Department of Mathematics

2012 - Spring semester

I. GRADUATE COURSE CATALOG

II. GRADUATE COURSE SPRING 2012 - (01/17/2012 - 05/11/2012)

SENIOR UNDERGRADUATE COURSES

Math 4309 - Section# 19367 - Mathematical Biology - by K. Josic
Math 4315 - Section# 13668 - Graph Theory with Applications - by Fajtlowicz
Math 4332 - Section# 13669 - Introduction to Real Analysis - by V. Paulsen
Math 4336 - Section# 24947 - Partial Differential Equations - by M. Perepelitsa
Math 4355 - Section# 20913 - Mathematics of Signal Representation - by D. Labate
Math 4365 - Section# 13670 - Numerical Analysis - by J. He
Math 4377 - Section# 17218 - Advanced Linear Algebra I - by A. Torok
Math 4378 - Section# 13671 - Advanced Linear Algebra II - by J. Qiu
Math 4380 - Section# 13672 - A Mathematical Introduction to Options - by I. Timofeyev
Math 4383 - Section# 19842 - Number Theory - by M. Flagg
Math 4389 - Section# 13673 - Survey of Undergraduate Mathematics - by S. Branton

GRADUATE ONLINE COURSES

Math 5330 - Section# 15892 - Abstract algebra - by K. Kaiser
Math 5332 - Section# 13701 - Differential equations - by G. Etgen
Math 5383 - Section# 13702 - Number Theory - by M. Ru
Math 5386 - Section# 18448 - Regression and Linear Models - by C. Peters
Math 5397 - Section# 20915 - Complex analysis - by S. Ji

GRADUATE COURSES

Math 6303 - Section# 13710 - Modern Algebra - by K. Kaiser
Math 6308 - Section# 16203 - Advanced Linear Algebra I- by A. Torok
Math 6309 - Section# 16204 - Advanced Linear Algebra II - by J. Qiu
Math 6313 - Section# 16202 - Introduction to Real Analysis - by V. Paulsen
Math 6321 - Section# 13728 - Theory of Functions of a Real Variable - by M. Tomforde
Math 6323 - Section# 20917 - Theory of Functions of a Complex Variable - by M. Ru
Math 6327 - Section# 20918 - Partial Differential Equations - by G. Auchmuty
Math 6361 - Section# 16207 - Applicable Analysis - by R. Glowinski
Math 6367 - Section# 13729 - Optimization and Variational Methods - by R. Hoppe
Math 6371 - Section# 13730 - Numerical Analysis - by T. Pan
Math 6374 - Section# 20920 - Numerical Partial Differential Equations - by Y. Kuznetsov
Math 6378 - Section# 13731 - Basic Scientific Computing - by R. Sanders

- Math 6383 - Section# 13732 - Probability Models and Mathematical Statistics - by R. Azencott
- Math 6385 - Section# 13733 - Continuous-Time Models in Finance - by E. Kao
- Math 6395 - Section# 20921 - Operator theory - by D. Blecher
- Math 6397 - Section# 20922 - Stochastic Process - by W. Ott
- Math 6397 - Section# 20923 - Topics in probability, large deviations and extreme value theory - by M. Nicol
- Math 7350 - Section# 13799 - Geometry of Manifolds - by G. Heier
- Math 7397 - Section# 20919 - Analysis of Financial and Energy Time Series - by E. Kao

III. HOW TO REGISTER COURSES

1. Log in to My UH (People Soft)
2. Select "UH Self-Service"
3. Select "Enrollment"
4. Select "Enrollment: add classes" and choose the semester in which you would like to be enrolled.
5. Enter the specific section number for the class.
6. Continue to add more courses if needed and continue to finish the enrollment process.

IV. ARCHIVE OF PREVIOUS COURSES

SENIOR UNDERGRADUATE COURSES

Math 4309 Mathematical Biology (Section# 19367)

Time:	TuTh 10:00AM - 11:30AM - Room: SEC 202
Instructor:	K. Josic
Prerequisites:	Calculus and Linear Algebra
Text(s):	S. Ellner and J. Guckenhemer: Dynamic Models in Biology http://press.princeton.edu/titles/8124.html
Description:	Mathematical modeling is of increasing importance in the biological and medical sciences. This course focuses on various models of biological processes using ordinary differential equations and probabilistic techniques. We will look at models in molecular and cell biology, physiology, neuroscience, ecology and epidemiology. Topics covered include the Hodgkin-Huxley model of electrical activity, Michaelis-Menton theory, continuous and discrete population interactions, biological oscillators, aspects of network theory, and the dynamics of infectious diseases.

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Math 4315 Graph Theory with Applications (Section# 13668)

Time:	MoWeFr 12:00PM - 1:00PM - Room: SEC 203
Instructor:	S. Fajtlowicz
Prerequisites:	Discrete Mathematics
Text(s):	Lecture Note

Description:	Eulerian tours with application to reconstruction of DNA sequences from fragments. Euler characteristic formula. Map coloring problems and 4-color theorem. Trivalent planar graphs with application to fullerenes - new forms of carbon. Hamiltonian tours. Ramsey Theory and Erdos's probabilistic method. Matchings and Marriage Theorem.

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Math 4332 Introduction to Real Analysis (Section# 13669)

Time:	MoWeFr 11:00AM - 12:00PM - Room: PGH 347
Instructor:	V. Paulsen
Prerequisites:	Math 4312
Text(s):	None required. Course notes will be distributed
Description:	This course is a continuation of Math 4331/6312. In the second part of this course we will study convergence of sequences and series of functions, paying special attention to power series and Fourier series, equicontinuity of sets of functions, and approximation of functions by polynomials. The course will then cover topics in multivarible differentiation theory, including the multivariable Newton approximation, inverse function theorem and implicit function theorem.

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Math 4336 Partial Differential Equations (Section# 24947)

Time:	TuTh 10:00AM - 11:30AM - Room: SR 634
Instructor:	M. Perepelitsa
Prerequisites:	Math 4335
Text(s):	Partial Differential Equations, Second Edition, by Walter Strauss, John Wiley & Sons, Inc. Pub.

Description:

This course is a continuation of MATH 4335. The following topics will be covered: PDEs and boundary value problems in multi-dimensions, Green's functions, Fourier Transform, Spectral methods, Nonlinear conservation laws.

Syllabus:

Chapter 7: Green's Identities and Green's Functions

7.1 Green's First Identity
7.2 Green's Second Identity
7.3 Green's Functions
7.4 Half-Space and Sphere

Chapter 9: Waves in Space

9.1 Energy and Causality
9.2 The Wave Equation in Space-Time
9.3 Rays, Singularities, and Sources

Chapter 10: Boundaries in the Plane and in Space

10.1 Fourier's Method, Revisited
10.2 Vibrations of a Drumhead
10.3 Solid Vibrations in a Ball

Chapter 11: General Eigenvalue Problems

11.1 The Eigenvalues Are Minima of the Potential Energy
11.2 Computation of Eigenvalues
11.3 Completeness
11.4 Symmetric Differential Operators
11.5 Completeness and Separation of Variables
11.6 Asymptotics of the Eigenvalues

Chapter 12: Distributions and Transforms
12.1 Distributions
12.2 Green's Functions
12.3 Fourier Transform
12.4 Source functions
12.5 Laplace Transform Techniques

Chapter 14(optional) Nonlinear PDE

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Math 4355 Mathematics of Signal Representation (Section# 20913)

Time: MoWe 4:00PM - 5:30PM - Room: PGH 348

Instructor: D. Labate

Prerequisites: MATH 2431 and one of the following: MATH 3333, MATH 3334, MATH 3330, MATH 3363. MATH 3321 can be used instead of MATH 2431. Students who wish to enroll without having one of the above junior-level courses are encouraged to discuss it with the instructor. While a prior knowledge of Matlab is not required, be aware that Matlab will be used for some homework. The use of the basic Matlab functions is very simple and it will be easy to acquire this basic-level knowledge during the course.

Text(s): A first course in wavelets with Fourier analysis by A. Boggess and F. Narcowich, Wiley, 2nd edition 2009.

This course is a self-contained introduction to a very active and exciting area of applied mathematics which deals the representation of signals and images. It addresses fundamental and challenging questions like: how to efficiently and robustly store or transmit an image or a voice signal? how to remove unwanted noise and artifacts from data? how to identify features of interests in a signal? Students will learn the basic theory of Fourier series and wavelets which are omnipresent in a variety of emerging applications and technologies including image and video compression, electronic surveillance, remote sensing and data transmission. Some specific applications will also be discussed in the course.

Description:

Inner product spaces

Inner product spaces.
The spaces of square integrable functions and square summable series.
Schwarz and triangle inequalities.
Orthogonal projections and the least squares fit.

Fourier series and transform

Computation of Fourier series.
Convergence of Fourier series.
The Fourier transform.
Convolutions.
Linear filters.
The sampling theorem: Analog to digital and digital to analog conversions.
From analog to digital filters.
The Discrete Fourier transform (DFT), FFT, its use for the approximate computation of integral Fourier transforms.

Wavelets

The Haar wavelet.
Multiresolution analysis.
The scaling relation.
Properties of the scaling function.
Decomposition and reconstruction.
Wavelet design in the frequency domain.
The Daubechies wavelet.

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Math 4365 Numerical Analysis (Section# 13670)

Time: TuTh 1:00PM - 2:30PM - Room: PGH 345
Instructor: J. He
Prerequisites: MATH 2331 (formerly 2431), MATH 3331.
Text(s): Numerical Analysis, by R. L. Burden and J. D. Faires, Thomson Brooks/Cole, 8th edition 2005 (ISBN 978-053-439-200-0) or 9th edition 2011 (ISBN: 978-053-873-351-9)

To introduce modern numerical techniques; to explain how, why, and when they can be expected to work; and to provide a foundation for further study of numerical analysis and scientific computing.

Description: Remarks:
This is the second semester of a two-semester course. The focus in this semester will be on interpolation and polynomial approximation, numerical differentiation and integration, numerical solutions to ordinary differential equations, and numerical solutions to partial differential equations.

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Math 4377 Advanced Linear Algebra I (Section# 17218)

Time: TuTh 11:30AM - 1:00PM - Room: SR 116
Instructor: A. Torok
Prerequisites: Math 2331 and minimum 3 hours of 3000 level mathematics.
Text(s): Linear Algebra, 4th edition, by Friedberg, Insel, and Spence, ISBN 0-13-008451-4
The course will cover Chapters 1-4 and the first two sections of Chapter 5.

Description: Topics include systems of linear equations, vector spaces and linear transformations (developed axiomatically), matrices, determinants, eigenvectors and diagonalization.

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Math 4378 Advanced Linear Algebra II (Section# 13671)

Time: TuTh 4:00PM - 5:30PM - Room: F 154
Instructor: J. Qiu
Prerequisites: Math 4377 (or Math 6308)
Text(s): Linear Algebra, 4th edition, by Friedberg, Insel, and Spence, ISBN 0-13-008451-4
Description: The instructor will cover Sections 5-7 of the textbook. Topics will include: Eigenvalues/Eigenvectors, Cayley-Hamilton Theorem, Inner Products and Norms, Adjoints of Linear Operators, Normal and Self-Adjoint Operators, Orthogonal and Unitary Operators, Jordan Canonical Form, Minimal Polynomials, Rational Canonical Form

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Math 4380 A Mathematical Introduction to Options (Section# 13672)

Time: TuTh 4:00PM - 5:30PM - Room: PGH 345
Instructor: I. Timofeyev
Prerequisites: Probability Math 3338
Text(s): "An Introduction to Financial Option Valuation: Mathematics, Stochastics and Computation" by Desmond Higham
Description: This course is an introduction to mathematical modeling of options. The topics covered include: calls and puts, American and European options, expiry, strike price, drift and volatility, non-rigorous introduction to continuous-time stochastic processes including Wiener Process and Ito calculus, the Greeks, geometric Brownian motion, Black-Scholes theory, binomial model, martingales, and self financing strategy.

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Math 4383 Number Theory (Section# 19842)

Time: MoWe 1:00PM - 2:30PM - Room: SEC 203
Instructor: M. Flagg
Prerequisites: Math 3330 (Abstract Algebra) or 3 hours of 3000 level math and consent of instructor
Text(s): Elementary Number Theory, 7th Edition by David M. Burton, McGraw-Hill

Description: This course will cover the standard topics in a one-semester introduction to number theory. These topics include: divisibility, primes and their distribution, congruence, Fermat's Little Theorem, number theoretic functions, Euler's Phi Function and Euler's Theorem, primitive roots, quadratic reciprocity, nonlinear Diophantine equations and other topics as time permits.

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Math 4389 Survey of Undergraduate Mathematics (Section# 13673)

Time: TuTh 2:30PM - 4:00PM - Room: SEC 203
Instructor: S. Branton
Prerequisites:
Text(s):
Description:

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GRADUATE ONLINE COURSES

Math 5330 Abstract algebra (Section# 15892)

Time: Arrange (online course)
Instructor: K. Kaiser
Prerequisites: Acceptance into the MAM program; PB standing
Text(s): Dan Saracino, Abstract Algebra: A First course. The book is complemented by the instructor's notes.
Description: Basic facts on Groups, Rings and Fields. Some Set Theory, Functions and Relations. Students have to submit weekly homework .
Grading: There will be two test and a final (25% +25%+40%), HW: 10%

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Math 5332 Differential equations (Section# 13701)

Time: Arrange (online course)
Instructor: G. Etgen
Prerequisites:
Text(s):
Description: **Remark:**
If you are a MA graduate student wanting to enroll for this course, in case the quota is full or any problem, please contact Dr. Etgen at etgen@math.uh.edu and he will help you.

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Math 5383 Number Theory (Section# 13702)

Time: Arrange (online course)
Instructor: M. Ru
Prerequisites: None
Text(s): Discovering Number Theory, by Jeffrey J. Holt and John W. Jones, W.H. Freeman and Company, New York, 2001, plus some supplementary notes (will be provided by Dr. Ru).

Description: Number theory is a subject that has interested people for thousand of years. This course is a one-semester long graduate course on number theory. Topics to be covered include divisibility and factorization, linear Diophantine equations, congruences, applications of congruences, solving linear congruences, primes of special forms, the Chinese Remainder Theorem, multiplicative orders, the Euler function, primitive roots, quadratic congruences, representation problems and continued fractions.

There are no specific prerequisites beyond basic algebra and some ability in reading and writing mathematical proofs. The method of presentation in this course is quite different. Rather than simply presenting the material, students first work to discover many of the important concepts and theorems themselves. After reading a brief introductory material on a particular subject, students work through electronic materials that contain additional background, exercises, and Research Questions. The research questions are typically more open ended and require students to respond with a conjecture and proof. We the present the theory of the material which the students have worked on, along with the proofs. The homework problems contain both computational problems and questions requiring proofs. It is hoped that students, through this course, not only learn the material, learn how to write the proofs, but also gain valuable insight into some of the realities of mathematical research by developing the subject matter on their own.

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Math 5386 Regression and Linear Models (Section# 18448)

Time: Arrange (online course)
Instructor: C. Peters
Prerequisites: Math 5385 or equivalent
Text(s): "Introduction to Linear Regression Analysis" by Montgomery, Peck and Vining, 4th Edition, Wiley
Description:

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Math 5397 Complex analysis (Section# 20915)

Time: Arrange (online course)
Instructor: S. Ji
Prerequisites: Math 5333 or 3333, or consent of instructor.
Text(s): Instructor's lecture notes.

Description: This course is an introduction to complex analysis. It will cover the theory of holomorphic functions, Cauchy theorem and Cauchy integral formula, residue theorem, harmonic and subharmonic functions, and other topics.

On-line course is taught through Blackboard Vista, visit http://www.uh.edu/webct/ for information on obtaining ID and password.

The course will be based on my notes.

In each week, some lecture notes will be posted in Blackboard Vista, including homework assignment.

Homework will be turned in by the required date through Blackboard Vista. It must be in pdf file.

Homework and test problems are mostly computational in nature

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GRADUATE COURSES

Math 6303 Modern Algebra (Section# 13710)

Time:	TuTh 11:30AM - 1:00PM - Room: PGH 348
Instructor:	K Kaiser
Prerequisites:	Math 6302 or consent of instructor.
Text(s):	Thomas W. Hungerford, Algebra, and my own posted notes.
Description:	The Structure of modules over Principal Ideal Domains with applications to Linear Algebra and finitely generated Abelian groups, Sylow theory, free algebras and sums of algebras, ultraproducts. There will be regular home assignments and a Final. Grading will be based on homework and classroom presentations, 40%, and the written final, 60%.

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Math 6308 Advanced Linear Algebra I (Section# 16203)

Time:	TuTh 11:30AM - 1:00PM - Room: SR 116
Instructor:	A. Torok
Prerequisites:	Math 2331 and minimum 3 hours of 3000 level mathematics.
Text(s):	Linear Algebra, 4th edition, by Friedberg, Insel, and Spence, ISBN 0-13-008451-4
Description:	The course will cover Chapters 1-4 and the first two sections of Chapter 5. Topics include systems of linear equations, vector spaces and linear transformations (developed axiomatically), matrices, determinants, eigenvectors and diagonalization
Remark:	There is a limitation for counting graduate credits for Math 6308, 6309, 6312, or 6313. For detailed information, see Masters Degree Options.

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Math 6309 Advanced Linear Algebra II (Section# 16204)

Time:	TuTh 4:00PM - 5:30PM - Room: F 154
Instructor:	J. Qiu
Prerequisites:	Math 4377 (or Math 6308)
Text(s):	Linear Algebra, 4th edition, by Friedberg, Insel, and Spence, ISBN 0-13-008451-4
Description:	The instructor will cover Sections 5-7 of the textbook. Topics will include: Eigenvalues/Eigenvectors, Cayley-Hamilton Theorem, Inner Products and Norms, Adjoints of Linear Operators, Normal and Self-Adjoint Operators, Orthogonal and Unitary Operators, Jordan Canonical Form, Minimal Polynomials, Rational Canonical Form
Remark:	There is a limitation for counting graduate credits for Math 6308, 6309, 6312, or 6313. For detailed information, see Masters Degree Options.

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Math 6313 Introduction to Real Analysis (Section# 16202)

Time:	MoWeFr 11:00AM - 12:00PM - Room: PGH 347
Instructor:	V. Paulsen
Prerequisites:	Math 6312
Text(s):	None required. Course notes will be distributed
Description:	This course is a continuation of Math 4331/6312. In the second part of this course we will study convergence of sequences and series of functions, paying special attention to power series and Fourier series, equicontinuity of sets of functions, and approximation of functions by polynomials. The course will then cover topics in multivarible differentiation theory, including the multivariable Newton approximation, inverse function theorem and implicit function theorem.
Remark:	There is a limitation for counting graduate credits for Math 6308, 6309, 6312, or 6313. For detailed information, see Masters Degree Options.

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Math 6321 Theory of Functions of a Real Variable (Section# 13728)

Time:	MoWeFr 11:00AM - 12:00PM - Room: PGH 345
Instructor:	M. Tomforde
Prerequisites:	Math 6320
Text(s):	"Real Analysis: Modern Techniques and Their Applications" by Gerald Folland
Description:	This is the second semester of a two semester sequence. The course will continue the development of topics Measure Theory, including L^p spaces and their duals. This will lead into a number of concepts in functional analysis.

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Math 6323 Theory of Functions of a Complex Variable (Section# 20917)

Time:	MoWe 1:00PM - 2:30PM - Room: AH 301
Instructor:	M. Ru
Prerequisites:	Math 6322 or Consent of Professor
Text(s):	"Function theory of one complex variable" by Robert Everist Greene, Steven George Krantz, Third Edition
Description:	This is the second semester of a two semester sequence. We'll cover the selected remaining chapters in the textbook and then will introduce some special topics like the theory of meromorphic functions, Schwarz lemma and its geometric generalization, as well as the theory of Riemann surfaces.

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Math 6327 Partial Differential Equations (Section# 20918)

Time:	TuTh 4:00PM - 5:30PM - Room: PGH 348
Instructor:	G. Auchmuty
Prerequisites:	Math 6326
Text(s):	L.C. Evans, Partial Differential equations, AMS Zeidler, Nonlinear Functional Analysis and Applications, Volume IIA, Springer Verlag
Description:	This is a continuation of M6326 and will treat the basic results about the analysis of initial value problems for evolution equations. The first part will treat weak solutions of linear evolution equations. Emphasis will be on the use of Galerkin methods and energy inequalities and their applications to systems of parabolic type. Then methods and results for some nonlinear systems will be studied.

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Math 6361 Applicable Analysis - by R. Glowinski (Section# 16207)

Time:	TuTh 10:00AM - 11:30AM - Room: PGH 348
Instructor:	R. Glowinski
Prerequisites:	Math 6360 will help but not mandatory
Text(s):	References textbook: J.K. Hunter & B. Nachtergaele, Applied Analysis, World Scientific, 2001, provides a solid foundation for the course.
Description:	In this course we will discuss Banach spaces(definition, basic properties, examples, bounded linear maps, convergence of bounded operators, dual spaces, weak convergence), Hilbert Spaces (projection on closed convex sets, the Riesz representation theorem, linear variational problems in Hilbert spaces, the Lax-Milgram theorem, conjugate gradient methods in Hilbert spaces), Fourier Series (Fourier bases, Fourier series, application to partial differential equations, wavelets), Optimization (existence and uniqueness results, optimality conditions, Lagrange multipliers and saddle-points, penalty methods and augmented Lagrangian functionals, discussion of some iterative methods for solving optimization problems). The course will be illustrated by numerous applications.

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Math 6367 Optimization and Variational Methods (Section# 13729)

Time:	MoWeFr 12:00PM - 1:00PM - Room: PGH 347

Instructor:	R. Hoppe
Prerequisites:	Graduate standing or consent of the instructor
Text(s):	D.P. Bertsekas; Dynamic Programming and Optimal Control, Vol. I, 3rd Edition. Athena Scientific, 2005 J.R. Birge and F.V. Louveaux; Introduction to Stochastic Programming. Springer, New York, 1997
Description:	This course gives an introduction to Dynamic Programming (DP) and to Stochastic Programming (SP). As far as DP is concerned, the course focuses on the theory and the application of control problems for linear and nonlinear continuous-time and discrete-time dynamic systems both in a deterministic and in a stochastic framework. Since DP-based control is essentially restricted to Markovian decision processes, we introduce SP as a more general framework to model path independence of the stochastic process within an optimization model. Emphasis will be on stochastic linear programming (SLP), but stochastic mixed integer linear programming (SMILP), and stochastic nonlinear programming (SNP) will be addressed as well. Applications aim at decision problems in economics.

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Math 6371 Numerical Analysis (Section# 13730)

Time:	MoWe 4:00PM - 5:30PM - Room: SR 116
Instructor:	T. Pan
Prerequisites:	Graduate standing or consent of instructor. Students should have had a course in Linear Algebra (for instance Math 4377-4378) and an introductory course in Analysis (for instance Math 4331-4332).
Text(s):	1. J. Stoer and R. Bulirsch: Introduction to Numerical Analysis, Springer-Verlag, New York, 3rd edition. 2. R. L. Burden & J. D. Faires, Numerical Analysis, 8th edition, Thomson, 2005. 3. P.G. Ciarlet: Introduction to numerical linear algebra and optimization, Cambridge University Press, 1995, ISBN 0-521-33948-7.
Description:	We will focus on numerical linear algebra, including direct methods for the solution of linear systems, eigenvalue problems, iterative methods for the solution of large linear systems. We will also discuss numerical solutions of boundary value problems for ordinary differential equations and cover briefly of numerical solutions of three basic partial differential equations.

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Math 6374 Numerical Partial Differential Equations (Section# 20920)

Time:	MoWe 1:00PM - 2:30PM - Room: F 162
Instructor:	Y. Kuznetsov
Prerequisites:	Undergraduate courses on partial differential equations and numerical analysis
Text(s):	none
Description:	Upon completion of the course,students will be able to apply Finite Difference,Finite Volume and Finite Element methods for the numerical solution of elliptic and parabolic partial differential equations. The course consits in three major parts.In the begining of the course, we will discuss the differential and variational formulations of the most typical boundary value problems for the diffusion and convection-diffusion equations.In the second part of the course,a systematic description of finite difference,finite volume and nodal finite element methods will be given.We shall also consider the simplest variants of the mixed finite element method which currently is very popular in many applications.Finally,we will study explicit and implicit dinite difference methods for the time dependent diffusion and convection-diffusion equations.

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Math 6378 Basic Scientific Computing (Section# 13731)

Time:	TuTh 1:00PM - 2:30PM - Room: PGH 348
Instructor:	R. Sanders

Prerequisites:	Elementary Numerical Analysis. Knowledge of C and/or Fortran. Graduate standing or consent of instructor.
Text(s):	Lecture note
Description:	Fundamental techniques in high performance scientific computation. Hardware architecture and floating point performance. Pointers and dynamic memory allocation. Data structures and storage techniques related to numerical algorithms. Parallel programming techniques. Code design. Applications to numerical algorithms for the solution of systems of equations, differential equations and optimization. Data visualization. This course also provides an introduction to computer programming issues and techniques related to large scale numerical computation.

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Math 6383 Probability Models and Mathematical Statistics (Section# 13732)

Time:	TuTh 2:30PM - 4:00PM - Room: AH 301
Instructor:	R. Azencott
Prerequisites:	undergraduate probability + basic knowledge of "Matlab"or "R" or other scientific programming language
Text(s):	Required reading will be extracted from Statistics.(by David Freemann, Robert Pisani, Roger Purves)2007.
Description:	COURSE OBJECTIVES: Upon completion of the course, students will havelearned key results and mathematical principles for the use of parametricmodels in applied statistics. Two applied projects will involve basiccomputer implementations of statistical techniques COURSE CONTENT: descriptive statistics, statistical sampling and estimation, exponentialfamilies and sufficient statistics, maximum likelihood estimators,confidence intervals and hypothesis testing, regression and linear models multiple examples of applied statistics (see textbook) COURSE REQUIREMENTS: A. written homework assignments + computer implementation of basicstatistical techniques B. Exams: There will be a midterm exam and a final exam. EVALUATION AND GRADING: Semester grades will be based on a weightedaverage of homework +projects average, midterm exam grade, and final exam grade. letter grades correspond to the standard scale: 90-100 for an A, 80-89 for a B, etc. Pluses and minuses will be attached if your average is within two points of the dividing line between one letter and another. Forexample, a grade of 88 is a B+; a grade of 81 is a B-.

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Math 6385 Continuous-Time Models in Finance (Section# 13733)

Time:	TuTh 5:30PM - 7:00PM - Room: PGH 345
Instructor:	E. Kao
Prerequisites:	MATH 6382 and MATH 6383
Text(s):	Arbitrage Theory in Continuous Time, 3rd edition, by Tomas Bjork, Oxford University Press, 2009.
Description:	The course is an introduction to continuous-time models in finance. We first cover tools for pricing contingency claims. They include stochastic calculus, Brownian motion, change of measures, and martingale representation theorem. We then apply these ideas in pricing financial derivatives whose underlying assets are equities, foreign exchanges, and fixed income securities. In addition, we will study the single-factor and multi-factor HJM models, and models involving jump diffusion and mean reversion.

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Math 6395 Operator theory (Section# 20921)

Time: MoWeFr 10:00AM - 11:00AM - Room: PGH 348
Instructor: D. Blecher
Prerequisites: Math6342: Topology, Math6320: Real variables and/or Math 6321 would be nice but not required
Text(s): Instructor's lecture note

Recommended books:
J. B. Conway's "A course in Operator Theory", and "A course in Functional Analysis",
Gerd Pedersen's "Analysis Now",
and Arveson's "A short course in spectral theory".

Description: An "operator" is a linear function between normed vector spaces (or between Hilbert spaces), usually continuous. Operator theory is a signicant part of many important areas of modern mathematics and mathematical physics. A subtitle for the course might be `Spectral Theory'. Spectral theory in some sense is the generalization to operators of the theory and applications of eigenvalues of matrices. This course covers the central themes of operator theory. We begin with Hilbert spaces, and the spectral theorem for compact operators. We continue discussing compact operators, Fredholm operators and the Calkin algebra. We then turn to Gelfand's theory of commutative Banach algebras, and use this to develop the functional calculus and spectral theorem for normal operators. We also discuss Hilbert-Schmidt operators, the trace, index theory, and the Schatten classes. Finally we develop the very basics of the theory of C*-algebras and von Neumann algebras. If time permits we will study unbounded operators.

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Math 6397 Stochastic Process (Section# 20922)

Time: TuTh 4:00PM - 5:30PM - Room: SW 102
Instructor: W. Ott
Prerequisites:
Text(s):
Description:

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Math 6397 Topics in Probability, Large Deviations and Extreme Value Theory (Section# 20923)

Time: TuTh 11:30AM - 1:00PM - Room: F 162
Instructor: M. Nicol
Prerequisites:
Text(s):
Reference Texts
Probability: Theory and Examples, Richard Durrett, 3rd edition.
• Large Deviations, Techniques and Applications, Dembo and Zeitouni, 2nd edition
• Extremes and related properties of random sequences and processes, Ledbet-ter et al
Lecture notes will be comprehensive and no texts are required, though Durrett would be a worthwhile purchase.

Extreme value theory plays a central role in applied statistics, and estimates the probability of unusual events such as floods, hurricanes or high animal population levels.

Large deviation results estimate the probability of outliers in the convergence of probability distributions. For example, Often we wish to estimate the probability of outliers in the convergence of a scaled sum of iid random variables Xi to the mean,

$$P(|\frac{1}{n}\sum_{j=0}^{n-1} X_j - \int X_1 dP| > \epsilon)$$

Description: Such estimates are useful in a variety of applications, including statistical mechanics, information theory and engineering. Like the theory of extreme values, large deviations are used to estimate risk. In fact the pioneering work of the statistician Cramer in large deviations theory was motivated by applications to the insurance industry. This course will develop the fundamentals of extreme value and large deviation theory, motivated by applications.

Topics will include:
(1) Characteristic functions and classical limit theorems
(2) Large deviations and applications
(3) Extreme value theory and applications

Assessment: There will be one midterm (worth 30 points), a final exam (50 points) as well as 2 to 4 take-home problem sheets (20 points in total). A random subset of the problems on the take-home problem sheets will be marked.

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Math 7350 Geometry of Manifolds (Section# 13799)

Time: TuTh 4:00PM - 5:30PM - Room: 104AH

Instructor: G. Heier

Prerequisites: A good knowledge of basic topology, abstract linear algebra and advanced multivariable calculus, as surveyed in the Appendix of the textbook.

Text(s): John M. Lee, Introduction to Smooth Manifolds.

Description: This course will cover the geometry part of the syllabus for the Topology/Geometry preliminary examination. The course in topology is not a prerequisite for this course, i.e., it can be taken before or after this course.

Topics to be discussed will include: manifolds, the inverse and implicit function theorems, submanifolds, partitions of unity, tangent bundles, vector fields, the Frobenius theorem, Lie derivatives, vector bundles differential forms, tensors and tensor fields on manifolds, exterior algebra, orientation, integration on manifolds, Stokes' theorem, Lie groups. A few additional topics might also be covered, depending on time and audience interest.

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Math 7397 Analysis of Financial and Energy Time Series (Section# 20919)

Time: TuTh 2:30PM - 4:00PM -Room: SEC 104

Instructor: E. Kao

Prerequisites:

Text(s): Analysis of Financial Time Series, 3rd edition, by Ruey S. Tsay, Wiley, 2010; and Statistical Models and Methods for Financial Markets, by Tzee Leung Lai and Hauipeng Xing, Springer, 2008.

Description:	The course is about time series analysis with special emphases on financial and energy data. The course covers ARCH/GARCH models, nonlinear model, high frequency data analysis, parameter estimation for diffusion and related processes, multiple time series, extreme value analysis, Levy processes, hidden Markov chain models, and Markov chain Monte Carlo methods. Students are expected to use R and Splus to perform data analysis.