyzed for their performance in handling traffic dynamics, route choice behavior, and network representation.
Grading: Regular grades are awarded for this course: A B C D E.
Identical to: C E 561. Usually offered: Spring.

SIE 562 -- Advanced Production Control (3)

Quantitative models in the planning, analysis and control of production systems. Topics include aggregate planning, multi-level production systems, inventory control, capacitated and uncapacitated lot-sizing, Just-in-time systems and scheduling. P, SIE 540, SIE 544.

SIE 563 -- Integrated Logistics and Distribution Systems

Plan and design of efficient logistics and distribution systems. Topics include: supply chain management, integration of production/inventory/location/transportation decisions, shipment scheduling with incomplete and uncertain information, vehicle routing and scheduling, goods distribution networks with multiple transshipment, terminals and warehouses.
Grading: Regular grades are awarded for this course: A B C D E.
Course Requisites: SIE 305, 321, 440/540

SIE 564 – Cost Estimation (3)

Focuses on principles of cost estimation and measurement systems with specific emphasis on parametric models. Approaches from the fields of hardware, software and systems engineering are applied to a variety of contexts (risk assessment, judgment & decision making, performance measurement, process improvement, adoption of new tools in organizations, etc.). Material is divided into five major sections: cost estimation fundamentals, parametric model development and calibration, advanced engineering economic principles, measurement systems, and policy issues. . May be convened with SIE 464.

SIE 567 –Financial Modeling for Innovation (3)

Strategic, tactical and operational planning; innovation and technological cycles; the elements of entrepreneurship, and human relations topics for technical managers. Graduate-level requirement includes two term papers. Grading: Regular grades are awarded for this course: A B C D E. Identical to: ENGR 567. May be convened with: SIE 467. Usually offered: Fall.

SIE 570- Intelligent Control Systems & Applications (3)

Architectures and algorithms of intelligent control systems. Concepts, methods and tools for task organization, task coordination, and task executions. Attention will be given to computer simulations and real-world applications. Offered Fall and Spring.

SIE 577 – Introduction to Biomedical Informatics

Driven by efforts to improve human health and healthcare systems, this course will cover relevant topics at the intersection of people, information, and technology. Specifically, we will survey the field of biomedical informatics that studies the effective uses of biomedical data, information, and knowledge from molecules and cellular processes to individuals and populations, for scientific inquiry, problem solving, and decision making. We will explore foundations and methods from both biomedical and computing perspectives, including hands-on experiences with systems, tools, and technologies in the healthcare system. Graduate students will be required to submit an additional assignment or project. Offered: Fall

SIE 583 -- Computer Integrated Manufacturing Systems (CIM) (3)

Modern manufacturing systems with emphasis on information requirements and data management. Includes CAD, CAM, CAPP, real time scheduling, networking and system justification. P, real time scheduling, networking and system justification.

SIE 599 -- Independent Study (1-5) [Rpt]

Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799. May be repeated: an unlimited number of times, consult your department for details and possible restrictions

SIE 606 -- Advanced Quality Engineering (3)

Advanced techniques for statistical quality assurance, including multivariate control charting, principal components analysis, economic design of acceptance sampling plans and control charts, inspection errors, and select papers from the recent literature. P, SIE 530, SIE 506.

SIE 608 – Advanced Reliability Engineering (3)

The course provides a comprehensive introduction to the statistical principles and methods for reliability data analysis. This course will cover parametric, nonparametric, and semiparametric methods for modeling degradation data and failure time data with different types of censoring. P. SIE 508.

SIE 631 -- Distributed Multi-Paradigm Simulation Systems (3)

Emphasis on current research problems including random variate generation, modeling, language development and statistical analysis of output. P, SIE 431 or MIS 521A or MIS 521B.

SYSTEMS AND INDUSTRIAL ENGINEERING GRADUATE COURSES

SIE 640 – Large Scale Optimization (3 units).

Decomposition-coordination algorithms for large-scale mathematical programming. Methods include generalized Benders decomposition, resource and price directive methods, subgradient optimization, and descent methods of nondifferentiable optimization. Application of these methods to stochastic programming will be emphasized. Prerequisite(s): SIE 544 or 545. Usually offered: Fall.

SIE 644 – Integer and Combinatorial Optimization (3)

Modeling and solving problems where the decisions form a discrete set. Topics include model development, branch and bound methods, cutting plane methods, relaxations, computational complexity, and solving well-structured problems. P, SIE 544.

SIE 645 – Nonlinear Optimization (3)

This course is devoted to structure and properties of practical algorithms for unconstrained and constrained nonlinear optimization. Grading: [Regular grades](#) are awarded for this course: A B C D E. Usually offered: Spring.

SIE 649 – Topics of Optimization (3)

Convexity, optimality conditions, duality and topics related to the instructor's research interest; e.g., stochastic programming, nonsmooth optimization, interior point methods.

SIE 654 – Advanced Concepts in Systems Engineering

(3) Modeling and design of complex systems using the Unified Modeling Language (UML), the Systems Modeling Language (SysML) and Wymorian System Theory. Applications come from systems, hardware and algorithm design. Course will emphasize architecture, requirements, testing, risk analysis and use of various systems design tools. P. SIE 554A (Spring).

SIE 678 – Transportation Systems (3)

Special topics in the analysis and design of transportation systems, including advanced traffic management, network routing, dynamic traffic estimation and assignment, network design, intermodal distribution and transportation, and intelligent transportation systems. P, SIE 305, SIE 321; SIE 540 or SIE 544; some knowledge of network modeling.

SIE 695A – Colloquium (1-3) [Rpt./ 12 units]

Contact department for a description of this course. P, consult department before enrolling.

SIE 699- Independent Study

(1-6) Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699.

SIE 900-Research (1-6) Individual research not related to thesis or dissertation preparation by graduate students.

SIE 909 – Master's Report (1-12)

Individual study or special project or formal report thereof submitted in lieu of thesis for certain master's degrees.

SIE 910- Thesis (1-12)

Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department.

SIE 920-Dissertation (1-12)

Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).