Industrial Engineering and Management Sciences
Graduate Core Topics

Optimization

IE 450-1:

- Basic optimization models: linear programming, integer programming, network models, nonlinear programming, deterministic dynamic programming; modeling languages
- Basic optimization theory: duality, sensitivity analysis, convexity, integrality property
- Basic optimization algorithms, implementation and complexity analysis: simplex method, branch-and-bound, some network algorithm(s), Newton's method, interior-point method

IE 450-2:

- Computational complexity: algorithm complexity, NP-completeness, Cook's theorem, problem reductions
- Basic nonlinear optimization: convex analysis, optimality conditions and solution methods for constrained and unconstrained, problems
- Basic polyhedral theory: Farkas' lemma, Minkowski and Weil theorems, equivalence of separation and optimization
- Approaches to hard discrete optimization problems: Lagrangian relaxation, cutting planes, heuristics; performance analysis of these approaches

Industrial Engineering and Management Sciences
Graduate Core Topics

Applied Probability

IE 460-1:

- Discrete and continuous time Markov chains: transient and steady state analysis
- Steady state analysis of Markovian and M/G/1 queues

IE 460-2:

- Renewal Theory; stopping times, Wald's lemma
- Regenerative reward processes
- Networks of Markovian queues (open and closed)
- Approximations for non-Markovian queues
- Stochastic ordering, modes of convergence, sample path coupling
- Numerical solution of large-scale Markov chains

Economics and Decision Analysis

IE 488:

- Investment/project evaluation: Time value of money, treatment of risk, analysis of cash flows, asset evaluation, discount rate, evaluation models, equipment replacement, portfolio analysis
- Basic decision analysis: decision trees, influence diagrams, utility and risk attitude, multiple objectives, information value, subjective probability
- Public-sector decisions: cost-benefit analysis

Industrial Engineering and Management Sciences
Graduate Core Topics

Production and Logistics

IE 480-1:

- Inventory control: EOQ, Wagner-Whiten, (s,S) , finite-horizon, multi-echelon, multi-item (probability, conditional expectation)
- Location: fixed charge, center, covering, multi-objective, multi-stage (Lagrangian relaxation, strong/weak formulations)
- Routing: models and approximation techniques

IE 480-2:

- Facility design/control: capacity management, layout, just-in-time, ConWIP (open/closed queues, Markovian, non-Markovian systems)
- Production scheduling: one- and two-machine, flow shop models, MRP (interchange arguments

Statistics

IE 401

- Linear model theory
- Multivariate normal and related distributions
- Multiple regression and correlation
- Analysis of variance for single and multifactor experiments
- Maximum likelihood estimation and likelihood ratio tests

Industrial Engineering and Management Sciences
Graduate Core Topics

Simulation

IE 435:

- Modeling: Discrete-event and process representations, High-level and low-level languages
- Input Modeling: fitting distributions to data, selecting distributions without data, nonstationary arrival processes, multivariate input models
- Output Analysis: point and interval estimation for means, probabilities and quantiles
- Experiment Design: terminating vs. steady-state simulation, determining number of reps/batches for fixed precision, initial bias mitigation, use of common random numbers and antithetic variates
- Variate Generation: pseudorandom number generators, inverse cdf transformation, nonstationary arrival processes, multivariate input models
- Using Simulation in Research: experiment within an experiment approach