

Suggested Mathematics Electives

MATH	202	Differential Equations & Modeling
MATH	211	Differential Equations
MATH	231	Principles of Real Analysis I
MATH	232	Principles of Real Analysis II
MATH	264	Scientific Computing
MATH	265	Numerical Analysis
MATH	281	Dynamical Systems
MATH	282	Partial Differentiation Equations
MATH	283	Mathematical Modeling
MATH	287	Operations Research
MATH	333	Differential Equations and Complex Analysis in Applied Mathematics
MATH	351	Time Series Analysis
MATH	355	Linear Statistical Models
MATH	359	Simulation
MATH	361	Numerical Methods for Finance
MATH	364	Intro to Scientific Computing
MATH	368	Advanced Numerical Analysis
MATH	462	Bayesian Inference and Machine Learning

Suggested management and Economics Electives

ECON	254	Game Theory for Economics
ECON	316	Math Methods in Microeconomics
ECON	383	Econometrics II
ECON	384	Econometrics III
MGT	327	Financial Statement Analysis
MGT	333	Global Financial Management
MGT	340	Strategy
MGT	373	Financial Strategy & Policy
MGT	376	The Global Economy
MGT	383	Economics of Strategy
MGT	410	Strategic Risk Management in an Emerging Economy
MGT	475A	Fixed Income Investment Management

Description

MATH 202PO Differential Equations & Modeling

Introduction to theory of ordinary differential equations, with applications to modeling in physical, biological, and social sciences. Emphasis is placed on qualitative study of differential equations via analytic methods or numerical techniques using standard mathematical software packages. A good understanding of theory of vector spaces, and linear transformations is assumed. Prerequisite; Math32 and 60.

MATH 211CM Differential Equations

An introduction to the general theory and applications of differential equations. Linear systems, nonlinear systems, and stability.

MATH 231HM/CM Mathematical Analysis I

Countable sets, least upper bounds, and metric space topology including compactness, completeness, connectivity, and uniform convergence. Related topics as time permits.

MATH 232HM/CM Mathematical Analysis II

A rigorous study of Calculus in Euclidean Spaces, including multiple Riemann Integrals, derivatives of transformations and the inverse function theorem.

MATH 264HM Scientific Computing

Scientific Computing. (Same as Computer Science 144.) Computational techniques applied to problems in the sciences and engineering. Modeling of physical problems, computer implementation, analysis of results; use of mathematical software; numerical methods chosen from: solutions of linear and nonlinear algebraic equations, solutions of ordinary and partial differential equations, finite elements, linear programming, optimization algorithms, and fast-Fourier transforms. (Second semester.)

MATH 265HM Numerical Analysis

An introduction to the theory and methods for numerical solution of mathematical problems. Core topics include: analysis of error and efficiency of methods; solutions of linear systems by Gaussian elimination and iterative methods; calculation of eigenvalue and eigenvectors; interpolation and approximation; numerical integration; solution of ordinary differential equations.

MATH 281PO Dynamical Systems

This course will consider both discrete and continuous dynamics. In any given year it will include most of the following topics: Linear and

nonlinear systems; Bifurcation theory, routes to chaos, symbolic dynamics, Sharkovii's theorem and chaos. Existence and uniqueness theory and dependence on data; Hartman-Grobman and Poincaré-Bendixson theorems, Lyapunov stability theory and stable manifold theory.

MATH 282HM Partial Differentiation Equations

Theory and applications of quasi-linear and linear equations of first order, including systems, higher order linear and non-linear equations, including classical methods of solutions of the wave, heat and potential equations, Green's function, similarity solutions, variational techniques, etc.

MATH 283PO Mathematical Modeling

Introduction to the construction and interpretation of deterministic and stochastic models in the biological, social, and physical sciences, including simulation studies. Students are required to develop a model in an area of their interest.

MATH 287HM Operations Research

Linear; integer; nonlinear and dynamic programming; classical optimization problems; network theory.

MATH 333 Differential Equations & Complex Analysis in Applied Mathematics

This will be a survey course encompassing the areas of ordinary differential equations, partial differential equations, and complex analysis. The level will be at that met in a full semester undergraduate class, and the emphasis will be on solution techniques.

MATH 351 Time Series Analysis

Analysis of time series data by means of particular models such as ARIMA. Associated methods of inference and applications. Additional topics may include spectral analysis and state-space models. Prerequisite: A course in probability and at least concurrent enrollment in statistics.

MATH 355 Linear Statistical models

A discussion of linear statistical models in both the full and less-than-full rank cases, the Gauss-Markov theorem, and applications to regression analysis, analysis of variance, and analysis of covariance. Topics in design of experiments and multivariate analysis. Prerequisite: linear algebra and a year course in probability and statistics.

MATH 359 Simulation

This course will introduce the students to the general concepts and tools of simulation analysis using pseudo random numbers generated on a computer. Starting with a background in calculus-based probability theory, the students will learn how to combine the mathematics of probability with the utility of the computer to find approximate solutions to a variety of mathematical problems arising in analysis, probability and statistics, stochastic processes, optimization, and general modeling. In undertaking this study, students will discover that many otherwise intractable problems can often be attacked using simulation techniques that are relatively easy to implement, thus adding to their general problem solving capabilities. Prerequisite: Mastery of Math 251 (Probability) or the equivalent

MATH 361 Numerical Methods for Finance

This course focuses on pricing derivatives and calibrating interest rate models, but some topics of risk management are also covered. Whereas the Mathematical Finance Math 358 course shows the student how to price instruments using closed-form (analytical) formulae, this course focuses on the instruments that can be best analyzed with numerical methods: structured loans, mortgage-backed securities, ...Topics include binomial and trinomial tree (lattice), finite differences, Monte Carlo simulation, and an introduction to copulae.

MATH 364 Introduction to Scientific Computing

This 4 unit module is intended to help students develop a basic competence in scientific computing in a PC/workstation environment, thus preparing them for the mathematics clinic and other work in industrial applied mathematics. Students will be given a high level introduction to computing in MATLAB and compiled high-level languages such as C and FORTRAN. A broad collection of basic numerical techniques will be presented including iterative methods for solving nonlinear equations, approximate integration and differentiation, interpolation, and numerical linear algebra. Additional topics will be covered depending on the interests of the students. By working examples on the computer that illustrate these techniques, students will develop proficiency in the basics of MATLAB and at least one high-level programming language under both Windows and LINUX environments.

MATH 368 Advanced Numerical Analysis

Numerical linear algebra including LU decomposition, Jacobi, Gauss-Seidel and SOR iterations, Krylov subspace methods (Conjugate Gradient, GMRES), QR and SVD factorization of matrices, eigenvalue problems via power, inverse, QR and Arnoldi iterations, error analysis,

forward and backward stability; numerical integration of ODEs including Runge-Kutta and Adams formulas, predictor-corrector methods, stiff equation solvers and shooting method for BVPs; other numerical methods including interpolation via Lagrange and Chebyshev polynomials and cubic splines, integration and quadrature with trapezoidal and Simpson rules, Newton-Cotes formulae, Gaussian quadrature, and singular integrals, root-finding via one-point iteration, bisection, Newton and secant methods, numerical differentiation using finite differences, spectral and pseudo-spectral methods. Prerequisites: advanced calculus and elementary numerical analysis.

MATH 462 Bayesian Inference and machine Learning

This is a one-semester 4-unit course covering selected topics in Bayesian inference and machine learning. In the first half of the course, students will learn about exact Bayesian inference methods as well as approximate, heuristic methods, such as Monte Carlo sampling and variational methods. The second half of the course will focus on machine learning techniques, primarily neural networks and Gaussian processes. The course is expected to be useful for students with a broad array of backgrounds, including Applied Mathematics, Computational Science, Computational Biology, and Financial Engineering.

ECON 254PO Game Theory for Economics

Introduces the main tools of noncooperative game theory as used in current economics literature. Topics include formalities of modeling competitive situations, various solution concepts such as Nash equilibrium and its refinements, signaling games, repeated games under different informational environments, bargaining models, issues of cooperation and reputation. Applications from economics, politics, law, corporate and business strategy. Lecture, discussion, problem sets, exams. Prerequisites: Economics 57 and 102.

ECON 316 Math methods in Microeconomics

A modern mathematical treatment of consumer demand, theory of the firm, markets, welfare optimization, and general equilibrium. Prerequisites: ECON 313.

ECON 383 Econometrics II

Topics in econometrics, including large sample theory, stochastic regressors, measurement error, missing data, limited dependent variables, seemingly unrelated regressions, pooled cross-sectional and time series models, non-normal disturbances. Prerequisite: ECON 382.

ECON 384 Econometrics III

Topics in econometrics, including nonlinear, ARIMA, VAR, distributed lag, and simultaneous equation models. Specification testing, rational expectations, cointegration, ARCH, Markov switching, GMM, and Kalman filtering. Prerequisite: ECON 383.

MGT 327 Financial Statement Analysis

This course focuses on fundamental financial analysis: how to interpret corporate financial data in light of current industry and economic conditions. It addresses earnings quality, financial metrics, pro-forma statements, and earnings management. This course compares the U.S. financial reporting system to other theoretical disclosure systems and non-U.S. financial reporting standards.

MGT 333 Global Financial Management

This course was taught for the first time in summer 1999 and was very well received. It covers a range of global finance issues including foreign exchange policies, international taxation, currency movements, foreign direct investment and the financing of international mergers and acquisitions. The visiting instructor has previously taught finance in the Drucker School and is currently Dean of the School of Management at the University of Haifa, Israel. Prerequisites: MGT 335 Corporate Finance

MGT 340 Strategy

The focus of this course is on how general managers enhance and sustain business performance. The course covers analytical and conceptual tools that are aids to the development of decision. Its fundamental focus, however, is not on tools but on sharpening skills at developing robust judgments in the face of uncertainty and complexity. The central concept of this course is that of strategy. Strategy is enabled and constrained by the underlying economic and political conditions that prevail in an industry or a country, as well as by the resources available to management.

MGT 373 Financial Strategy & Policy

This course will investigate the key financial choices of a corporation and their impact on the overall strategy of the firm. Payout policy (dividends and share repurchases) will be one of the topics covered in this course. We will then study the securities issuance decision of the firm, including initial and secondary public offerings (IPOs and SEOs). Value creation and mergers & acquisitions will be another topic we will investigate. Finally, we will examine corporate governance policies as they pertain to the overall strategy of the firm.

MGT 376 The Global Economy

This course is designed to provide a framework for understanding and managing the impact of changing international economic environments and international competition. In particular, this course has the following objectives: (1) To develop a conceptual framework for business managers that will improve their ability to compete internationally; (2) To examine the sources of international competitive advantage available to firms--competitive advantages from their country bases, their specific capabilities, and their governments' policies; and (3) To provide an understanding of the impacts of changing international economic environments on competitive strategy - emerging trade blocs (the European Union and NAFTA), fluctuations of foreign exchange rates, and the emergence of new markets.

MGT 383 Economics of Strategy

This class uses the business-related tenets of economics (old and new) to generate a modern, consistent, formal framework for strategic decision-making. Using economic intuition we will be able to address issues ranging from outsourcing to new product lines. We will be able to explain why some firms actively compete through price changes while others, in apparently similar competitive industries, do not. Economic theories seem very abstract to many students because these theories usually assume many unrealistic things about people and society. Students must be mindful of the fact that these assumptions are what allow economists to answer many otherwise intractable questions. The results that we attain usually hold even without these simplifying assumptions. This class will show how some of these economic models can provide a powerful, formal framework for answering managerial questions ranging from dealing with competition to setting proper incentives for managers.

MGT 410 Strategic Risk Management in an Emerging Economy

With Mexico City as our venue, we introduce you to the challenges of managing the strategic risks of doing business in an emerging economy. Beginning with an introduction to the economy of Mexico, the course develops a framework for formulating strategies and managing the risks of international business initiatives anywhere in the world. While our approach is financial in nature, the course is non-quantitative and is intended for students who are interested in strategic management and international business.

MGT 475A Fixed Income Investment Management

This course introduces the practical, real world approach to bond investing, with detailed presentations of bonds and a wide range of interest-rate instruments. The class will discuss investment

characteristics of bonds and interest-rate instruments, state of the art technology for valuing them, and portfolio strategies for using them. Specific topics include pricing, measuring yield, price volatility, municipal securities, non-U.S. bonds, performance measurement and evaluation, and interest-rate options evaluation.