INDUSTRIAL ENGINEERING & MANAGEMENT SCIENCES (IEMS)

IEMS 303-0 Statistics (1 Unit)
Introduction to the foundations of statistics and statistical computing for data analysis and their applications. Descriptive statistics and statistical inference for estimation, testing, and prediction. May not receive credit for both IEMS 303-0 and any of IEMS 201-0, STAT 210-0, BMD_ENG 220-0, or CHEM_ENG 312-0. May not be taken for credit with or after STAT 320-1.
Prerequisites: IEMS 202-0 or equivalent; COMP_SCI 110-0 or COMP_SCI 111-0 or equivalent.

IEMS 304-0 Statistical Learning for Data Analysis (1 Unit)
Predictive modeling of data using modern regression and classification methods. Multiple linear regression; logistic regression; pitfalls and diagnostics; nonparametric and nonlinear regression and classification such as trees, nearest neighbors, neural networks, and ensemble methods.
Prerequisites: IEMS 303-0 and COMP_SCI 111-0 or equivalents.

IEMS 307-0 Quality Improvement by Experimental Design (1 Unit)
Methods for designing and analyzing industrial experiments. Blocking; randomization; multiple regression; factorial and fractional factorial experiments; response surface methodology; Taguchi's robust design; split plot experimentation. Homework, labs, and project.
Prerequisite: IEMS 201-0, IEMS 303-0, or equivalent.

IEMS 308-0 Data Science and Analytics (1 Unit)
Focuses on select problems in data science, in particular clustering, association rules, web analytics, text mining, and dimensionality reduction. Lectures will be completed with exercises and projects in open source framework R. Prior knowledge of classification techniques and R is required.
Prerequisites: IEMS 304-0; COMP_SCI 217-0.

IEMS 310-0 Operations Research (1 Unit)
Survey of operations research techniques. Linear programming, decision theory, stochastic processes, game theory. May not be taken for credit with or after IEMS 313-0.
Prerequisites: IEMS 201-0 or IEMS 202-0; GEN_ENG 205-1 or MATH 240-0.

IEMS 313-0 Foundations of Optimization (1 Unit)
Formulation and solution of applicable optimization models, including linear, integer, nonlinear, and network problems. Efficient algorithmic methods and use of computer modeling languages and systems. Homework, exams, and project.
Prerequisites: COMP_SCI 111-0; GEN_ENG 205-1; MATH 228-1; sophomore standing.

IEMS 315-0 Stochastic Models (1 Unit)
Fundamental concepts of probability theory; modeling and analysis of systems having random dynamics, particularly queueing systems.
Prerequisites: IEMS 202-0 and concurrent enrollment in IEMS 303-0; GEN_ENG 205-1.

IEMS 317-0 Discrete Event Systems Simulation (1 Unit)
Computer simulation of discrete-change systems subject to uncertainty. Choice of input distributions; development of models; design and analysis of simulation experiments. Mini-projects, exams, and computer labs.
Prerequisites: IEMS 303-0; IEMS 310-0 or IEMS 315-0.

IEMS 325-0 Engineering Entrepreneurship (1 Unit)
Overview of the entrepreneurial process from an engineering perspective. Idea generation, planning, financing, marketing, protecting, staffing, leading, growing, and harvesting. Students write startup business plans. Lectures, guest speakers, and case studies. Taught with ENTREP 325-0; may not receive credit for both courses.
Prerequisite: 1 course in accounting or finance such as CIV_ENV 205-0 or ENTREP 330-1.

IEMS 341-0 Social Networks Analysis (1 Unit)
The use of social network analysis to understand the growing connectivity and complexity in the world around us on different scales, ranging from small groups to the World Wide Web. How we create social, economic, and technological networks, and how they enable and constrain attitudes and behaviors.

IEMS 342-0 Organizational Behavior (1 Unit)
Manager's view of tools available to recruit, develop, appraise, compensate, organize, and lead a team going through change. Application of psychological principles relating to human dynamics, motivation, teams, power, and organizational culture. Lectures, guest speakers, and exams. Work experience recommended.

IEMS 343-0 Project Management for Engineers (1 Unit)
A case study-based exploration of the body of project management knowledge. Key topics include project scheduling, risk management, project leadership, small-group dynamics, project methodologies, lifecycle concepts, and project controls. A Socratic approach is taken to exploring various case studies in the context of established and leading-edge project management concepts.
Prerequisites: CIV_ENV 205-0 and IEMS 303-0.

IEMS 344-0 Leading Organizations and Teams (1 Unit)
In this class, a combination of theory and practice are leveraged to help students develop their leadership skill-set so that they can become more effective leaders of teams and organizations. In particular, fundamental tools and concepts from the behavioral and social sciences are studied that will help students’ to analyze organizational dynamics and to take robust action. In addition, students explore their own “leadership brand” and begin to answer the question of what type of leader they aspire to become so that they can thoughtfully and deliberately manage their careers.
Prerequisite: Junior standing.

IEMS 345-0 Negotiations and Conflict Resolution for Engineers (1 Unit)
In this highly interactive class, students participate in negotiation and dispute resolution simulations that range in complexity from single-party/single-issue to multiparty/multi-issue cases. In addition students explore the role of agents and third parties in the managing conflict. Throughout all of the simulations integrative and distributive strategies are emphasized that can be applied across a variety of contexts.
Prerequisite: Junior standing.

IEMS 351-0 Optimization Methods in Data Science (1 Unit)
Introduction to nonlinear mathematical optimization with applications in data science. The theoretical foundation and the fundamental algorithms for nonlinear optimization are studied and applied to supervised learning models, including nonlinear regression, logistic regression, and deep neural networks. Students write their own implementation of the algorithms in the Python programming language and explore their performance on realistic data sets.
Prerequisites: COMP_SCI 111-0 and IEMS 303-0 and IEMS 313-0, or equivalent.

IEMS 373-0 Intro to Financial Engineering (1 Unit)

Prerequisites: IEMS 451-0 and IEMS 452-0 or equivalent.

IEMS 452-0 Large Scale Optimization (1 Unit)

Efficient methods and min-max results for combinatorial optimization problems including minimum spanning trees, shortest paths, maximum flows, minimum cost flows, matching; polyhedral combinatorics; complexity theory.

Prerequisite: IEMS 450-1 or equivalent.

IEMS 453-0 Robust Optimization (1 Unit)

Optimization with uncertain variables or parameters to find solutions that are both optimal and immune to uncertainties. Covers computational tools and applications including supply chains, revenue management, energy, portfolio theory, options pricing, risk management, healthcare, statistics and engineering design.

Prerequisite: IEMS 450-1 or equivalent.

IEMS 454-0 Large Scale Optimization (1 Unit)

Algorithms for large-scale optimization. Ellipsoid method and complexity of linear programming; equivalence of separation and optimization;
path-following interior point methods, including self-dual methods; decomposition algorithms, including column generation and row generation for linear, nonlinear, and integer programming; selected applications.

Prerequisite: IEMS 450-1.

IE 455-0 Machine Learning (1 Unit)
A survey of large-scale machine learning with emphasis on neural networks and kernel methods, including model formulation, large-scale applications and training (optimization). Case studies include text classification, image and speech recognition, and recommender systems. Construction of deep neural networks for large data sets.

Prerequisites: IEMS 202-0, IEMS 303-0 and IEMS 313-0 (or equivalent) and computer programming.

IE 457-0 Integer Programming (1 Unit)
Methods for NP-hard discrete optimization problems including general methods like branch and bound and cutting planes, as well as special purpose branch-and-cut methods and heuristics.

Prerequisite: IEMS 450-1 or equivalent.

IE 459-0 Convex Optimization (1 Unit)
The course develops expert knowledge in the theory and algorithms for convex optimization. Emphasis is on understanding fundamental properties of convex sets and functions, and on the role of duality. Covers practical algorithms.

Prerequisites: IEMS 202-0, IEMS 303-0 (or equivalent), and IEMS 450-1 or IEMS 450-2 (or equivalent).

IE 460-1 Stochastic Processes I (1 Unit)

Prerequisite: Permission of instructor.

IE 460-2 Stochastic Processes II (1 Unit)
Bernoulli processes, Poisson processes, Markov chains, renewal theory, regenerative process, and queuing models.

Theory and applications.

Prerequisite: Permission of instructor.

IE 462-1 Predictive Analytics I (1 Unit)
Parametric regression and classification models for analyzing medium to large data sets.

IE 463-0 Statistical Analysis (1 Unit)
Principles of experimental design and their application to the analysis of standard designs including one-way layout, block designs, factorial/fractional factorial experiments, random/mixed effect models, nested/split-plot designs.

IE 464-0 Advanced Queueing Theory (1 Unit)
Queueing networks, the single-server queue, heavy-traffic approximations for the G/G/1 queue. Advanced level.

Prerequisite: IEMS 460-1 or equivalent.

IE 465-0 Simulation Experiment Design & Analysis (1 Unit)
Selected current topics in modern stochastic simulation research, including variance reduction, simulation optimization, model risk, and simulation analytics.

Prerequisites: IEMS 435-0, IEMS 401-0 and IEMS 460-1, or equivalent.

IE 468-0 Stochastic Control (1 Unit)
Optimal control of Markov chains, dynamic programming, finite horizon and discounted models, and applications in operations research.

Prerequisite: IEMS 460-1.

IE 469-0 Dynamic Programming (1 Unit)
Theoretical and computational aspects of solving stochastic sequential decision problems. Material supported by many real-world applications.

IE 473-1 Financial Engineering I (1 Unit)

IE 473-2 Financial Engineering II (1 Unit)

Prerequisite: IEMS 373-0.

IE 481-0 Logistics (1 Unit)
This course will provide an introduction to modeling and solution methods for facility location, transportation and inventory management decisions. By the end of the quarter, you should learn to model and formulate a variety of logistics problems; to develop and assess solution methods for these problems; and to use these tools to analyze strategic, tactical, and operational supply-chain decisions.

Prerequisites: IEMS 450-1; students should be familiar with some high-level programming language.

IE 482-0 Operations (1 Unit)
First Quarter: Introduction to production/logistics including: multi-objective, stochastic and dynamic facility location problems, multi-echelon and multi-item inventory models and heuristic, approximate and exact vehicle routing algorithms. Second Quarter: Introduction to production/distribution facility design and control, capacity management, push and pull production systems: MRP, JIT, ConWIP; introduction to deterministic and stochastic production scheduling: job shop, flow shop.

Prerequisites: IEMS 450-1 and at least concurrent enrollment in IEMS 460-1.

IE 484-0 Inventory and Distribution Systems (1 Unit)
Multistage inventory and production models, multiproduct systems, distribution systems, and random yield models.

Prerequisites: IEMS 481-0 and IEMS 482-0.

IE 488-0 Economics and Decision Analysis (1 Unit)
Investment project evaluation: time value of money, treatment of risk, asset evaluation; decision trees, utility theory and risk attitude, multiobjectives. Public sector decision analysis, including cost/benefit analysis, and cost/effectiveness analysis.

Prerequisite: Calculus.

IE 490-0 Selected Topics in IE (1 Unit)

IE 499-0 Projects (1-3 Units)
SEE DEPT FOR SECTION AND PERMISSION NUMBERS - Special projects under faculty direction. Permission of instructor and department required. May be repeated for credit.

IE 519-0 Responsible Conduct of Research Training (0 Unit)

IE 590-0 Research (1-3 Units)
Independent investigation of selected problems pertaining to thesis or dissertation. May be repeated for credit. SEE DEPT FOR SECTION AND PERMISSION NUMBERS.