

SYSTEMS ENGINEERING (SYS ENG)

SYS ENG 5000 Special Problems (IND 1.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

SYS ENG 5001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

SYS ENG 5040 Oral Examination (IND 0.0)

After completion of all other program requirements, oral examination for on-campus MS/PhD students may be processed during intersession. Off-campus MS students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive exam (oral/written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

SYS ENG 5099 Research (IND 1.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required. Prerequisite: Graduate standing.

SYS ENG 5101 System Engineering and Analysis (LEC 3.0)

The concepts of Systems Engineering are introduced through a project. Students work in virtual teams. The topics covered are architecture development, basic system architectural design techniques, functional decomposition, design and technical review objectives, and initial specifications. Prerequisite: Graduate Standing.

SYS ENG 5105 Project Management (LEC 3.0)

Organization structure and staffing; motivation, authority and influence; conflict management; project planning; network systems; pricing, estimating, and cost control; proposal preparation; project information systems; international project management. Prerequisites: Graduate standing. (Co-listed with Eng Mgt 5320).

SYS ENG 5211 Computational Intelligence (LEC 3.0)

Introduction to Computational Intelligence (CI), Biological and Artificial Neuron, Neural Networks, Evolutionary Computing, Swarm Intelligence, Artificial Immune Systems, Fuzzy Systems, and Hybrid Systems. CI application case studies covered include digital systems, control, power systems, forecasting, and time-series predictions. Prerequisite: Graduate Standing. (Co-listed with Elec Eng 5810 and Comp Eng 5310).

SYS ENG 5212 Introduction to Neural Networks and Applications (LEC 3.0)

The course provides an introduction to basic neural network architectures and their applications. Students learn to construct neural networks and train them to solve engineering problems, specifically pattern recognition and function approximation. Mathematical analysis of network architectures, training algorithms and practical applications of neural nets. Prerequisites: Graduate Standing. (Co-listed with Elec Eng 5820).

SYS ENG 5281 Introduction to Probabilistic Risk Assessment (LEC 3.0)

An introduction to advanced techniques for assessing reliability, safety and risk in complex systems. Classification of initiating events, fault tree analysis, consequences, figures of merit, and use of probabilistic risk analysis in regulation are discussed using examples and applied through a simple case study. (Co-listed with Nuc Eng 5281).

SYS ENG 5323 Wireless Networks (LAB 1.0 and LEC 2.0)

Introduction to wireless communications and networking. Topics include transmission fundamentals, wireless channel, coding techniques and error control, satellite and cellular networks, cordless systems, mobile IP and management, multiple access techniques and wireless protocols, wireless LAN, IEEE 802.11, and adhoc and sensor networks. Prerequisites: Comp Eng 3150. (Co-listed with Comp Eng 5430 and Elec Eng 5430).

SYS ENG 6000 Special Problems (IND 1.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

SYS ENG 6001 Special Topics (LEC 1.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

SYS ENG 6010 Seminar (RSD 0.0-6.0)

Discussion of current topics.

SYS ENG 6040 Oral Examination (IND 0.0)

After completion of all other program requirements, oral examination for on-campus MS/PhD students may be processed during intersession. Off-campus MS students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive exam (oral/written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

SYS ENG 6050 Continuous Registration (IND 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from campus must continue to enroll for at least one credit hour each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

SYS ENG 6099 Research (IND 1.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required. Prerequisite: Graduate standing.

SYS ENG 6101 Advanced Research Methodology in Engineering Management (LEC 3.0)

An advanced study of research methodology techniques and theories in conducting research activities. The research problems, hypotheses, literature search, data requirements and analyses, interpretation and presentation of results are examined. Prerequisite: Graduate standing. (Co-list with Eng Mgt 6101).

SYS ENG 6102 Information Based Design (LEC 3.0)

This course is an introduction to the use of common data analytical methods and analysis for the purpose of decision making during the design phase of engineering system development. Through the introduction to such analytical methodologies, the systems engineering tool belt is made more effective as it is the foundation to decision analysis. Prerequisites: Graduate Standing.

SYS ENG 6103 Systems Life Cycle Costing (LEC 3.0)

Methods of economic evaluation for engineering projects involving complex systems. Economic impacts on choosing system alternatives, life cycle costing, economic decisions involving risk and uncertainty, and engineering cost estimation for projects in government, defense, and commercial industries. Prerequisites: Graduate Standing.

SYS ENG 6104 Systems Architecting (LEC 3.0)

Tools and concepts of architecting complex engineering systems. Ambiguity in Systems Architecting and Fuzzy Systems; Search as an Architecting Process; Architecting Heuristics; Systems Scoping and Attribute Selection; Assessing Architectures; Systems Aggregation, Partitioning; Systems Behavior Generation; System Science and Thinking, Cyber Physical Systems. Prerequisites: Graduate Standing.

SYS ENG 6105 Complex Engineering Systems Project Management (LEC 3.0)

The course topics include issues specific to distributed project management, team development, resource management, constraint planning, development of Integrated Master Schedule and Integrated Master Plan, monitoring technical performance, schedule, cost, and risk. Prerequisites: Graduate Standing.

SYS ENG 6110 Optimization under Uncertainty (LEC 3.0)

Optimization in the presence of model uncertainty or system stochasticity is discussed. The course covers fundamentals of stochastic programming, robust optimization, and dynamic programming. Prerequisite: Graduate standing. (Co-listed with ENG MGT 6415).

SYS ENG 6167 Software Intensive Systems Architecting (LEC 3.0)

Basic tools and concepts of architecting complex software intensive systems are introduced. The following topics are covered under four main sections; namely Architecting Process, Architecting Heuristics, Architecting Patterns and Frameworks, and Architecture Assessment. Prerequisite: Graduate Standing.

SYS ENG 6196 Systems Engineering Capstone (LEC 3.0)

The topics covered are Systems Engineering Management Plan (SEMP), Systems Engineering processes, process re-engineering, standards, and systems engineering case studies. Students will apply the skills and theory that they mastered in previous five core courses to the analysis of assigned cases. Prerequisites: Sys Eng 6105.

SYS ENG 6213 Deep Learning (LEC 3.0)

Use of deep learning and advance neural networks in the design of cyber physical complex adaptive systems. Machine learning basics, deep feed forward networks, regularization for deep learning, optimization for training deep models, convolutional networks, recurrent and recursive nets, practical, vision and natural language processing applications. Prerequisite: Graduate Standing.

SYS ENG 6214 Clustering Algorithms (LEC 3.0)

An introduction to cluster analysis and clustering algorithms rooted in computational intelligence, computer science and statistics. Clustering in sequential data, massive data and high dimensional data. Students will be evaluated by individual or group research projects and research presentations. Prerequisite: At least one graduate course in statistics, data mining, algorithms, computational intelligence, or neural networks, consistent with student's degree program. (Co-listed with Comp Eng 6330, Elec Eng 6830, Comp Sci 6405 and Stat 6239).

SYS ENG 6215 Adaptive Dynamic Programming (LEC 3.0)

Review of Neurocontrol and Optimization, Introduction to Approximate Dynamic Programming (ADP), Reinforcement Learning (RL), Combined Concepts of ADP and RL - Heuristic Dynamic Programming (HDP), Dual Heuristic Programming (DHP), Global Dual Heuristic Programming (GDHP), and Case Studies. Prerequisites: Elec Eng 5370 or Comp Eng 5310. (Co-listed with Comp Eng 6320, Elec Eng 6360, Mech Eng 6458 and Aero Eng 6458).

SYS ENG 6216 Advanced Topics in Data Mining (LEC 3.0)

Advanced topics of current interest in the field of data mining. This course involves reading seminal and state-of-the-art papers as well as conducting topical research projects including design, implementation, experimentation, analysis, and written and oral reporting components. Prerequisite: A "C" or better grade in Comp Sci 5001 Introduction to Data Mining . (Co-listed with Comp Sci 6402 and Comp Eng 6302).

SYS ENG 6217 Markov Decision Processes (LEC 3.0)

Introduction to Markov Decision Processes and Dynamic Programming. Application to Inventory Control and other optimization and control topics. Prerequisites: Graduate standing in background of probability or statistics. (Co-listed with Comp Eng 6310, Mech Eng 6447, Aero Eng 6447, Eng Mgt 6410, and Comp Sci 6202).

SYS ENG 6239 Smart Engineering System Design (LEC 3.0)

Covers the tools, techniques and methods used in developing Flexible Intelligent Learning Architectures for system of systems (SoS) and cyber physical systems (CPS) through evolutionary approach. Meta-architecture generation algorithms, SoS and CPS architecture evaluation methods, executable architectures, many meta-architecture objectives trade. Prerequisites: Graduate Standing.

SYS ENG 6321 Modeling Complex Systems (LEC 3.0)

Engineering Systems of today are non-linear, distributed, global, and adaptive to their environment in both space and time, thereby creating emergent behaviors. This course covers the current modeling tools and techniques used in modeling and architecting these complex systems. Prerequisites: Graduate Standing. (Co-listed with COMP ENG 6410).

SYS ENG 6322 Resilient Networks (LEC 3.0)

This course presents reliability and fault tolerance for network-centric systems, including models, metrics, and analysis techniques. This course also concentrates on security, including technical tools and methods for audit and assessment as well as management and policy issues. Prerequisites: Sys Eng 6410, Comp Eng 6410, or Comp Eng 5420. (Co-listed with COMP ENG 6510).

SYS ENG 6324 Wireless Ad hoc and Sensor Networks (LEC 3.0)

Introduction to ad hoc and sensor networks, IEEE standards, heterogeneity, quality of service, wireless channel issues, energy awareness, power and topology control, routing, scheduling, rate adaptation, self-organization, admission and flow control, energy harvesting, security and trust levels, hardware and applications. Prerequisite: Comp Eng 5430 or Comp Eng 5420 or equivalent. (Co-listed with Comp Eng 6420 and Elec Eng 6430).

SYS ENG 6412 Mathematical Programming (LEC 3.0)

Linear optimization and its engineering applications; problem modeling, search-based optimization, the simplex method for solving linear problems, multi-objective optimization, discrete dynamic programming. Applications of optimization in the fields such as transportation, project management, manufacturing and facility location will be discussed. Prerequisites: One of the following: Stat 3113, Stat 3115, or Stat 3117; Math 3108. (Co-listed with Math 6665 and Eng Mgt 6412).

SYS ENG 6541 Digital Engineering (LEC 3.0)

This course discusses issues related to distributed systems architecting, modeling, analysis and representation, with specific focus on the digital system engineering domain. Distributed modeling techniques and other model decomposition methods using simulation modeling and scalability issues will also be addressed.

SYS ENG 6542 Model Based Systems Engineering (LEC 3.0)

Provides the student with understanding of the use of models to represent systems and validate system architectures. The student will gain proficiency in using a systems modeling language and shifting systems engineering from a document centric to a model centric paradigm. Prerequisites: Graduate Standing. (Co-listed with COMP SCI 6102).

SYS ENG 6612 Investment (LEC 3.0)

An introduction to the theory and practice of investment, including financial markets and instruments, security trading, mutual funds, investment banking, interest rates, risk premiums, the capital asset pricing model, arbitrage pricing theory, market efficiency, bonds and the fixed income market, equity valuation, fundamental and technical analysis. Prerequisite: Eng Mgt 1210 or 5210. (Co-listed with Eng Mgt 6212).

SYS ENG 6613 Financial Engineering (LEC 3.0)

An introduction to financial engineering, with an emphasis on financial derivatives, including the future markets, the pricing of forwards and futures, forward rate agreements, interest and exchange rate futures, swaps, the options markets, option strategies, the binomial and Black-Scholes models for option valuation, the option Greeks, and volatility smiles. Prerequisites: Eng Mgt 1210 or 5210. (Co-listed with Eng Mgt 6213).

SYS ENG 6614 Financial Engineering II (LEC 3.0)

This course introduces advanced topics in financial engineering, which includes introduction to Wiener processes, martingales and Ito's lemma; basic numerical methods for options pricing, exotic options; interest rate models; stochastic volatility models and jump-diffusion models; and value-at-risk. Prerequisite: Eng Mgt 6213/Sys Eng 6613. (Co-listed with Eng Mgt 6214).

SYS ENG 6615 Financial Risk Management (LEC 3.0)

Techniques and methods for managing financial risk, including portfolio theory, Monte Carlo methods, ARIMA, time series forecasting, Value-at-Risk, stress testing, extreme value theory, GARCH and volatility estimation, random variables and probability distributions, real options, decision trees, utility theory, statistical decision techniques, and game theory. Prerequisite: Eng Mgt 1210 or 5210. (Co-listed with Eng Mgt 6215).
