

# Courses that Count Towards Majors and Minors in the IEMS PhD Requirements

The following areas can be chosen as majors or minors in the IEMS PhD course requirements.

- Analytics (minor only)
- Applied Statistics & Statistical Learning
- Financial Engineering
- Healthcare Engineering
- Optimization
- Management Science
- Logistics & Operations
- Stochastic Analysis & Simulation

In general, any two courses in an area fulfill a minor, and any four courses in an area fulfill a major. The exceptions are that there is no major in Analytics (only a minor), the rules for Healthcare Engineering are more complicated (as explained below), and half-credit courses do not fulfill a “slot” on their own.

Some courses belong to multiple areas, but courses *cannot* be counted towards multiple areas at the same time in a student’s degree plan. Each course taken can be counted only once towards fulfilling the degree requirements.

Courses may not appear here, even if they were approved to count towards an area in the past, if they have not been taught in recent years. They may appear in gray if future offerings are in doubt.

## Analytics

There is a minor in Analytics, but no major.

- IEMS 455 Machine Learning
- IEMS 462-1 Predictive Analytics I
- IEMS 462-2 Predictive Analytics II
- MSiA 420 Predictive Analytics
- MSiA 421 Data Mining
- MSiA 490-23 Health Analytics and Decision Making
- MSiA 490-21 Predictive Models for Credit Risk Management
- MSiA 490 (Selected Topics) Smart Grid Analytics
- MSiA 490-20 Text Analytics
- MSiA 490 Reinforcement Learning for Artificial Intelligence
- ELEC\_ENG 435 Neural Networks
- COMP\_SCI 496: Advanced Topics in Deep Learning

## Applied Statistics & Statistical Learning

- IEMS 462-1 Predictive Analytics I

- IEMS 462-2 Predictive Analytics II
- IEMS 463 Statistical Analysis of Designed Experiments
- IEMS 465 Simulation Experiment Design and Analysis
- IEMS 490 Statistical Learning
- IEMS 490 Uncertainty Quantification
- IEMS 490 Information Theory and Reinforcement Learning (formerly listed as Information Theory, Statistical Learning, and Reinforcement Learning)
- ECON 480-1,2,3 Introduction to Econometrics
- ECON 481-1,2,3 Econometrics
- ECON 482 Applied Econometrics: Time-Series Methods
- ECON 483 Applied Econometrics: Cross-Section Methods
- ELEC\_ENG 433 Statistical Pattern Recognition
- COMP\_SCI 574 Probabilistic Graphical Models
- FINC 520 Time Series Analysis
- MECS 577 Introduction to Applied Econometrics 2
- MECS 578 Introduction to Applied Econometrics 3
- STAT 325 Survey Sampling
- STAT 348 Applied Multivariate Analysis
- STAT 350 Regression Analysis
- STAT 351 Design and Analysis of Experiments
- STAT 352 Nonparametric Statistical Methods
- STAT 355 Analysis of Qualitative Data
- STAT 356 Hierarchical Linear Models
- STAT 359 (Topics) Data Mining
- STAT 420-1,2,3 Statistical Theory & Methodology
- STAT 448 Multivariate Statistical Methods
- STAT 453 Survival Analysis
- STAT 454 Time-Series Analysis
- STAT 455 Advanced Analysis of Qualitative Data
- STAT 457 Applied Bayesian Inference
- STAT 461 (Topics) Theory of Statistical Data Mining
- STAT 461 (Topics) Advanced Survey Sampling
- STAT 465 Statistical Methods for Bioinformatics and Computational Biology
- \*University of Chicago: STAT 31150 Inverse Problems and Data Assimilation

## Financial Engineering

- IEMS 461 Advanced Stochastic Models
- IEMS 473 Financial Engineering
- IEMS 475 Simulation in Financial Engineering
- ELEC\_ENG 495 Game Theory and Networked Systems
- FINC 585 Introduction to Financial Theory / 485-1 Asset Pricing I
- FINC 587 Dynamic Asset Pricing Theory / 485-2 Asset Pricing II

- FINC 588 Econometrics of Financial Markets

## Healthcare Engineering

Courses that belong to Healthcare Engineering are classified as category A, B, or C. A minor requires two courses from category A. A major requires at least two courses from category A, three from A + B, and four from A + B + C.

### Category A

- MSiA 490 (Selected Topics) Healthcare Analytics
- IEMS 443 Health Policy Modeling
- IEMS 444 Health Management Science
- IEMS 445 Decision and Risk Analysis

### Category B

- IEMS 490 (Selected Topics) Humanitarian and Non-profit Logistics
- STAT 453 Survival Analysis
- STAT 465 Statistical Methods for Bioinformatics and Computational Biology

### Category C

- IEMS 441 Social Network Analysis
- PUB HLTH 444 Advanced Decision Analysis

## Optimization

- IEMS 451 Stochastic Optimization
- IEMS 452 Combinatorial Optimization
- IEMS 453 Robust Optimization
- IEMS 454 Large-Scale Optimization
- IEMS 455 Machine Learning
- IEMS 457 Integer Programming
- IEMS 459 Convex Optimization
- IEMS 469 Dynamic Programming
- IEMS 490 (Selected Topics) Data-Driven Decisions Under Uncertainty
- IEMS 490 (Selected Topics) Machine Learning
- IEMS 490 (Selected Topics) Robust Optimization
- IEMS 490 (Selected Topics) Stochastic Optimization
- IEMS 490 (Selected Topics) Conic
- COMP\_SCI 457 Advanced Algorithms
- ELEC\_ENG 495 Distributed Optimization
- MECS 560-1 Foundations of Managerial Economics I: Static Decision Models
- MECS 560-2 Dynamic Optimization

## Management Science

- COMP\_SCI 472 Designing and Constructing Models with Multi-Agent Languages

- IEMS 411 Field Research in Organizations
- IEMS 430 Systems Analysis
- IEMS 432 Systems Engineering
- IEMS 433 Theory and Practice of Evaluation
- IEMS 434 Systems Methodology
- IEMS 436 Engineering Project Management
- IEMS 441 Social Network Analysis
- IEMS 490 (Selected Topics) Computational Social Science
- CEE 482 Evaluation and Decision-Making for Infrastructure Systems
- ECON 414-3 Economics of Information
- MORS 524-1 The Individual and the Organization
- MORS 524-2 Social Processes in Organizations
- MORS 525-1 Behavior in Organizational Systems
- MORS 525-2 Organizations in their Environments
- MORS 526-1 Micro-Organizational Research Methods
- MORS 526-2 Macro-Organizational Research Methods
- MORS 522 Economics, Social Psychology and their Experiments
- MTS 525 (Selected Topics) Peer Production: Collective Action & Organization
- ELEC\_ENG 495 Game Theory and Networked Systems

## Logistics & Operations

- IEMS 482 Routing and Scheduling
- IEMS 489 Transportation Network Design and Operation
- IEMS 490 (Selected Topics) Humanitarian and Non-profit Logistics
- IEMS 490 (Selected Topics) Service Systems
- CEE 471-1,2 Transportation Systems Analysis
- CEE 479 Transportation Systems Planning and Management
- CEE 480-1,2 Travel Demand Analysis and Forecasting
- CEE 482 Evaluation and Decision-Making for Infrastructure Systems
- ECON 414-3 Economics of Information
- OPNS 521 Foundations of Operations Management
- ELEC\_ENG 495 Game Theory and Networked Systems

## Stochastic Analysis & Simulation

- IEMS 451 Stochastic Optimization
- IEMS 461 Advanced Stochastic Models
- IEMS 464 Advanced Queueing Theory
- IEMS 465 Simulation Experiment Design and Analysis
- IEMS 468 Stochastic Control
- IEMS 469 Dynamic Programming
- IEMS 490 Service Systems
- IEMS 490 Uncertainty Quantification

- MATH 450-1,2 Probability
- MATH 450-3 Stochastic Analysis III
- MATH 455-1,2 Stochastic Analysis
- OPNS 516 Stochastic Foundations
- OPNS 522 Queueing Networks: Performance Analysis
- \*University of Chicago Stochastic Optimization (BUS 36912)
- \*University of Chicago Management Science and Operations Management: Queueing Models for Service Operations Management (40911) (Half Credit Course)