Analogs to Courses Required by UC Berkeley's Department of IEOR

Computer Programming (excludes databases, simulation, etc..)

UC BERKELEY: Engineering 7 (Matlab)
Semester 1 or 2

UC BERKELEY: CS 61A, or CS 9 series (Python, Java, or C++)
By Semester 8

PENN STATE: Matlab, C, or Fortran
Semester 4

UNIVERSITY OF FLORIDA: Visual Basic.Net
Semester 4

UNIVERSITY OF FLORIDA: Matrix and Numerical Methods in Systems Engineering uses Matlab
Semester 5

ARIZONA STATE: CSE 110 – Principles of Programming in Java
Semester 2

ARIZONA STATE: CSE 205 – Object Oriented Programming and Data Structures
Semester 3

CAL POLY (SLO): CSC 232 – Visual Basic and Visual Studio
Quarter 2.2

COLUMBIA (IE & OR): COMS W1004x – Introduction to CS (Java)
Semester 3

COLUMBIA (IE & OR): COMS 3134 – Data Structures in Java
Semester 4

CORNELL: CS 111x – Introduction to CS through Matlab or Java
Semester 2

CORNELL: ENGRD 2110 – O.O. and Data Structures
Semester 3

GEORGIA TECH: CS 1301 – Introduction to Programming through Python
Semester 3

GEORGIA TECH: CS 2316 – Data Input and Manipulation through Python
Semester 4

MICHIGAN: Engineering 101 – Introduction to Numerical Computing
Semester 2

PURDUE: ENGR 132 – Transforming Ideas to Innovation II
Uses Matlab
Semester 2

PURDUE: CS159 – Introduction to Programming
Semester 2

UW MADISON: Computer Science Elective
Semester 3

TEXAS A&M: CSCE 206 – Structured Programming in C++
Semester 3

VIRGINIA TECH: One of the two…
CS1044 – Introduction to Programming in C
ENGE 2314 – Engineering Problem Solving in C++
Semester 3

STANFORD: CS 106A – Programing Methodology in Java
Year 2

STANFORD: CS 106B – Programming Abstractions in C++
Year 2

Probability and Statistics

UC BERKELEY: IEOR 172 or STAT 134 - Probability and Risk Analysis for Engineers
Course Objectives:
1. Focus on random variables and their applications
2. Study discrete and continuous random variables
3. Study independence and conditional expectation

UC BERKELEY: IEOR 165 - Engineering Statistics, Quality Control, and Forecasting
This course will introduce students to basic statistical techniques such as parameter estimation, hypothesis testing, regression analysis, analysis of

variance. Specific applications in forecasting and quality control will be considered in detail.
Semester 6

PENNSYLVANIA STATE UNIVERSITY: Probabilistic Models in IE

Exposes students to the probability theory and models and discrete and continuous probability distributions, which are necessary for solving real life engineering problems with uncertainty. Reliability modeling, one such problem of interest to the manufacturers and consumers, will be taught in this course. The course will also cover sampling distributions and point and interval estimation of mean, variance and proportion.
Semester 5

PENNSYLVANIA STATE UNIVERSITY: Statistical Methods in IE

Description: exposes students to the statistical tools such as estimation, testing of hypotheses, control charts, process capability indexes, gage R & R studies, simple regression and design of experiments, which are necessary for analyzing and solving real life engineering problems using data.
Semester 6

UNIVERSITY OF FLORIDA: STA4123 – Introduction to Probability

Introduction to the theory of probability, counting rules, conditional probability, independence, additive and multiplicative laws, Bayes Rule. Discrete and continuous random variables, their distributions, moments and moment generating functions. Multivariate probability distributions, independence, covariance. Distributions of functions of random variables, sampling distributions, central limit theorem.
Semester 4

UNIVERSITY OF FLORIDA: STA 4322 – Introduction to Statistics

Sampling distributions, central limit theorem, estimation, properties of point estimators, confidence intervals, hypothesis testing, common large sample tests, normal theory small sample tests, uniformly most powerful and likelihood ratio tests, linear models and least squares, correlation. Introduction to ANOVA.
Semester 5

UNIVERSITY OF FLORIDA: ESI 4221C: Industrial Quality Control

- Quality Improvement in the Modern Business Environment
- The DMAIC Process
- Statistical Methods Useful in Quality Improvement
- Methods and Philosophy of Statistical Process Control
- Control Charts for Variables
- Control Charts for Attributes
- Process and Measurement System Capability Analysis
- Process Design and Improvements with Designed Experiments

- Acceptance Sampling

Semester 7

ARIZONA STATE UNIVERSITY: IEE 380: Introduction to Probability and Statistics for Engineering Problem Solving

- understand the differences between probability and statistics
- be able to recognize and use common discrete and continuous probability functions
- use sample statistics to draw inferences about a population of interest through hypothesis testing
of means, variances and proportions
- build simple empirical models from data
- design simple experiments and analyze results
- understand and apply basic statistical process control charts and analyses

Semester 5

ARIZONA STATE UNIVERSITY: IEE 385: Engineering Statistics - Probability

Students will understand the differences between probabilistic (stochastic) models and statistical applications

Students will be able to recognize applications of and use important discrete and continuous distribution functions such as the
Binomial, Geometric, Poisson, Multinomial, Uniform, Exponential, Gamma, and Normal

Students will be able to develop Maximum Likelihood Estimators for distribution parameters

Students will be able to perform Chi Square Goodness of Fit tests on data to determine underlying distributions

Students will understand reliability models and concepts

Semester 6

ARIZONA STATE UNIVERSITY: IEE 474: Quality Control

Basic statistical process control techniques, capability analysis, design of experiments, and acceptance sampling plans.

Semester 7

CAL POLY (SLO): STAT 321. Probability and Statistics for Engineers and Scientists.

Tabular and graphical methods for data summary, numerical summary measures, probability concepts and properties, discrete and continuous probability distributions, expected values, statistics and their sampling distributions, point estimation, confidence intervals for a mean and proportion. Use of statistical software. 4 lectures. Fulfills GE B6.

Quarter 2.3

CAL POLY (SLO): Engineering Test Design and Analysis

Data gathering and statistical testing applied to industrial engineering and manufacturing fields. Experimental methods for product and process

evaluation and comparisons; interpretation of engineering data. Engineering experimental design, linear and nonlinear regression, ANOVA, and multifactor ANOVA. Utilization of existing computer software. 4 lectures. Prerequisite: STAT 321 with a grade of C- or better, or consent of instructor.
Quarter 3.2

CAL POLY (SLO): IME 430 – Quality Engineering

Quality control, reliability, maintainability, and integrated logistic support. Statistical theory of process control and sampling inspection. Risks associated with decisions based on operating characteristics of control charts and sampling plans. Reliability and life testing methods. Economics of statistical QC. Specifications and standards. 4 lectures. Prerequisite: IME 326 or STAT 302
Quarter 4.1

COLUMBIA: SIEO W3600: Introduction to Probability and Statistics

This class must be taken by the fourth semester.
This course serves as an introduction to both probability theory and statistics as used in engineering and applied science.
In probability the course covers random variables, both continuous and discrete, independence, expected values, variance, conditional distributions, conditional expectation and variance, moment generating functions, the strong law of large numbers and the central limit theorem.
In statistics it covers the basics of confidence intervals, hypothesis testing and linear regression.
Semester 4

COLUMBIA: IEOR E4412y Quality Control and Management

This course covers modern methods for quality control and improvement: Statistical Process Control, introduction to Acceptance Sampling, and the relationships between quality and productivity.
We will introduce elements of latest concepts of Lean Manufacturing, Six Sigma, and ISO 9000-2008. The course discusses the methods and tools used to manage processes to achieve highest quality at lowest cost. We cover the interaction of management methods and quality productivity. The course covers methods used in manufacturing, as well as service industries such as finance, healthcare, etc.
Semester 8

CORNELL: ENGRD 2700 - Basic Engineering Probability and Statistics

Fall, spring, summer. 3 credits.
Gives students a working knowledge of basic probability and statistics and their application to engineering. Includes computer analysis of data and simulation. Topics include random variables, probability distributions, expectation, estimation, testing, experimental design, quality control, and

regression. Students will build familiarity with current software used for statistical inference and data analysis.
Semester 3

CORNELL: ORIE 3500: Engineering Probability and Statistics II

A rigorous foundation in theory combined with the methods for modeling, analyzing, and controlling randomness in engineering problems.
Specific topics include random variables, probability distributions, density functions, expectation and variance, multidimensional random variables, and important distributions including normal, Poisson, exponential, hypothesis testing, confidence intervals, and point estimation using maximum likelihood and the method of moments.
Semester 5

GEORGIA TECH: ISYE 2027: Probability with Applications

Topics include probability, conditional probability, density and distribution functions from engineering, expectation, conditional expectation, laws of large numbers, and the central limit theorem.
Semester 3

GEORGIA TECH: ISYE 2028 BASIC STATISTICAL METHODS

(uses the R programming language)
TWO WEEKS: Data Description: Random Sampling; Data Displays; Sampling Distributions include t-Distribution and F-Distribution.
FOUR WEEKS: Point and Interval Estimation: Estimating the Mean; Estimating the Differences between Means; Proportions, and Variances; Methods of Moments; Maximum Likelihood Estimation; Properties of Estimators.
FOUR WEEKS: Tests of Hypothesis: One-and Two-Sided Tests; Single Sample Tests; Two Sample Tests; Use of p-Values; Goodness-of-Fit Test; Test for Independence; Test for Homogeneity.
FOUR WEEKS: Linear Regression and Correlation: Least Squares and the Fitted Model; Properties of the Least Squares Estimators; Inferences Concerning the Regression Coefficients; Analysis of Variance.
Semester 4

GEORGIA TECH: Quality Control offered, but not required with O.R. emphasis.

UNIVERSITY OF MICHIGAN: IOE 265. Probability and Statistics for Engineers

Graphical Representation of Data; Axioms of Probability; Conditioning, Bayes Theorem; Discrete Distributions (Geometric, Binomial, Poisson); Continuous Distributions (Normal Exponential, Weibull), Point and Interval Estimation, Likelihood Functions, Test of Hypotheses for Means, Variances and Proportions for One and Two Populations.
Semester 4

UNIVERSITY OF MICHIGAN: IOE 366. Linear Statistical Models (2 credits, 7 weeks)

Linear statistical models and their application to engineering data analysis. Linear regression and correlation; multiple linear regression, analysis of variance, introduction to design of experiments.

Semester 5

UNIVERSITY OF MICHIGAN: IOE 461 - Quality Engineering Principles and Analysis

Offered, but not required

UNIVERSITY OF MICHIGAN: IOE 466 – Statistical Quality Control

Offered, but not required

PURDUE: IE 230 – Probability and Statistics in Engineering I

An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems. Typically offered Fall Spring.

Semester 3

PURDUE: IE 330 - Probability And Statistics In Engineering II

1. Learn use of statistical software packages (e.g. Minitab).
2. Learn parametric statistical tests (e.g. t-test, ANOVA).
3. Learn non-parametric statistical tests.
4. Learn design of experiments (e.g. factorial).
5. Learn how to implement statistical process controls.

Semester 4

UW MADISON: Stat 311 – Intro to Theory and Methods of Mathematical Statistics I

Elements of probability, important discrete distributions, acceptance sampling by attributes, sample characteristics, probability distributions and population characteristics, the normal distribution, acceptance sampling plans based on sample means and variances, sampling from the normal, the central limit theorem, point and interval estimation.

Semester 3

UW MADISON: Stat 312 – Intro to Theory and Methods of Mathematical Statistics II

Unbiased estimation, maximum likelihood estimation, confidence intervals, tests of hypotheses, Neyman-Pearson lemma, likelihood ratio test, regression, analysis of variance with applications.

Semester 4

TEXAS A&M: Stat 211 – Principles of Statistics I

Introduction to probability and probability distributions; sampling and descriptive measures; inference and hypothesis testing; linear regression, analysis of variance.

Semester 4

TEXAS A&M: Stat 212 – Principles of Statistics II

Learn basic principles of regression analysis, experimental design, analysis of variance, categorical data analysis, and nonparametric (or distribution-free) methods.

Learn how to use the program JMP to perform various statistical analyses.

Gain an appreciation for the role that statistics plays in helping us to quantify and explain variability.

Semester 5

TEXAS A&M: ISEN 3 14 – Statistical Control of Quality

Quality control with statistical principles applied to problems in various production systems, including probability concepts, density and distribution functions, control chart concepts and sampling inspection plans; laboratory exercises for exposure to basic metrology and applied statistics for quality control applications in discrete-item manufacturing systems.

Semester 6

VIRGINIA TECH: Stat 4105 – Theoretical Statistics I

Probability theory, counting techniques, conditional probability; random variables, moments; moment generating functions; multivariate distributions; transformations of random variables; order statistics.

Semester 4

VIRGINIA TECH: Stat 4706 – Statistics for Engineers

Multiple regression, analysis of variance, factorial and fractional experiments.

Semester 5

VIRGINIA TECH: ISE 4404 – Statistical Quality Control

Application of statistical methods and probability models to the monitoring and control of product quality. Techniques for acceptance sampling by variables and attributes are presented. Shewhart control charts for both classes of quality characteristics are examined in depth. The motivation for each method, its theoretical development, and its application are presented. The focus is upon developing an ability to design effective quality control procedures. A grade of C- or better required in ISE 3414, STAT 4105, and STAT 4706. I. Pre: 3414, STAT 4105, STAT 4706. (3H,3C)

Semester 7

STANFORD: STATS 110: Statistical Methods in Engineering and the Physical Sciences

Introduction to statistics for engineers and physical scientists. Topics: descriptive statistics, probability, interval estimation, tests of hypotheses, nonparametric

methods, linear regression, analysis of variance, elementary experimental design. Prerequisite: one year of calculus.
Year 2

STANFORD: MS&E 120: Probabilistic Analysis

Concepts and tools for the analysis of problems under uncertainty, focusing on model building and communication: structuring, processing, and presentation of probabilistic information. Examples from legal, social, medical, and physical problems. Spreadsheets illustrate and solve problems as a complement to analytical closed-form solutions. Topics: axioms of probability, probability trees, random variables, distributions, conditioning, expectation, change of variables, and limit theorems. Prerequisite: MATH 51. Recommended: knowledge of spreadsheets.
Year 3

Operations Research and Mathematical Programming

UC BERKELEY: IEOR 160 - Operations Research I (Deterministic)

Deterministic methods and models in operations research. Unconstrained and constrained optimization. Equality, inequality, and integer constraints. Sequential decisions; dynamic programming. Resource allocation, equipment replacement, inventory control, production planning.
Semester 5

UC BERKELEY: IEOR 161 - Operations Research II (Stochastic)

1. Students understand the concept of a random model.
2. Students can use the building blocks of the course -- Poisson processes, Markov processes, queuing and reliability theory -- to formulate a realistic model for many industrial engineering applications.
3. Students can analyze the model to understand and improve the performance of the underlying system.

Semester 6

UC BERKELEY: IEOR 162 - Linear Programming

Formulation to linear programs. Optimal allocation and control problems in industry and environmental studies. Convex sets; properties of optimal solutions. The simplex method; theorems of duality; complementary slackness. Problems of post-optimization. Special structures; network problems. Digital computation.
Semester 5

PENN STATE: Deterministic Models in OR

The student will learn to formulate linear programs, network models, and integer programs. The student will also learn solution strategies such as the simplex method and branch and bound. Duality and sensitivity analysis will be covered along with their economic interpretation. Optimization software will be used for solving the formulations. Practical examples along with a detailed case study will be presented to help the student to synthesize the topic.
Semester 6

PENN STATE: Stochastic Models in OR

Poisson processes, Markov Chains, Dynamic Programming, and Queueing systems.
Direct connections will be made to manufacturing and service systems.
Inventory theory, including fundamental tradeoffs, EOQ modeling, and stochastic models.
Semester 7

UNIVERSITY OF FLORIDA: ESI 4312 – Operations Research 1

Introduction to the use of linear decision models, particularly linear programming and related decision analysis optimization software, to aid in the analysis and solution of complex, large-scale decision problems. Consideration of related network modeling concepts.
Required text: Operations Research: Applications and Algorithms: Wayne L. Winston.
Semester 6

UNIVERSITY OF FLORIDA: ESI 4313 – Operations Research 2

Dynamic programming and optimization. Markov processes and queuing theory. Network analysis. Applications.
Software: GAMS
To be successful in this class, you need to have a knowledge of basic programming techniques and a working knowledge of calculus and probability. Further, "ESI4312 " and "STAT 4321 " are formal pre-requisites for the class.
Semester 6

ARIZONA STATE UNIVERSITY: IEE 376: Operations Research Deterministic

Techniques/Applications- Industrial systems applications with deterministic operations research techniques. Resource allocation, product mix, production, transportation, task assignment, networks.
Semester 6

ARIZONA STATE UNIVERSITY: IEE 470: Stochastic Operations Research

Modeling and analysis with emphasis on stochastic operations research. Models for stochastic processes, including Markov chains, queuing and decision analysis.
Semester 7

CAL POLY (SLO): IME 301 – Operations Research I

Systems modeling methodology, mathematical model formulations, linear programming, graphical and simplex methods. Duality and sensitivity analysis. Transportation, transshipment and assignment models. Introduction to goal programming and elastic constraints. Computer applications. 3 lectures, 1 activity.
Quarter 3.1

CAL POLY (SLO): IME 405: Operations Research II

Stochastic decision analysis. Queuing models, inventory models and analysis. Markov processes. Computer aided modeling and case studies. 3 lectures, 1 activity. Prerequisite: IME 301, IME 326 STAT 321 or consent of instructor. Change effective Spring 2012.
Quarter 4.1

COLUMBIA (IE): IEOR 3106: Introduction to Operations Research: Stochastic Models

Probability at the level of SIEO W3600 or SIEO W4150.
Must be taken during or before the fifth semester.
Among the stochastic processes to be considered are discrete-time Markov chains, random walks, continuous-time Markov chains, Poisson processes, birth-and-death processes, renewal processes, renewal-reward processes, Brownian motion and geometric Brownian motion. Among the engineering applications to be considered are queuing, inventory and finance.
Semester 5

COLUMBIA (IE): IEOR E3608x Introduction to Mathematical Programming

Prerequisites:MATH V2010: Linear Algebra. Corequisites: COMS W3134 (or COMS W3137): Data Structures.
This class must be taken during (or before) the fifth semester.
Linear programming and the simplex method, dynamic programming, network flow models and algorithms, implicit enumeration for integer programs. A wide range of applications is also discussed.
Semester 5

COLUMBIA (IE): IEOR 4705 – Topics in OR (not listed)

Semester 7

COLUMBIA (OR): IEOR E4600y Applied Integer Programming

Prerequisites: Linear programming, linear algebra, and computer programming.

This course covers applications of mathematical programming techniques, especially integer programming, with emphasis on software implementation. This course also covers topics of modeling and solution of problems in supply chain, logistics, routing. Particular emphasis is placed on optimization modeling systems, such as AMPL and OPL and state-of-the-art solvers.
Semester 6

COLUMBIA (OR): IEOR E4407x Game Theoretic Models of Operations

Prerequisites: IEOR E3608: Introduction to Mathematical Programming or IEOR E4004: Introduction to Operations Research: Deterministic Models, IEOR E3106 or IEOR E4106: Introduction to Operations Research: Stochastic Models, familiarity with differential equations and computer programming; or instructor's permission.
One of the major discrepancies between traditional operations research models and the actual business decision making process is the presence of multiple agents and their mutual interaction. Competitors, consumers, and suppliers are agents seeking their self-interest, and their actions affect one's profit and optimal decision. This course exposes students to strategic thinking through game theory. Students will learn the theory of games and auctions and gain insights into their application to operations management. No previous knowledge of game theory is assumed.
Semester 7

CORNELL: ORIE 3300: Optimization I

Formulation of linear programming problems and solutions by the simplex method. Related topics such as sensitivity analysis, duality, and network programming. Applications include such models as resource allocation and production planning. Introduction to interior-point methods for linear programming.
Semester 5

CORNELL: ORIE 3310: Optimization II

A variety of optimization methods stressing extensions of linear programming and its applications but also including topics drawn from integer programming, dynamic programming, and network optimization. Formulation and modeling are stressed as well as numerous applications.
Semester 6

CORNELL: ORIE 3510: Introductory Engr. Stochastic Processes

Uses basic concepts and techniques of random processes to construct models for a variety of problems of practical interest. Topics include the Poisson process, Markov chains, renewal theory, models for queuing, and reliability.
Semester 6

GEORGIA TECH: ISYE 3133 ENGINEERING OPTIMIZATION

Linear program models: objective functions, constraints, decision variables, absolute values, optimization software. Standard and advanced Integer Programming.

Linear program solution using simplex method and tableaus. Duality, sensitivity LP Relaxations, and branch and bound.

Use of commercial software tools.

Semester 5

GEORGIA TECH: ISYE 3232 STOCHASTIC MFG & SERVICE SYSTEMS

- Model a system when randomness is significant
- Describe how variability affects a system's behavior and performance
- Apply Markov Chains
- Apply basic inventory models
- Define key concepts in production flow such as bottlenecks, line balancing, and Little's Law
- Use open and closed Jackson networks
- Maintain throughput in a closed Jackson network and compute corresponding WIP levels

Semester 5

GEORGIA TECH: ISYE 4133 ADVANCED OPTIMIZATION

Programming skills required. Students will learn…

- a deeper understanding of the key concepts, theory, and algorithms of linear optimization, integer optimization, and some modern convex optimization,
- more advanced modeling techniques,
- ways of solving optimization problems that are too hard, too large for direct solutions,
- ways of solving optimization problems faster when speed is essential,
- ways to assess the quality of sub-optimal solutions.

Semester 6

GEORGIA TECH (OR Track): ISYE 4232 ADVANCED STOCHASTIC SYSTEMS

- Model a system when randomness is significant
- Apply Continuous Time Markov Chains
- Use open and closed Jackson networks
- Use Markov Decision Processes
- Develop models for sequential decision making under uncertainty

Semester 7

MICHIGAN: IOE 202. Operations Modeling

Prerequisite: ENGR 100 and ENGR 101. I, II (2 credits) (7-week course)

Process of mathematically modeling operational decisions including the role of uncertainty in decision-making. Basic tools for solving the resulting models, particularly mathematical programs, statistical models and queueing models. Cases may come from manufacturing and service operations and ergonomics.
Semester 3

MICHIGAN: IOE 310. Introduction to Optimization Methods
Prerequisite: Math 214, IOE 202 and ENGR 101. I, II (4 credits)
Introduction to deterministic models with emphasis on linear programming; simplex and transportation algorithms, engineering applications, relevant software. Introduction to integer, network and dynamic programming, critical path methods.
Semester 5

MICHIGAN: IOE 316. Introduction to Markov Processes
Prerequisite: IOE 265 and Math 214. I, II (2 credits) (7-week course)
Introduction to discrete Markov Chains and continuous Markov processes, including transient and limiting behavior. The Poisson/Exponential process. Applications to reliability, maintenance, inventory, production, simple queues and other engineering problems.
Semester 5

PURDUE: IE 335 - Operations Research (Optimization)
Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs. Typically offered Fall Spring.
Semester 5

PURDUE: IE 336 - Operations Research (Stochastics)
Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queueing systems.
Semester 6

UW MADISON: ISyE 323 – Operations Research-Deterministic Modeling. 3 cr.
Basic techniques for modeling and optimizing deterministic systems with emphasis on linear programming. Computer solution of optimization problems. Applications to production, logistics, and service systems. Prereq: Math 222, ISYE 313, and either Math 320 or 340. I5; II0; S1
Semester 5

TEXAS A&M: ISEN 420 – Operations Research I
Development and application of fundamental deterministic analytical methods including linear programming, integer programming, dynamic programming and nonlinear optimization.

Semester 6

VIRGINIA TECH: ISE 2404 – Deterministic Operations Research

Deterministic operations research modeling concepts; linear programming modeling, assumptions and algorithms, duality and sensitivity analysis with economic interpretation; transportation and assignment problems; convexity issues, optimality conditions for continuous unconstrained and constrained nonlinear optimization problems, numerical optimization methods; and discrete optimization concepts. II,III. Co: MATH 2224. (3H,3C)

Semester 4

VIRGINIA TECH: ISE 3414 – Probabilistic Operations Research

This course introduces probability models used to investigate the behavior of industrial systems. The major topics include conditioning, elementary counting processes and Markov chains. Emphasis is on the use of these tools to model queues, inventories, process behavior and equipment reliability.

Semester 5

STANFORD: MS&E 111 – Introduction to Optimization

Formulation and analysis of linear optimization problems. Solution using Excel solver. Polyhedral geometry and duality theory. Applications to contingent claims analysis, production scheduling, pattern recognition, two-player zero-sum games, and network flows. Prerequisite: MATH 51.

Year 2

STANFORD: MS&E 121: Introduction to Stochastic Modeling

Stochastic processes and models in operations research. Discrete and continuous time parameter Markov chains. Queuing theory, inventory theory, simulation. Prerequisite: 120 or Statistics 116.

Year 3

Finance and Economics

E 120 - Principles of Engineering Economics

1. Being able to read and understand financial statements.
2. Understand the time value of money.
3. Develop the ability to identify, evaluate and compare cash-flow streams.
4. Understand the concept of tradeoff between risk and return and how it affects the prices of financial assets as well as investment decisions.

Semester 4

PENN STATE: Introduction to Economics (micro or macro)

Semester 2

PENN STATE: IE 302 Engineering Economy

Principles and methods for analyzing the economic feasibility of technical alternatives leading to a decision or recommendation.

Semester 5

UNIVERSITY OF FLORIDA: ECO 2013 – Macroeconomics

This course provides a general overview of the theory, policies, and institutions of macroeconomics. We will analyze the tradeoffs created via trade; the workings of the market mechanism; the definitions and models used by economists to define the macroeconomy and the business cycle; the foundations of the international banking system; and government intervention in the forms of fiscal and monetary policy.

Semester 1

UNIVERSITY OF FLORIDA: ECO 2023 – Microeconomics

No description available

Semester 2

UNIVERSITY OF FLORIDA: ACG 2021 – Introduction to Financial Accounting

Identify the information conveyed in each of the four basic financial statements and the way that it is used by different decision makers. Identify what constitutes a business transaction and apply transaction analysis to record the effects of those transactions. Prepare basic financial statements based upon Generally Accepted Accounting Principles. Describe common financial statement relationships used in financial analysis.

Semester 4

UNIVERSITY OF FLORIDA: EIN 4354 – *Engineering Economy*

Basic principles and applications of economic decision-making between alternatives encountered in engineering systems projects. The analysis will include methodologies of economics and finance in addition to engineering fundamentals

Semester 5

ARIZONA STATE: ECN 211: Macroeconomic Principles

Basic macroeconomic analysis. Economic institutions and factors determining income levels, price levels, and employment levels.

Semester 3

ARIZONA STATE: IEE 300: Economic Analysis for Engineers

Economic evaluation of alternatives for engineering decisions, emphasizing the time value of money.

Semester 4

CAL POLY (SLO): IME 239 – Industrial Costs and Controls

Estimation of manufacturing costs for production planning, cost analysis, and cost control. Planning, budgeting and control processes. Costs, accounting data and analysis of variances for managerial control, inventory valuation and decision making. Techniques of forecasting, pricing, cost estimating and cost reduction. 3 lectures. Prerequisite: IME 223.

Quarter 2.2

CAL POLY (SLO): IME 314 – Engineering Economics

Economic analysis of engineering decisions. Determining rates of return on investments. Effects of inflation, depreciation and income taxes. Sensitivity, uncertainty, and risk analysis. Application of basic principles and tools of analysis using case studies. 3 lectures. Prerequisite: MATH 241.

Quarter 3.3

COLLUMBIA (IE *and* OR): ECON W1105

How a market economy determines the relative prices of goods, factors of production, and the allocation of resources and the circumstances under which it does it efficiently. Why such an economy has fluctuations and how they may becontrolled.

Semester 1

COLUMBIA (IE *and* OR): IEOR E2261x: Introduction to Accounting and Finance.

Topics covered in this course include: principles of accrual accounting; recognizing and recording accounting transactions; preparation and analysis of financial statements, including balance sheets, income statements, cash flow statements, and statements of owners' equity; ratio analysis; pro-forma projections; time value of money (present values, future values and interest/discount rates); inflation; discounted-cash-flow (DCF) project evaluation methods; deterministic and probabilistic measures of risk; capital budgeting.

Semester 3

COLUMBIA (IE *and* OR): IEOR E4003x Industrial Economics

Prerequisites: Probability and Statistics at the level of SIEO W3600 or SIEO W4150, and Deterministic Models at the level of IEOR E3608 or IEOR E4004, or instructor permission.

We describe how an investment project can be characterized by its cash flow profile, i.e., the amount and timing of costs and benefits of this project in the planning horizon. We show how firms should take into account the cost of capital, budgets, taxes, depreciation, inflation, and uncertainty, in order to decide which projects to undertake, reject, or postpone. This course is a good preparation for positions in investment banking, consulting, private equity, venture capital, corporate finance, and construction management, and for entrepreneurs. Students can take only one of IEOR E4003 andIEOR E4403, but not both.

Semester 7

CORNELL: ORIE 3150: Financial and Managerial Accounting

Covers principles of accounting, financial reports, financial-transactions analysis, financial-statement analysis, budgeting, job order and process-cost systems, standard costing and variance analysis, and economic analysis of short-term decisions.
Semester 5

GEORGIA TECH: ECON 2100: ECONOMIC ANALYSIS & POLICY

Learn the "Microeconomics" tools designed to help you understand the functioning of various markets (e.g., goods and services, labor, financial). Examine selected economic policy issues (e.g., taxation, immigration, education, health, environmental regulation).
Focus on the "Macroeconomic" topics: business cycles, monetary policy (money supply, interest rates), fiscal policy (federal government revenues and expenditures, taxes), unemployment and inflation. We will also examine the current economic crisis.
Semester 4

GEORGIA TECH: ISYE 3025 ESSENTIALS OF ENGINEERING ECONOMY (1 unit)

Financial Mathematics: Concept of Equivalence; Equivalence Formulas; Interest Rates.
Decision making: Economic Decision Criteria. Fundamentals of Economic Decisions, Future, Present, and Annual Worth, Internal Rate of Return, Benefit/Cost Ratio and Payback Period. Multiple Alternatives.
Taxes: Corporate Income Taxes, Depreciation Accounting, Sale of and Asset, Financing with a Loan. Inflation and Uncertainty.
Semester 5

GEORGIA TECH: ACCT 2101 or MGT 3000 or MGT 3150

An introduction to the measurement and financial reporting of organizations and the interpretation of the resulting financial statements.
Semester 5

MICHIGAN: IOE 201. Economic Decision Making

Prerequisite: ENGR 100 and ENGR 101. I, II (2 credits) (7-week course)
Overview of business operations, valuation and accounting principles. Time value of money and net present values. Practical team project experience.
Semester 3

PURDUE: IE 343: Engineering Economics

Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies.
Semester 3

UW MADISON: Econ 111 (combined micro and macro), or Econ 101 (micro)
Semester 2

UW MADISON: ISyE – 313 Engineering Economic Analysis. 3 cr
Financial accounting principles and cost systems, interpretation and use of accounting reports and supplemental information for engineering economic analyses, consideration of cost-volume-profit analyses, use of discounted cash flow techniques, flexible budgeting, transfer pricing, and capital budgeting.
Semester 4

UW MADISON: Acct IS 100 / 300 – Introduction to Financial Accounting
Examines generally accepted accounting principles for measurement and reporting of financial information in a balance sheet, income statement, and statement of cash flows; introduction to analysis and interpretation of financial accounting data for decision-making purposes.
Semester 5

TEXAS A&M: ISEN 303 – Engineering Economic Analysis
Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and tax implications; certainty; uncertainty; risk analysis; public sector analysis and break-even concepts.
Semester 5

VIRGINIA TECH: ISE 2014 – Engineering Economy
Concepts and techniques of analysis for evaluating the worth of products, systems, structures, and services in relation to their cost. Economic and cost concepts, calculating economic equivalence, comparison of alternatives, replacement economy, economic optimization in design and operations, and after-tax analysis. Pre: ENGE 1024. (3H,2C)
Semester 3

STANFORD: Econ 1A – Principles of Economics
The economic way of thinking and the functioning of a modern market economy. The behavior of consumers and firms. Markets for goods and inputs. Analysis of macroeconomic variables: output, employment, inflation, interest rate. Determination of long-run growth and short-term fluctuations. The role of government: regulation, monetary, and fiscal policy.
Year 1

STANFORD: ENGR 60 – Engineering Economy

Fundamentals of economic analysis. Interest rates, net present value, and internal rate of return. Applications to personal and corporate financial decisions. Mortgage evaluation, insurance decision, hedging/risk reduction, project selection, capital budgeting, and investment valuation. Effects of taxes on personal and business decisions. Investment decisions under uncertainty and utility theory. Please see http://www.stanford.edu/class/engr60. Prerequisites: precalculus and elementary probability.

Year 2

STANFORD: Econ 50 – Economic Analysis I

Individual consumer and firm behavior under perfect competition. The role of markets and prices in a decentralized economy. Monopoly in partial equilibrium. Economic tools developed from multivariable calculus using partial differentiation and techniques for constrained and unconstrained optimization. Prerequisites: Econ 1, and Math 51 or CME 100. Must be taken for a Letter grade if majoring/minoring in Economics.

Year 2

STANFORD: Econ 51 – Economic Analysis II

Neoclassical analysis of general equilibrium, welfare economics, imperfect competition, externalities and public goods, intertemporal choice and asset markets, risk and uncertainty, game theory, adverse selection, and moral hazard. Multivariate calculus is used.

Year 2

STANFORD: MS&E 140: Accounting for Managers and Entrepreneurs (MS&E 240)

Non-majors and minors who have taken or are taking elementary accounting should not enroll. Introduction to accounting concepts and the operating characteristics of accounting systems. The principles of financial and cost accounting, design of accounting systems, techniques of analysis, and cost control. Interpretation and use of accounting information for decision making. Designed for the user of accounting information and not as an introduction to a professional accounting career. Enrollment limited. Admission by order of enrollment.

Year 4

SIMULATION

UC BERKELEY: IEOR 131 - Simulation

1. Recognize the fundamental similarities among simulation software products,
2. Model discrete event dynamics using a wide variety of different methodologies,
3. Understand how to simulate randomness and the potential pitfalls in doing so,

4. Design and run effective and efficient simulation experiments and correctly analyze the results of those experiments.
Semester 7

PENN STATE: IE 453 - Simulation Modeling for Decision Support

Description: apply discrete event simulation modeling for decision support in IE problems through developing skills in model building, simulation output analysis, and communication of technical information and conclusions drawn from data analysis.
Semester 8

UNIVERSITY OF FLORIDA: *Industrial Systems Simulation*

This purpose of this course is to introduce you to the digital simulation techniques and industrial applications. The emphasis is on building computer-based models for real systems and performing simulation experiments to evaluate the behavior of a system under different sets of conditions. Students are required to do a term project, as detailed in a separate handout.
Kelton, Sadowski and Sturrock, "Simulation Using ARENA," 5th Edition, McGraw-Hill
Semester 7

ARIZONA STATE: IEE 475: Simulating Stochastic Systems

Analyzes stochastic systems using basic queuing networks and discrete event simulation. Basic network modeling, shared resources, routing, assembly logic.
Semester 7

CAL POLY (SLO): IME 420 – Simulation

Design and analysis of manufacturing and service systems by simulation. System modeling. Random number and function generators, programming, and characteristics of simulation languages. Design projects using real world problems. Introduction to rule-based expert systems. 3 lectures, 1 laboratory.
Prerequisite: IME 326, IME 405, or consent of instructor.
Quarter 4.2

COLUMBIA (IE *and* OR): IEOR E4404: Simulation

Prerequisites: SIEO W3600 or SIEO W4150: Introduction to Probability and Statistics, computer programming language such as C, C++, Java or Matlab.
Corequisites: IEOR E3106 or IEOR E4106: Introduction to Operations Research: Stochastic Models.
Topics covered in the course include the generation of random numbers, sampling from given distributions, simulation of discrete-event systems, output analysis, variance reduction techniques, goodness of fit tests, and the selection of input distributions. The first half of the course is oriented towards the design

and implementation of algorithms, while the second half is more theoretical in nature and relies heavily on material covered in prior probability courses. The teaching methodology consists on lectures, recitations, weekly homework, and both in-class and take-home exams. Homework almost always includes a programming component for which students are encouraged to work in teams **Students who have taken IEOR E4703 Monte Carlo simulation may not register for this course for credit.**
Semester 6

CORNELL: ORIE 4580: Simulation Modeling and Analysis

Introduction to Monte Carlo simulation and discrete-event simulation. Emphasizes tools and techniques needed in practice. Random variate, vector, and process generation modeling using a discrete-event simulation language, input and output analysis, modeling.
Semester 7

PURDUE: IE 332 – Computing in Industrial Engineering

Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools. Typically offered Fall Spring.
Semester 5

GEORGIA TECH: ISYE 3044 SIMULATION ANALYSIS AND DESIGN

(1) Introduction to simulation models and simulation studies;
(2) Organization of simulation languages;
(3) Modeling with a state-of-the art simulation package with 3-D, true-to-scale animation capabilities such as Simio;
(4) Statistical aspects including input data analysis, generation of realizations from statistical distributions, output data analysis, and simulation-based optimization.
Semester 6

GEORGIA TECH: ISYE 4803 ADVANCED SIMULATION

A “special topics” course, might not be regularly offered?
Semester 7

MICHIGAN: IOE 474. Simulation

Prerequisite: IOE 316, IOE 366, IOE 373. I, II (4 credits)
Simulation of complex discrete-event systems with applications in industrial and service organizations. Course topics include modeling and programming simulations in one or more high-level computer packages such as ProModel or GPSS/H; input distribution modeling; generating random numbers; statistical analysis of simulation output data. The course will contain a team simulation project.

Semester 7

UW MADISON: ISyE 320 – Simulation and Probabilistic Modeling. 3 cr

Analysis of stochastic systems using both analytic methods and computer simulation. Empirical and theoretical models of arrival and service processes. State spaces and state transition probabilities. Simulation of queuing and manufacturing systems. Continuous time Markov analysis of manufacturing systems. Prereq: Stat 311 or equiv. I4; II4; S0

Semester 6

UW MADISON: ISyE 321 – 321 Simulation Modeling Laboratory. 1 cr

Computer exercises involving generation and analysis of random variables, spreadsheet models of queuing systems, use of simulation software packages. Project. Prereq: Concurrent registration in ISYE 320. I4; II4; S0

Semester 6

TEXAS A&M: ISEN 424 – Systems Simulation

Understand the fundamental methodologies of discrete event (process oriented) simulation modeling.

Understand the key statistical issues involved in simulation data preparation and the analysis of simulation output,

Become familiar with modeling using a commercial language (ARENA), and

Demonstrate effective written communication of a modeling problem, the solution method employed and recommendations

Semester 6

VIRGINIA TECH: ISE 3424 – Discrete Event Computer Simulations

No description available

Semester 6

Capstone Projects

UC BERKELEY: IEOR 180 - Senior project

PENN STATE: IE 480W: **Capstone Design Course**

UNIVERSITY OF FLORIDA: EIN 4335 Senior Design

ARIZONA STATE: IEE 485: Capstone I

ARIZONA STATE: IEE 490: Project in Design and Development(L)-Individual or team capstone project in creative design and synthesis.

CAL POLY (SLO): IME 481 Senior Project Design Laboratory I (2)

Culminating design project typical of problems faced in professional practice. Individual or group projects typically involve system design, modeling, analysis and testing. Project method includes costs, planning, scheduling, appropriate research methodology and formal reports. 2 laboratories. Prerequisite: Senior standing in major and consent of instructor.
Quarter 4.2

CAL POLY (SLO): IME 482 Senior Project Design Laboratory II (3)
Continuation of IME 481. Involves research methodology: problem statement, method, results, analysis, synthesis, project design, construction (when feasible), and evaluation/conclusions. Project results presented in thesis-like formal reports suitable for reference library and formal oral presentations. 3 laboratories. Prerequisite: IME 481.
Quarter 4.3

COLUMBIA: no senior project in IE or OR

CORNELL: no senior project

GEORGIA TECH: ISYE 4106 SENIOR DESIGN

MICHIGAN (ONE OF TWO)
IOE 481. Practicum in Hospital Systems OR
IOE 424. Practicum in Production and Service Systems

PURDUE: IE 431 - Senior project

UW MADISON: Senior Design Elective
(one of the following; consists of a project with an outside organization)
Industrial Engineering Design
Engineering Management
Human Factors Engineering Design and Evaluation Ergonomics in Service
Design and Analysis of Manufacturing Systems
Organization & Job Design
E-Business: Technologies, Strategies and Applications
E-Business Transformation: Design, Analysis and Justification

TEXAS A&M: ISEN 459 – Industrial Engineering Systems Design
Semester 8

VIRGINIA TECH: ISE 4005 – Project Management and System Design (Capstone I)
The capstone design sequence for ISE majors. Survey of methods, tools and techniques used to plan, communicate, manage and control projects. Students work in teams to develop a proposal for and implement an industrial engineering design project for actual manufacturing or service industry clients. A grade of C- or better required in ISE prerequisites 3214,

3424, and 3024. Pre: 3024, 3214, 3424, 3614 for 4005; 4005 for 4006. Co: 4204, 3624 for 4005. 4005: (3H,3C) 4006: (2H,2C)
Semester 7

VIRGINIA TECH: ISE 4006 – Project Management and System Design (Capstone II)
Semester 8

STANFORD: MS&E 108: Senior Project
Restricted to MS&E majors in their senior year. Students carry out a major project in groups of four, applying techniques and concepts learned in the major. Project work includes problem identification and definition, data collection and synthesis, modeling, development of feasible solutions, and presentation of results. Service Learning Course (certified by Haas Center).
Year 4