Department of Mathematics

Spring 2014

GRADUATE COURSE SPRING 2014 - (01/13/2014 - 05/09/2014)

SENIOR UNDERGRADUATE COURSES

Math 4309 - Section# 17645 - Mathematical Biology - by Z. Kilpatrick
Math 4315 - Section# 12936 - Graph Theory with Applications - by Fajtlowicz
Math 4332 - Section# 12937 - Introduction to Real Analysis - by V. Paulsen
Math 4336 - Section# 19602 - Partial Differential Equations - by R. Glowinski
Math 4355 - Section# 18504 - Mathematics of Signal Representation - by D. Labate
Math 4365 - Section# 21224 - Numerical Analysis - by R. Hoppe
Math 4377 - Section# 16074 - Advanced Linear Algebra I - by K. Kaiser
Math 4378 - Section# 12938 - Advanced Linear Algebra II - by J. Qui
Math 4380 - Section# 12939 - A Mathematical Introduction to Options - by E. Kao
Math 4389 - Section# 12940 - Survey of Undergraduate Mathematics - by S. Branton

GRADUATE ONLINE COURSES

Math 5330 - Section# 14912 - Abstract algebra - by K. Kaiser
Math 5332 - Section# 12968 - Differential equations - by A. Torok
Math 5333 - Section# 20415 - Analysis - by S. Ji
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GRADUATE COURSES

Math 6303 - Section# 12975 - Modern Algebra - by G. Heier
Math 6308 - Section# 15157 - Advanced Linear Algebra I- by K. Kaiser
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Math 6313 - Section# 15156 - Introduction to Real Analysis - by V. Paulsen
Math 6321 - Section# 12993 - Theory of Functions of a Real Variable - by D. Blecher
Math 6323 - Section# 21358 - Theory of Functions of a Complex Variable - by S. Ji
Math 6327 - Section# 21359 - Partial Differential Equations - by Y. Gorb
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Math 6367 - Section# 12994 - Optimization and Variational Methods - by J. He
Math 6371 - Section# 12995 - Numerical Analysis - by M. Olshanski
Math 6376 - Section# 21360 - Numerical Linear Algebra (Y. Kuznetsov)
Math 6378 - Section# 21361 - Basic Scientific Computing (R Sanders)
Math 6383 - Section# 12996 - Probability Models and Mathematical Statistics - by K. Josic
Math 6385 - Section# 12997 - Continuous-Time Models in Finance - by E. Kao
Math 6395 - Section# 21363 - Introduction to C* algebra - by M. Tomforde

Math 6395 - Section# 21362 - Stochastic Process - by I. Timofeyev
Math 6397 - Section# 21364 - Riemannian geometry - by M. Ru
Math 6397 - Section# 21365 - Classical limit laws, large deviations and extremes - by M. Nicol
Math 6397 - Section# 22396 - Automatic Learning and Data Mining - by R. Azencott
Math 7350 - Section# 13062 - Geometry of Manifolds - by V. Climenhaga

SENIOR UNDERGRADUATE COURSES

Math 4309 Mathematical Biology (Section# 17645)

Time:	MoWeFr 10:00AM - 11:00AM - Room: SEC 201
Instructor:	Z. Kilpatrick
Prerequisites:	Linear Algebra (MATH 2331) and Differential Equations (MATH 3321 or MATH 3331)
Text(s):	Mathematical Models in Biology by Leah Edelstein-Keshet (ISBN-13: 978-0898715545)
Description:	This course will introduce a variety of discrete and continuous ordinary and partial differential equation models of biological systems. Mathematical methods taught will be phase plane analysis, bifurcation methods, separation of timescales, and some scientific computing in MATLAB. Biological topics will include population dynamics, epidemiology, gene networks, neuroscience, and biological transport.

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Math 4315 Graph Theory with Applications (Section# 12936)

Time:	MoWeFr 10:00AM - 11:00AM - Room: SEC 205
Instructor:	S. Fajtlowicz
Prerequisites:	Introductory Linear Algebra
Text(s):	Instructor's notes
Description:	Konigsburg Bridges and Eulerian tours with possible applications to reconstruction of DNA sequences. A very simple short new proof of Euler's Characteristic Formula. Planar graphs with application to fullerenes. 4-color problem and a proof of 5-color theorem. Selected graph invariants including chromatic, independence and the matching numbers with applications. Ramsey Theory with application to Foundations of Mathematics. Erdos's probabilistic method, and time permitting the eigenvalues of graphs. The grade for the course will be based on two tests and the optional final.

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Math 4332 Introduction to Real Analysis (Section# 12937)

Time:	MoWeFr 11:00AM - 12:00PM - Room: AH 301
Instructor:	V. Paulsen
Prerequisites:	Math 4331 or consent of instructor.
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 multivariable differentiation theory, including the multivariable Newton approximation, inverse function theorem and implicit function theorem.

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Math 4336 Partial Differential Equations (Section# 19602)

Time:	MoWe 4:00PM - 5:30PM - Room: AH 301
Instructor:	R. Glowinski

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.

Content:

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# 18504)

Time: MoWeFr 10:00AM - 11:00AM - Room: AH 301

Instructor: D. Labate

Prerequisites:	MATH 2331 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 need 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.
Description:	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.

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Math 4365 Numerical Analysis II(Section# 21224)

Time:	MoWe 1:00PM - 2:30PM - Room: SEC 105
Instructor:	R. Hoppe
Prerequisites:	Numerical Analysis I
Text(s):	R.L. Burden and J.D. Faires, Numerical Analysis 9th Edition, Brooks Cole, 2011
Description:	We address Chapter 5 (Ordinary Differential Equations I), Chapter 8 (Approximation Theory), Chapter 9 (Eigen-values), Chapter 10 (Nonlinear Systems), Chapter 11 (Ordinary Differential Equations II), and Chapter 12 (Partial Differential Equations)

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Math 4377 Advanced Linear Algebra I (Section# 16074)

Time:	TuTh 11:30AM - 1:00PM - Room: CBB 108
Instructor:	K. Kaiser
Prerequisites:	Math 2331 and minimum 3 hours of 3000 level mathematics
Text(s):	Linear Algebra, fourth Edition, by S.H. Friedberg, A.J Insel, L.E. Spence, Prentice Hall, ISBN 0-13-008451-4
Description:	Chapter 1, Chapter 2, Chapter 3, , Chapter 4 (4.1-4.4), Chapter 5 (5.1—5.2). Course Description: The general theory of Vector Spaces and Linear Transformations will be developed in an axiomatic fashion. Determinants will be covered to the extent to study eigenvalues, eigenvectors and diagonalization. There will be three tests and a Final. Homework will be assigned regularly and discussed in class. Grading: Tests worth 60% , Final, worth 40%

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Math 4378 Advanced Linear Algebra II (Section# 12938)

Time:	TuTh 11:30AM - 1:00PM - Room: F 154
Instructor:	J. Qiu
Prerequisites:	Advanced Linear Algebra I

Text(s):	Linear Algebra and Its Applications" by Peter Lax
Description:	The instructor will cover Sections 5-7 of the textbook. Topics will include: Inner Products and Norms, Gram?Schmidt Procedure, Unitary and Orthogonal Matrices, Range-Null space Decomposition, Orthogonal Decomposition, Singular Value Decomposition, Eigenvalues-Eigenvectors, Cayley-Hamilton Theorem, Adjoints of Linear Operators, Normal and Self-Adjoint Operators, Normal and Self-Adjoint Operators, Orthogonal and Unitary Operators, Jordan Canonical Form, Minimal Polynomials.

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Math 4380 A Mathematical Introduction to Options (Section# 12939)

Time:	TuTh 10:00AM - 11:30AM - Room: AH 301
Instructor:	E. Kao
Prerequisites:	Math 3338 (Probability) and Math 2433 (Calculus III)
Text(s):	(1) Investment Science, 2nd Edition, by David G. Luenberger, Oxford University Press, 2014. (2) Options, Futures, and Other Derivatives, 8th Edition, by John Hull, Prentice Hall. 2012.
Description:	This course is an introduction to financial economics and derivatives. We survey fundamental ideas underlying the financial mathematics and the roles played by options, futures, and forwards in risk management. We introduce the notions of geometric Brownian motion, jump diffusion processes, risk-neutral valuation principle, Arrow-Debreu securities, binomial models, stochastic volatility, and martingales. Some uses of computer are expected to enhance learning. We hope that students plan to take the Actuarial Exams would benefit from the materials covered in this course.

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Math 4389 Survey of Undergraduate Mathematics (Section# 12940)

Time:	
Instructor:	S. Branton
Prerequisites:	Math 3331, 3330, 3333 and 3 hours of 4000 level mathematics, or consent of instructor.
Text(s):	None, Instructor will provide course materials
Description:	A sequence of two to three week modules reviewing some of the most important concepts in undergraduate mathematics. Topics will be discussed from Calculus, Linear Algebra, Differential Equations, Abstract Algebra, Analysis and Probability.

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GRADUATE ONLINE COURSES

Math 5330 Abstract algebra (Section# 14912)

Time:	Arrange (online course)
Instructor:	K. Kaiser
Prerequisites:	
Text(s):	
Description:	

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Math 5332 Differential equations (Section# 12968)

Time:	Arrange (online course)
Instructor:	A. Torok
Prerequisites:	MATH 5331 and consent of instructor.

Text(s):

Description: Linear and nonlinear systems of ordinary differential equations; existence, uniqueness and stability of solutions; initial value problems; higher dimensional systems; Laplace transforms. Theory and applications illustrated by computer assignments and by projects. This course will apply toward the Master of Arts in Mathematics degree; it will not apply toward the Master of Science in Mathematics or the Master of Science in Applied Mathematics degrees.

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. Torok.

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Math 5333 Analysis (Section# 20415)

Time: Arrange (online course)

Instructor: S. Ji

Prerequisites: graduate standing

Text(s): Analysis, by Steven R. Lay, 5th edition, Prentice Hall

Description:

This course is an introduction to Analysis. It will cover limit, continuity, differentiation and integration for functions of one variable and functions of several variables, and some selected applications. More precisely, it will cover the textbook from the chapter 3 to the chapter 7 (skip the section 15 and the section 24).

On-line course is taught through Blackboard Learn, visit https://accessuh.uh.edu/login.php for information on obtaining ID and password.

Homework: Homework will be submitted through Blackboard Learn by pdf file. The deadline for each homework assignment can be found in Blackboard Learn. No late homework assignments accepted.

Exams: There are two exams. The mid-term exam, and the comprehensive final exam. The dates are to be dertermined

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Math 5386 Regression and Linear Models (Section# 17014)

Time: Arrange (online course)

Instructor: C. Peters

Prerequisites:

Text(s):

Description:

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Math 5397 Complex analysis (Section# 21357)

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 Learn, 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 Learn, including homework assignment. Homework will be turned in by the required date through Blackboard Learn. It must be in pdf file. There are two exams. Homework and test problems are mostly computational in nature.

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GRADUATE COURSES

Math 6303 Modern Algebra (Section# 12975)

Time:	TuTh 2:30PM - 4:00PM - Room: SEC 105
Instructor:	G. Heier
Prerequisites:	Math 6302 or consent of instructor.
Text(s):	"Abstract Algebra" by David Dummit and Richard Foote, 3rd Edition
Description:	The instructor plans to cover topics from: field theory, commutative ring theory, algebraic geometry, and homological algebra.

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Math 6308 Advanced Linear Algebra I (Section# 15157)

Time:	TuTh 11:30AM - 1:00PM - Room: CBB 108
Instructor:	K. Kaiser
Prerequisites:	
Text(s):	
Description:	
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# 15158)

Time:	TuTh 11:30AM - 1:00PM - Room: F 154
Instructor:	J. Qui
Prerequisites:	Advanced Linear Algebra I
Text(s):	Matrix Analysis and Applied Linear Algebra, by Carl D. Meyer, see the link: http://www.matrixanalysis.com.

Description:	The instructor will cover Sections 5-7 of the textbook. Topics will include: Inner Products and Norms, Gram?Schmidt Procedure, Unitary and Orthogonal Matrices, Range-Null space Decomposition, Orthogonal Decomposition, Singular Value Decomposition, Eigenvalues-Eigenvectors, Cayley-Hamilton Theorem, Adjoints of Linear Operators, Normal and Self-Adjoint Operators, Normal and Self-Adjoint Operators, Orthogonal and Unitary Operators, Jordan Canonical Form, Minimal Polynomials.
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# 15156)

Time:	MoWeFr 11:00AM - 12:00PM - Room: AH 301
Instructor:	V. Paulsen
Prerequisites:	Math 4331/Math6312 or approval of instructor
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 multivariable 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# 12993)

Time:	MoWeFr 11:00AM - 12:00PM - Room: AH 15
Instructor:	D. Blecher
Prerequisites:	Math 6320
Text(s):	"Lebesgue integration on Euclidean spaces," by Frank Jones & Bartlett. Other recommended background texts by Cohn, Folland, Rudin, Royden
Description:	This semester we will be continuing to develop the basic principles of measure, integration, and real analysis. This body of knowledge is essential to many parts of mathematics (in particular to analysis and probability). We will cover the following topics: Banach and Hilbert spaces. Applications to Fourier series. Signed and complex measures. The Radon-Nikodym theorem. The duality of L^p spaces. Differentiation and integration of measures and functions on R^n. Fundamental theorem of calculus. Basic connections with probability theory (distributions, density, independence). The Riesz representation theorem. Convolutions. The Fourier transform. Suggested topics by students. After each chapter we will schedule a problem solving workshop, based on the homework assigned for that chapter.

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Math 6323 Theory of Functions of a Complex Variable (Section# 21358)

Time:	MoWeFr 9:00AM - 10:00AM - Room: AH 15
Instructor:	S. Ji
Prerequisites:	Math 6322 or consent of instructor.
Text(s):	No textbook required. Lecture notes provided.

Description: This course is an introduction to complex analysis. This two semester course will cover the theory of holomorphic functions, residue theorem, harmonic and subharmonic functions, Schwarz's lemma, Riemann mapping theorem, Casorati-Weterstrass theorem, infinite product, Weierstrass' (factorization) theorem, little and big Picard Theorems and compact Riemann surfaces theory.

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Math 6327 Partial Differential Equations (Section# 21359)

Time: TuTh 10:00AM - 11:30AM - Room: C 108

Instructor: Y. Gorb

Prerequisites: MATH 6326 or consent of the instructor.

Text(s): L.C. Evans, Partial Differential Equations, AMS, 2010.

Description: This course treats topics related to the theory of partial differential equations (PDEs). It is a continuation of MATH 6326 that mostly focuses on study of the theory for linear PDEs, such as the second order elliptic equations, linear evolution equations among others. Questions to be discussed for each topic include but are not limited to the weak formulation, existense of the solution, regularity, basic properties, etc.

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Math 6361 Applicable Analysis (Section# 15160)

Time: TuTh 4:00PM - 5:30PM - Room: AH 16

Instructor: G. Auchmuty

Prerequisites: Real Analysis (M 4331-2) or equivalent.
Advanced Linear Algebra.

Text(s): The instructor has written lecture notes for this course that will be available to students in the class. He may not follow the lecture notes closely, but the course will cover most of the topics in the notes.

References: Good texts that cover most of the material include
L.D. Berkowitz, "Convexity and Optimization in R^n", John Wiley, (2002).
D.G. Luenberger, "Linear and Nonlinear Programming", 2nd edition, Addi-son Wesley (1984).

Description: This course is independent of Math 6360. The course will cover a range of theoretical topics in finite dimensionaloptimization, quadratic and convex programming. It is not a numerical analysis course and will not involve computer programming. Topics include one dimensional optimization, theory of convex sets and norms on R^n. Definitions and criteria for local minimizers and extremality conditions. Criteria for optimization on convex sets and theory of Lagrange and KKT multipliers. Energy and least squares methods for quadratic optimiz ation and solving linear equations. Various examples will be studied in detail.

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Math 6367 Optimization and Variational Methods (Section# 12994)

Time: TuTh 11:30AM - 1:00PM - Room: CBB 214

Instructor: J. He

Prerequisites: Graduate standing or consent of the instructor.

Students are expected to have a good grounding in advanced calculus, introductory probability theory, and matrix-vector algebra. Having prior knowledge on dynamic systems theory, control, optimization, or operations research is useful but not mandatory.

Text(s): Dimitri P. Bertsekas, Dynamic Programming and Optimal Control, Vol. I, 3rd Edition, 2005, Athena Scientific, ISBNs: 1-886529-26-4.

Description: This is an introduction to the modern control theory of dynamic systems, focusing on typical and characteristic results. Linear and nonlinear continuous-time and discrete-time systems are dealt with for finite state space sets, in either a deterministic or a stochastic framework. Continuous-time stochastic control problems, encountered in modern control theory, and discrete-time Markovian decision problems, typical in operations research, are both treated. Simulation-based approximation techniques for dynamic programming are discussed.

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Math 6371 Numerical Analysis (Section# 12995)

Time: TuTh 5:30PM - 7:00PM - Room: AH 203

Instructor: M. Olshanski

Prerequisites: Calculus, Linear Algebra, some knowledge of ODEs and PDEs

Text(s): A. Quarteroni, R. Sacco, F. Saleri, Numerical Mathematics, 2nd edition, Texts in Applied Mathematics, V.37, Springer, 2010.

Description: This is the second semester of a two semester course. The focus in this semester is on approximation theory, numerical integration and differentiation, and numerical analysis of both ordinary and partial differential equations.
The course addresses polynomial and trigonometric interpolation, discrete Fourier and wavelet transforms and there applications, one-dimensional and multi-dimensional quadrature rules. The concepts of consistency, convergence, stability for the numerical solution of differential equation will be discussed. Other topics covered include multistep and Runge-Kutta methods for ODEs; finite difference and finite elements techniques for partial differential equations; and several algorithms to solve large, sparse algebraic systems.

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Math 6376 Numerical Linear Algebra (Section# 21360)

Time: MoWe 1:00PM - 2:30PM - Room: CBB 124

Instructor: Y. Kuznetsov

Prerequisites: Senior Undergraduate Courses on Advanced Linear Algebra and Numerical Analysis are strongly recommended

Text(s): G.H. Golub and C.F. Van Loan, Matrix Computations

Description: In this course, we consider basic numerical methods for numerical solution of linear algebraic systems and eigenvalue problems with symmetric and non-symmetric matrices. The list of methods includes LU and QR factorization algorithms, relaxation, conjugate gradient, and GMRES methods for solving algebraic systems, as well as QR algorithm and Lanczos method for solving eigenvalue problems. We will also consider numerical methods for the least squares and constrained minimization problems which result in algebraic systems with saddle-point matrices. The methods and algorithms will be illustrated by examples from real life practical applications.

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Math 6378 Basic Scientific Computing (Section# 21361)

Time: MoWe 4:00PM - 5:30PM - Room: SEC 202

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# 12996)

Time: TuTh 8:30AM - 10:00AM - Room: AH 16
Instructor: K. Josic
Prerequisites: Undergraduate course in probability and an undergraduate course in statistics (requiring calculus).
Text(s): Mathematical Statistics and Data Analysis with CD Data Sets 3rd Edition Paperback, by John A. Rice, the third edition, Duxbury Press.
Description: In this course students will have learn the key results and mathematical principles for the use of parametric models in applied statistics. Applied project will involve basic implementations of statistical techniques using R.

We will cover descriptive statistics, statistical sampling and estimation, exponential families and sufficient statistics, maximum likelihood estimators, confidence intervals and hypothesis testing, regression and linear models. All concepts will be illustrated using concrete examples.

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Math 6385 Continuous-Time Models in Finance (Section# 12997)

Time: TuTh 4:00PM - 5:30PM - Room: AH 204
Instructor: E. Kao
Prerequisites: graduate standing
Text(s): (1) Arbitrage Theory in Continuous Time, 3rd edition, by Tomas Bjork, Oxford University Press, 2009.
(2) Option Pricing and Portfolio Optimization: Modern Methods of Financial mathematics, Ralf Korn and Elke Korn, Graduate Studies in Mathematics, Volume 31, American Mathematical Society, 2000, providence, Rhode Island.
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 Introduction to C* algebra (Section# 21363)

Time: MoWeFr 12:00PM - 1:00PM - Room: AH 302
Instructor: M. Tomforde
Prerequisites: Math 6342: Point-Set Topology and Math 6302: Modern Algebra I; or consent of instructor.
Text(s): None. Notes will be provided.
Description: An introduction to the modern theory of C*-algebras and its methods.
The particular topics covered will depend on who signs up for the course.

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Math 6395 Stochastic Process (Section# 21362)

Time: TuTh 2:30PM - 4:00PM - Room: AH 301
Instructor: I. Timofeyev
Prerequisites:
Text(s): Required textbook: none

Suggested:
Gardinar, Handbook of stochastic methods
Liggett, Interacting Particle Systems
Pavliotis & Stuart, Multiscale Methods: Averaging and Homogenization

Description:

This course will cover a wide range of topics in stochastic processes and applied probability. Main emphasis will be on applied topics in continuous-time stochastic processes and stochastic differential equations (SDEs).

The following topics will be covered - continuous time Markov chains, averaging of fast sub-system in Markov chains, estimation of transition probability matrix from data, application of Markov chains to particle systems and cellular automata, multiscale SDEs, avergaing and homogenization for multiscale SDEs.

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Math 6397 Riemannian geometry (Section# 21364)

Time:	MoWe 1:00PM - 2:30PM - Room: SEC 201
Instructor:	M. Ru
Prerequisites:	Riemannian geometry I
Text(s):	Riemannian geometry by S. Gallot, D. Hulin and J. Lafontaine, Springer, 2004. and lecture note
Description:	This is the second part of the year-long course. I'll cover the remaining chapters of the textbook.

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Math 6397 Classical limit laws, large deviations and extremes (Section# 21365)

Time:	TuTh 11:30AM - 1:00PM - Room: SEC 203
Instructor:	M. Nicol
Prerequisites:	

Text(s):

Lecture notes will be comprehensive and no texts are required, though Billingley's or Durrett's book would be a worthwhile purchase.

Reference Texts:

- Probability: Theory and Examples, Richard Durrett, Any edition will do.
  The most recent edition is the 4th edition but 2nd or 3rd would also be fine.
- Large Deviations, Techniques and Applications, A. Dembo and O. Zeitouni, 2nd edition
- Extremes and related properties of random sequences and processes, M. R. Leadbetter, G. Lindgren and H. Rootzen, 1983 (Springer-Verlag)
- Probability and Measure, P. Billingsley, 3rd edition

Description:	This is a graduate course topics of current research in probability. It will assume a background in graduate level real analysis. First we will review classical limit theorems such as: the central limit theorem, stable laws, law of the iterated logarithm and ergodic theorems. Then we will consider extreme value theory and large deviations. Extreme value theory plays a central role in applied statistics, and estimates the probability of unusual events such as oods, hurricanes or high animal population levels. It is concerned with the behavior of the sequence of successive maxima of a time series. Large deviation results estimate the probability of outliers in the convergence of probability distributions. 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

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Math 6397 Automatic Learning and Data Mining (Section# 22396)

Time:	TuTh 2:30PM - 4:00PM - Room: F 154
Instructor:	R. Azencott
Prerequisites:	Previous familiarity with random variables and standard probability distributions at the undergraduate level will be assumed
Text(s):	selected chapters in - The Elements of Statistical Learning, Data Mining : Freedman, Hastie, Tibshirani - Kernel Methods in Computational Biology : B. Schölkopf, K. Tsuda, J.-P. Vert - Introduction to Support Vector Machines: N. Cristianini and J. Shawe-Taylor
Description:	Automatic Learning of unknown functional relationships Y = f(X) between an output Y and high-dimensional inputs X , involves algorithms dedicated to the intensive analysis of large finite "training sets" of "examples" of inputs/outputs pairs (X,Y) to discover efficient approximations of the function f. Automatic learning was first applied to emulate intelligent tasks involving identification of complex patterns such as shapes, sounds and speech, handwriting, texts, etc. and has then been widely extended to the analysis of classification / proteomics and genes interactions data, as well as to smart mining of massive data sets gathered on the Internet. The course will study major machine learning algorithms such as Support Vector Machines, Decision Trees, Random Forests , Artificial Neural Nets, etc. with emphasis on key conceptual features of automatic learning such as generalisation capacity and functional approximation. We will present selected applications to proteomics and to automated pattern classification . Homework and exams : Students familiar with Mathlab or equivalent scientific softwares will have the possibility to replace a large part of the homework assignments and of the exams by applied projects involving computer simulations and algorithms implementation .

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Math 7350 Geometry of Manifolds (Section# 13062)

Time:	MWF 10:00AM-11:00 AM - Room: SEC 206
Instructor:	V. Climenhaga
Prerequisites:	Math 6342 or consent of the instructor.
Text(s):	Introduction to Smooth Manifolds, by John M. Lee
Description:	This is the second part of the two-semester topology/geometry sequence. We will study smooth manifolds and maps, tangent and cotangent vectors, and vector fields and bundles. Further topics may include embeddings, Lie groups and algebras, tensors, differential forms, integration on manifolds, de Rham cohomology, flows, and distributions and foliations.