EIN 6910 Supervised Research 1-5 Credits, Max 5 Credits  
Grading Scheme: S/U  
Supervised Research

EIN 6918 Graduate Seminar 1 Credit, Max 15 Credits  
Grading Scheme: S/U  
Graduate Seminar

EIN 6940 Supervised Teaching 1-5 Credits, Max 5 Credits  
Grading Scheme: S/U  
Supervised Teaching

EIN 6971 Research for Master’s Thesis 1-15 Credits  
Grading Scheme: S/U  
Research for Master’s Thesis

EIN 7933 Special Problems 1-6 Credits, Max 12 Credits  
Grading Scheme: Letter Grade  
Laboratory, lecture, field work, or conferences.

EIN 7979 Advanced Research 1-12 Credits  
Grading Scheme: S/U  
Research for doctoral students before admission to candidacy. Designed for students with a master's degree in the field of study or for students who have been accepted for a doctoral program. Not appropriate for students who have been admitted to candidacy.

EIN 7980 Research for Doctoral Dissertation 1-15 Credits  
Grading Scheme: S/U  
Research for Doctoral Dissertation

ESI 5236 Reliability Engineering 3 Credits  
Grading Scheme: Letter Grade  
Mathematical models and methods of reliability engineering. Typical component failure distributions; system reliability as a function of component reliability. Reliability block diagrams and fault trees.  
Prerequisite: ESI 4567C, STA 4322.

ESI 6314 Deterministic Methods in Operations Research 4 Credits  
Grading Scheme: Letter Grade  
Introduction to basic models and their solution with modern computer packages. Emphasis on modeling, computer solution, and sensitivity analysis with minimal reference to model theory and development of algorithmic methods.  
Prerequisite: calculus through differential equations, knowledge of linear algebra, and experience using mainframes or PCs.

ESI 6323 Models for Supply Chain Management 3 Credits  
Grading Scheme: Letter Grade  
Essential elements including controlling and coordinating activities such as order processing, purchasing, material storage and handling, production scheduling, packaging, transportation, and setting customer service standards.  
Prerequisite: prior course work in linear programming, probability, and stochastic processes.

ESI 6325 Applied Probability Methods in Engineering 3 Credits  
Grading Scheme: Letter Grade  
Applied probability theory and statistics, reliability engineering, quality control, robust design, forecasting, Markov processes, and queuing theory.  
Prerequisite: calculus, differential equations, undergraduate probability, and statistics.
ESI 6341 Intro to Stochastic Optimization 3 Credits
Grading Scheme: Letter Grade
Introduction to Stochastic Optimization is intended as a first introductory course for graduate students in such fields as engineering, operations research, statistics, mathematics, and business administration (in particular, finance or management science). 3 credits.
Prerequisite: Basic knowledge of calculus, statistics and linear programming.

ESI 6346 Decision Making under Uncertainty 3 Credits
Grading Scheme: Letter Grade
Introduction to the use of quantitative models for decision-making in environments where uncertainty is present. Focuses on fundamentals of probability simulation, Markov chains, queueing analysis, decision trees and dynamic programming.
Prerequisite: ESI6314 Deterministic Methods for Operations Research, and Students should have had a course in probability/statistics at the undergraduate level.

ESI 6352 Financial Optimization Case Studies 3 Credits
Grading Scheme: Letter Grade
Prerequisite: There are no formal prerequisites for the course. The course requires knowledge of basic statistical concepts (probability distributions, linear regression). Familiarity with optimization (linear programming). Familiarity with high level programming languages, which can be used for data analysis (e.g., with MATLAB or R).

ESI 6355 Decision Support Systems for Industrial and Systems Engineers 4 Credits
Grading Scheme: Letter Grade
Applications of decision support systems: developing and implementing systems arising in industrial and systems engineering using popular database management and spreadsheet software.
Prerequisite: programming course in C++ or Java and operations research.

ESI 6417 Linear Programming and Network Optimization 3 Credits
Grading Scheme: Letter Grade
Prerequisite: matrix theory.

ESI 6418 Linear Programming Extensions and Applications 3 Credits
Grading Scheme: Letter Grade
Extension of linear programming to large scale linear and nonlinear problems. Integer programming methods. Applications of the methodology to real world models.
Prerequisite: ESI 6417, ESI 6429.

ESI 6420 Fundamentals of Mathematical Programming 3 Credits
Grading Scheme: Letter Grade
Introducing mathematical programming with an emphasis on classical optimization concepts, models and solution techniques. Focus on convex analysis (convex sets, separation theorems, convex functions), optimality conditions (Fritz-John Karush-Kuhn-Tucker), Lagrangian duality and iterative solution methods 9gradient, conjugate gradients barrier methods.
Prerequisite: Mathematical background, ability to proof mathematical statements and ability to write simple codes with Matlab or C.

ESI 6429 Introduction to Nonlinear Optimization 3 Credits
Grading Scheme: Letter Grade
Nonlinear optimization models, convex sets and functions, optimality conditions, nonlinear algorithms, dynamic programming methods.
Prerequisite: ESI 6417 and multivariable calculus.

ESI 6448 Discrete Optimization Theory 3 Credits
Grading Scheme: Letter Grade
Modeling with integer variables; enumeration and cutting plane methods; decomposition algorithms; branch and bound methods; computational complexity and software issues; special combinatorial optimization problems; parallel algorithms for integer programming.
Prerequisite: linear programming and nonlinear optimization or equivalent.

ESI 6449 Integer Programming 3 Credits
Grading Scheme: Letter Grade
Advanced topics in the theory, algorithms and applications of integer programming. Focus on polyhedral approaches (cutting planes, integer polyhedra, primal algorithms), theory of lattices and algebraic geometry approaches (Gobner bases, generating functions, sos relaxations).
Prerequisite: ESI 6417 and ESI 6448

ESI 6492 Global Optimization 3 Credits
Grading Scheme: Letter Grade
Prerequisite: linear and nonlinear programming.

ESI 6529 Digital Simulation Techniques 3 Credits
Grading Scheme: Letter Grade
Computer programming aspects of digital simulation. Deterministic simulation; stochastic simulation. Use of simulation languages.
Prerequisite: computer programming and probability theory.

ESI 6533 Advanced Simulation Design and Analysis 3 Credits
Grading Scheme: Letter Grade
Fundamental concepts and techniques for stochastic simulation and applications in communications, transportation and manufacturing systems, and financial engineering. Discrete-event systems and Monte-Carlo evaluation.
Prerequisite: ESI 6546, and a graduate-level course in statistical inference.

ESI 6546 Stochastic Modeling and Analysis 3 Credits
Grading Scheme: Letter Grade
Prerequisite: STA 6326.
ESI 6552 Systems Architecture 3 Credits
**Grading Scheme:** Letter Grade
Foundations for developing and evaluating architectures for systems of systems. Process for generating functional, physical, and operational architecture from a top-level operations concept.
**Prerequisite:** calculus, linear algebra, ESI 6553: Systems Design

ESI 6553 Systems Design 3 Credits
**Grading Scheme:** Letter Grade
Broad introduction to systems engineering and the structured approaches needed to design complex systems. Emphasizes formulation of systems problems and approaches to their solution. Introduces basic mathematical techniques for dealing with systems design.
**Prerequisite:** calculus, linear algebra, basics of statistics, ESI 6314.

ESI 6555 Systems Management 3 Credits
**Grading Scheme:** Letter Grade
Introduction to the concepts of systems and the role of systems engineering in their development. Basic framework for planning and assessing system development, and how systems analysis methods and techniques are integrated into systems engineering processes.
**Prerequisite:** calculus, linear algebra, basics of statistics.