Department of Mathematics

Fall 2015

GRADUATE COURSE FALL 2015 - (08/24/2015 - 12/17/2015)

SENIOR UNDERGRADUATE COURSES

Course	Section	Course Title	Course Day & Time	Rm #	Instructor
Math 4310	20582	Biostatistics	MWF 11:00AM - 12:00PM	AH 301	C. Peters
Math 4320	14904	Intro to Stochastic Processes	MW 1:00PM - 2:30PM	SEC 202	I. Timofeyev
Math 4331	20583	Introduction to Real Analysis	TuTh 2:30PM - 4:00PM	CBB 108	B. Bodmann
Math 4364	25240	Introduction to Numerical Analysis in Scientific Computing	MW 4:00PM - 5:30PM	AH 16	T-W Pan
Math 4377	20585	Advanced Linear Algebra I	TuTh 11:30AM-1:00PM	F 154	D. Wagner
Math 4377	20586	Advanced Linear Algebra I	MWF 12:00PM - 1:00PM	F 154	Z. Kilpatrick
Math 4383	23829	Number Theory	TuTh 10:00AM - 11:30AM	CBB 108	M. Ru
Math 4388	17908	History of Mathematics	Online course	Online	S. Ji
Math 4389	16542	Survey of Undergraduate Mathematics	MWF 11:00AM - 12:00AM	SEC 105	M. Almus

GRADUATE ONLINE COURSES

Course	Section	Course Title	Course Day & Time	Instructor
Math 5331	17034	Linear Algebra with Applications	Arrange (online course)	K. Kaiser
Math 5333	18515	Analysis	Arrange (online course)	G. Etgen
Math 5347	23832	Technology in Math Instruction	Arrange (online course)	A. Torok
Math 5385	15842	Statistics	Arrange (online course)	C. Peters
Math 5397	23835	Mathematical Models: Math of Sports & Gambling	Arrange (online course)	J. Morgan

GRADUATE COURSES

Course	Section	Course Title	Course Day & Time	Rm #	Instructor
Math 6302	14918	Modern Algebra I	MW 1:00PM - 2:30PM	C 110	G. Heier
Math 6308	20587	Advanced linear algebra I	TuTh 11:30AM - 1:00PM	F 154	D. Wagner
Math 6308	20588	Advanced linear algebra I	MWF 12:00PM - 1:00PM	CBB 106	P. Kilpatrick
Math 6312	20584	Introduction to Real Analysis	TuTh 2:30PM - 4:00PM	CBB 108	B. Bodmann
Math 6320	14950	Func Real Variable	MWF 10:00AM-11:00AM	C 113	V. Climenhaga
Math 6322	23846	Functions of a Complex Variable	MWF 11:00AM - 12:00PM	AH 304	S. Ji
Math 6326	23847	Partial Differential Equations	TuTh 4:00PM - 5:30PM	SEC 105	M. Perepelitsa
Math 6342	14951	Topology	MWF 12:00PM - 1:00PM	CBB 214	M. Tomforde
Math 6360	15819	Applicable Analysis	MW 4:00PM - 5:30PM	C 102	D. Onofrei
Math 6366	14952	Optimization Theory	TuTh 11:30AM - 1:00PM	SEC 206	J. He
Math 6370	14953	Numerical Analysis	TuTh 4:00PM - 5:30PM	AH 301	M. Olshanskii
Math 6374	23855	Numerical PDE	TuTh 10:00AM - 11:30AM	C 114	M. Olshanskii

Math 6382	14954	Probability and Statistics	TuTh 8:30AM - 10:00AM	AH 304	R. Azencott
Math 6384	14955	Discrete Time Model in Finance	TuTh 2:30PM - 4:00PM	AH 302	E. Kao
Math 6395	23861	Homogenization theory and its applications	TuTh 1:00PM - 2:30PM	SW 219	Y. Gorb
Math 6395	23864	Stochastic Differential Equation	TuTh 2:30PM - 4:00PM	AH 205	A. Torok
Math 6397	23867	Convexity & Choquet Theory	MWF 12:00PM - 1:00PM	CBB 124	D. Blecher
Math 6397	23870	Complex Hyperbolic Manifolds	TuTh 11:30AM - 1:00PM	C 114	M. Ru
Math 6397	23874	Time Series Analysis	TuTh 10:00AM - 11:30AM	MH 128	E. Kao
Math 6397	27128	Design of Experiments	MW 1:00PM - 2:30PM	CV N106	W. Fu
Math 6397	27129	Statistcal Computing	MW 4:00PM - 5:30PM	CV N115	W. Fu

---Course Details---

SENIOR UNDERGRADUATE COURSES

Math 4310 - Biostatistics

Prerequisites:	MATH 3339 and BIOL 3306 or consent of instructor.
Text(s):	Biostatistics: A Methodology for the Health Sciences | Edition: 2, Gerald van Belle, Lloyd D. Fisher, Patrick J. Heagerty, 9780471031857
Description:	Statistics for biological and biomedical data, exploratory methods, generalized linear models, analysis of variance, cross-sectional studies, and nonparametric methods. Students may not receive credit for both MATH 4310 and BIOL 4310.

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Math 4320 - Intro to Stochastic Processes

Prerequisites:	Math 3338
Text(s):	An Introduction to Stochastic Modeling" by Mark Pinsky, Samuel Karlin. Academic Press, Fourth Edition. ISBN-10: 9780123814166 ISBN-13: 978-0123814166
Description:	We study the theory and applications of stochastic processes. Topics include discrete-time and continuous-time Markov chains, Poisson process, branching process, Brownian motion. Considerable emphasis will be given to applications and examples.

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Math 4331 - Introduction to Real Analysis

Prerequisites:	MATH 3334 or consent of instructor. In depth knowledge of Math 3325 and Math 3333 is required.
Text(s):	K. Davidson and A. P. Donsig, Real Analysis with Real Applications, 9780130416476

Description:	This first course in the sequence Math 4331-4332 provides a solid introduction to deeper properties of the real numbers, continuous functions, differentiability and integration needed for advanced study in mathematics, science and engineering. It is assumed that the student is familiar with the material of Math 3333, including an introduction to the real numbers, basic properties of continuous and differentiable functions on the real line, and an ability to do epsilon-delta proofs. Topics: Open and closed sets, compact and connected sets, convergence of sequences, Cauchy sequences and completeness, properties of continuous functions, fixed points and the contraction mapping principle, differentiation and integration.

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Math 4364 - Introduction to Numerical Analysis in Scientific Computing

Prerequisites:	MATH 2331, In depth knowledge of Math 3331 (Differential Equations) or Math 3321 (Engineering Mathematics) *Ability to do computer assignments in FORTRAN, C, Matlab, Pascal, Mathematica or Maple.
Text(s):	Numerical Analysis (9th edition), by R.L. Burden and J.D. Faires, Brooks-Cole Publishers, 9780538733519
Description:	This is an one semester course which introduces core areas of numerical analysis and scientific computing along with basic themes such as solving nonlinear equations, interpolation and splines fitting, curve fitting, numerical differentiation and integration, initial value problems of ordinary differential equations, direct methods for solving linear systems of equations, and finite-difference approximation to a two-points boundary value problem. This is an introductory course and will be a mix of mathematics and computing.

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Math 4377 - Advanced Linear Algebra I

Prerequisites:	Math 2331 and minimum 3 hours of 3000 level mathematics.
Text(s):	"Matrix Analysis and Applied Linear Algebra" by Carl D. Meyer, published by SIAM, ISBN 978-0-898714-54-8

Description:

This is a two semester sequence. The first semester will cover chapters 1-5 of the text. Topics include:

- Linear Systems of Equations and Gaussian Elimination
- Matrix algebra
- Vector Spaces
- Norms, Inner Products, and Orthogonality

These topics will be covered with more depth and difficulty than in Math 2331.

We will discuss various applications including two-point boundary value problems, Electrical Circuits, Least-Squares approximation, the Discrete Fourier Transform, and the Fast Fourier Transform.

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Math 4377 - Advanced Linear Algebra I

Prerequisites: MATH 2331 and a minimum of three semester hours of 3000-level mathematics.

Text(s): Matrix Analysis and Applied Linear Algebra by Carl D. Meyer, 9780898714548

Description: Linear systems of equations, matrices, determinants, vector spaces and linear transformations, eigenvalues and eigenvectors, spectral theory, matrix inequalities, linear mappings, Perron-Frobenius theory, applications including ranking algorithms and kinematics.

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Math 4383 - Number Theory

Prerequisites: MATH 3330 or consent of instructor.

Text(s): Beginning Number Theory by Neville Robbins, second Edition, 9780763737689

Description: Number theory is a subject that has interested people for thousand of years. This course is a one-semester long 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'll be no specific prerequisites beyond basic algebra and some ability in reading and writing mathematical proofs.

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Math 4388 - History of Mathematics

Prerequisites: Math 3333 Intermediate Analysis, or content of instructor.

Text(s): No textbook is required.

This course is designed to provide a college-level experience in history of mathematics. Students will understand some critical historical mathematics events, such as creation of classical Greek mathematics, and development of calculus; recognize notable mathematicians and the impact of their discoveries, such as Fermat, Descartes, Newton and Leibniz, Euler and Gauss; understand the development of certain mathematical topics, such as Pythagoras theorem, the real number theory and calculus.

Aims of the course: To help students
to understand the history of mathematics;
to attain an orientation in the history and philosophy of mathematics;
to gain an appreciation for our ancestor's effort and great contribution;
to gain an appreciation for the current state of mathematics;
to obtain inspiration for mathematical education,
and to obtain inspiration for further development of mathematics.

Description:

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.

Homework and Essays assignement are posted in Blackboard Learn. There are four submissions for homework and essays and each of them covers 10 lecture notes. The dates of submission will be announced.

All homework and essays, handwriting or typed, should be turned into PDF files and be submitted through Blackboard Learn. Late homework is not acceptable.

There is one final exam in multiple choice.

Grading: 40% homework, 45% projects, 15 % Final exam.

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Math 4389 - Survey of Undergraduate Mathematics

Prerequisites: MATH 3330, MATH 3331, MATH 3333, and three hours of 4000-level Mathematics.

Text(s): Instructor will use her own notes

Description: A review of some of the most important topics in the undergraduate mathematics curriculum.

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ONLINE GRADUATE COURSES

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MATH 5331 - Linear Algebra with Applications

Prerequisites: Graduate standing and consent of instructor.

Text(s): Linear Algebra Using MATLAB, Selected material from the text *Linear Algebra and Differential Equations Using Matlab* by Martin Golubitsky and Michael Dellnitz)
The text will made available to enrolled students free of charge.

Software: Scientific Note Book (SNB) 5.5 (available through MacKichan Software, http://www.mackichan.com/)

Syllabus: Chapter 1 (1.1, 1.3, 1.4), Chapter 2 (2.1-2.5), Chapter 3 (3.1-3.8), Chapter 4 (4.1-4.4), Chapter 5 (5.1-5.2, 5.4-5-6), Chapter 6 (6.1-6.4), Chapter 7 (7.1-7.4), Chapter 8 (8.1)

Project: Applications of linear algebra to demographics. To be completed by the end of the semester as part of the final.

Description:

Course Description: Solving Linear Systems of Equations, Linear Maps and Matrix Algebra, Determinants and Eigenvalues, Vector Spaces, Linear Maps, Orthogonality, Symmetric Matrices, Spectral Theorem

Students will also learn how to use the computer algebra portion of SNB for completing the project.

Homework: Weekly assignments to be emailed as SNB file.

There will be two tests and a Final.

Grading: Tests count for 90% (25+25+40), HW 10%

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MATH 5333 - Analysis

Prerequisites: Graduate standing. Two semesters of calculus or consent of instructor.

Text(s): Analysis with an Introduction to Proof | Edition: 5, Steven R. Lay, 9780321747471

Description: A survey of the concepts of limit, continuity, differentiation and integration for functions of one variable and functions of several variables; selected applications. Applies toward the Master of Arts in Mathematics degree; does not apply towards the Master of Science in Mathematics or the Master of Science in Applied Mathematics degrees.

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MATH 5347 - Technology in Math Instruction

Prerequisites: Graduate standing. Three semesters of calculus or consent of instructor. Acceptance into the MAM program.

Text(s): No textbook is required. Material will be available on the web.
The software that will be discussed include Mathematica, Octave (the free version of Matlab) and Geometer's Sketchpad. Instructions about installing them will be posted in advance: see the course web-page, under Teaching at www.math.uh.edu/~torok.

Description: The purpose of the course is to introduce software that can be used for teaching mathematics. Descriptions and examples will be posted on-line, followed by assignments aimed at classroom applications.

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MATH 5385 - Statistics

Prerequisites: Graduate standing and consent of instructor.

Text(s): instructor will use his own notes/text. This text will be made available to students.

Description: Data collection and types of data, descriptive statistics, probability, estimation, model assessment, regression, analysis of categorical data, analysis of variance. Computing assignments using a prescribed software package (e.g., EXCEL, Minitab) will be given.

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MATH 5397 - Mathematical Models: Math of Sports & Gambling

Prerequisites: Graduate standing. Consent of instructor. The prerequisite for the course is a basic knowledge of sports, fundamental knowledge of functions, and general knowledge of introductory undergraduate statistics.

Text(s): "Mathletics: How Gamblers, Managers and Sports Enthusiasts Use Mathematics in Baseball, Basketball and Football" by Wayne L. Winston, Princeton University Press, ISBN 978-0-691-15458-9
The text is available in Kindle and paperback editions.

Description: This course hopes to give students an overview of how the people running sports and La Vegas sports bookies use simple mathematics, statistics and probability to make decisions.

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GRADUATE COURSES

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MATH 6302 - Modern Algebra I

Prerequisites: Graduate standing. MATH 4333 or MATH 4378, or consent of instructor.

Text(s): Abstract Algebra, David S. Dummit, Richard M. Foote, Richard M. Foote, 9780471433347

Description: Topics from the theory of groups, rings, fields, and modules with special emphasis on universal constructions.

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MATH 6308 - Advanced linear algebra I

Prerequisites: Graduate standing. Math 2331 and minimum 3 hours of 3000 level mathematics

Text(s): "Matrix Analysis and Applied Linear Algebra" by Carl D. Meyer, published by SIAM, ISBN 978-0-898714-54-8

Description:

This is a two semester sequence. The first semester will cover chapters 1-5 of the text. Topics include:

- Linear Systems of Equations and Gaussian Elimination
- Matrix algebra
- Vector Spaces
- Norms, Inner Products, and Orthogonality

These topics will be covered with more depth and difficulty than in Math 2331.

We will discuss various applications including two-point boundary value problems, Electrical Circuits, Least-Squares approximation, the Discrete Fourier Transform, and the Fast Fourier Transform.

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MATH 6308 - Advanced linear algebra I

Prerequisites: Graduate standing. MATH 2331 and at least 3 semester hours of 3000-level math courses.

Text(s): Matrix Analysis and Applied Linear Algebra by Carl D. Meyer, 9780898714548

Description: Linear systems of equations, matrices, determinants, vector spaces and linear transformations, eigenvalues and eigenvectors, spectral theory, matrix inequalities, linear mappings, Perron-Frobenius theory, applications including ranking algorithms and kinematics.

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MATH 6312 - Introduction to Real Analysis

Prerequisites:	Graduate standing. MATH 3334, or consent of instructor. In depth knowledge of Math 3325 and Math 3333 required.
Text(s):	K. Davidson and A. P. Donsig, Real Analysis with Real Applications
Description:	This first course in the sequence Math 4331-4332 provides a solid introduction to deeper properties of the real numbers, continuous functions, differentiability and integration needed for advanced study in mathematics, science and engineering. It is assumed that the student is familiar with the material of Math 3333, including an introduction to the real numbers, basic properties of continuous and differentiable functions on the real line, and an ability to do epsilon-delta proofs. **Topics**: Open and closed sets, compact and connected sets, convergence of sequences, Cauchy sequences and completeness, properties of continuous functions, fixed points and the contraction mapping principle, differentiation and integration.

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MATH 6320 - Func Real Variable

Prerequisites:	Graduate standing. Math 4332 (Introduction to real analysis) or consent of instructor
Text(s):	Primary: "Real Analysis: Modern Techniques and Their Applications" (Gerald Folland, 2nd edition) Supplementary: "Real Analysis for Graduate Students" (Richard F. Bass, 2nd edition)
Description:	Math 6320 introduces students to modern real analysis. The core of the course will cover measures, Lebesgue integration, and L^p spaces. We will study elements of functional analysis, Fourier analysis, ergodic theory, and probability theory.

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MATH 6322 - Functions of a Complex Variable

Prerequisites:	Graduate standing. MATH 4331 or consent of instructor. In depth knowledge of Math 3333 required.
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 6326- Partial Differential Equations

Prerequisites:	Graduate standing. MATH 4331 or consent of instructor
Text(s):	The instructor will provide notes for this class, but the following textbooks are highly recommended: Partial Differential Equations by L. Evans, 9780821849743 Partial Differential Equations by E. DiBenedetto, 9780817645519
Description:	The core of the course will cover the methods from the theory linear partial differential equations such as integral representation of solutions, the methods of Fourier Transform, the Galerkin's approximation, the energy methods and the theory of semigroups of linear operators. Additional topics will include the comprehensive theory of kinetic equations and non-linear conservation laws.

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MATH 6342 - Topology

Prerequisites:	Graduate standing. MATH 4331 and MATH 4337 or consent of instructor.
Text(s):	Topology (2nd Edition) by James Munkres, 9780131816299
Description:	We will cover the basics of point-set topology. Topics include: Topological Spaces and Continuous Functions. Connectedness and Compactness. Countability and Separation Axioms. The Tychonoff Theorem. Metrization Theorems and Paracompactness. Complete Metric Spaces and Function Spaces. Baire Spaces and Dimension Theory.

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MATH 6360 - Applicable Analysis

Prerequisites:	Graduate standing. MATH 4331 or equivalent or consent of instructor.
Text(s):	John Hunter, Bruno Nachtergaele, Applied Analysis, World Scientific Publishing Company, 2005
Description:	This course treats topics related to the solvability of various types of equations, and also of optimization and variational problems. The first half of the semester will concentrate on introductory material about norms, Banach and Hilbert spaces, etc. This will be used to obtain conditions for the solvability of linear equations, including the Fredholm alternative. The main focus will be on the theory for equations that typically arise in applications. In the second half of the course the contraction mapping theorem and its applications will be discussed. Also, topics to be covered may include finite dimensional implicit and inverse function theorems, and existence of solutions of initial value problems for ordinary differential equations and integral equations

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MATH 6366 - Optimization Theory

Prerequisites:	Graduate standing or consent of the instructor. Students are expected to have a good grounding in basic real analysis and linear algebra.
Text(s):	Convex Optimization, Stephen Boyd and Lieven Vandenberghe, Cambridge University Press, 2004 (available on the web at http://www.stanford.edu/~boyd/cvxbook.html)
Description:	The focus is on key topics in optimization that are connected through the themes of convexity, Lagrange multipliers, and duality. The aim is to develop a analytical treatment of finite dimensional constrained optimization, duality, and saddle point theory, using a few of unifying principles that can be easily visualized and readily understood. The course is divided into three parts that deal with convex analysis, optimality conditions and duality, computational techniques. In Part I, the mathematical theory of convex sets and functions is developed, which allows an intuitive, geometrical approach to the subject of duality and saddle point theory. This theory is developed in detail in Part II and in parallel with other convex optimization topics. In Part III, a comprehensive and up-to-date description of the most effective algorithms is given along with convergence analysis.

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MATH 6370 - Numerical Analysis

Prerequisites:	Graduate standing in mathematics, Calculus, Linear Algebra, consent of instructor.
Text(s):	A. Quarteroni, R. Sacco, F. Saleri, Numerical Mathematics, 2nd edition, Texts in Applied Mathematics, V.37, Springer, 2010, 9783642071010

Description:	The course introduces to the methods of scientific computing and their application in analysis, linear algebra, approximation theory, optimization and differential equations. The purpose of the course to provide mathematical foundations of numerical methods, analyse their basic properties (stability, accuracy, computational complexity) and discuss performance of particular algorithms. This first part of the two-semester course spans over the following topics: (i) Principles of Numerical Mathematics (Numerical well-posedness, condition number of a problem, numerical stability, complexity); (ii) Direct methods for solving linear algebraic systems; (iii) Iterative methods for solving linear algebraic systems; (iv) numerical methods for solving eigenvalue problems; (v) non-linear equations and systems, optimization.

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MATH 6374 - Numerical PDE	
Prerequisites:	Graduate standing. MATH 6371 or consent of instructor. Introduction to PDEs, Linear Algebra, also Numerical Analysis is desirable
Text(s):	Partial Differential Equations with Numerical Methods / Edition 1 by Stig Larsson, Vidar Thomee, 9783540017721
Description:	For each type of PDE, elliptic, parabolic, and hyperbolic, the course refreshes necessary mathematical theory of the differential equation, further discusses basic finite difference and finite element methods for important examples of each type of equations. Most part of the course deals with multi-dimensional differential problems.

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MATH 6382 - Probability and Statistics	
Prerequisites:	Graduate standing. MATH 3334, MATH 3338 and MATH 4378, or consent of instructor
Text(s):	**Recommended Texts :** - A First Look at Rigorous Probability Theory by Jeffrey Rosenthal, 2000.. - An Intermediate Course in Probability Theory by Allan Gut, Springer 2009 (any edition) **Review of Undergraduate Probability:** - A First Course in Probability, 6th Edit. by Sheldon Ross, 2002, Prentice Hall **Complementary Texts for further reading:** - Probability: theory and Examples, 3rd Edit., Richard Durrett, Duxbury Press - An Introduction to Probability Theory and Its Applications, Vol 1, by William Feller - Probability by Leo Breiman, 1968, Addison-Wesley

Description:

General Background (A).
(1) Combinatorial analysis and axioms of probability
(2) Elementary random variables theory: expectation, variance, moments, distribution function, probability density functions, impact of change of variable on density functions
(3) Major discrete probability distributions: Bernoulli, Binomial, Poisson, Geometric
Major continuous probability distributions: Uniform, Normal, Exponential
(4) Basic Modelling Applications
(5) Conditional probability: Bayes formula, Independence, Conditional Expectation, Conditional density function, Conditional Probability distribution, Independent identically distributed random variables
(6) Joint distributions, joint density functions, marginal distributions, marginal densities, covariances and correlation coefficients
(7) Moment generating functions, Characteristic functions,

Measure theory (B).
(1) Elementary measure theory : Boolean algebras, probability spaces , continuity of probabilities, Borel-Cantelli lemma, Chebychevs inequality,
(2) Convergence of random variables: Almost sure convergence, Convergence in distribution, Law of Large Numbers, Central Limit theorem

Markov chains and random walks (C).
Markov chain theory for finite or countable state spaces
(1) Markov property and Transition matrix, Irreducibility
(2) First hitting times, Transience, Recurrence ,
(3) Stationary distributions : existence theorems and computation
(4) Random walks on Z and Z2 as Markov chains; Gambler's ruin problem

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MATH 6384 - Discrete Time Model in Finance

Prerequisites: Graduate standing. MATH 6382 or consent of instructor.

Text(s): Introduction to Mathematical Finance: Discrete Time Models, by Stanley R. Pliska, Blackwell, 1997, 9781557869456

Description: The course is an introduction to discrete-time models in finance. We start with single-period securities markets and discuss arbitrage, risk-neutral probabilities, complete and incomplete markets. We survey consumption investment problems, mean-variance portfolio analysis, and equilibrium models. These ideas are then explored in multiperiod settings. Valuation of options, futures, and other derivatives on equities, currencies, commodities, and fixed-income securities will be covered under discrete-time paradigms.

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MATH 6395 - Homogenization theory and its applications

Prerequisites: Graduate standing. MATH 6360 (Applicable Analysis-I), 6327 (PDE-II) or consent of the instructor

Text(s):
- Cioranescu D., Donato P., "An introduction to homogenization", Oxford Lecture Series in Mathematics and Applications 17, Oxford, 1999 (Required), 9780198565543
- Bensoussan A., Lions J.L., Papanicolaou G., "Asymptotic analysis for periodic structures", North-Holland, Amsterdam, 1978 (Optional), 9780821853245
- Jikov V., Kozlov S., Oleinik O., "Homogenization of differential operators and integral functionals", Springer, Berlin, 1995 (Optional), 9783642846618

Description:	Homogenization theory is a rigorous version of what is known as averaging of processes in media with rapidly oscillating spatial local characteristics. Composite materials is one of the examples of such media. When the scale of the microstructure of the medium is much smaller than the scale of the physical process under consideration, the medium has homogenized characteristics, that is, in general, different from local ones. Then homogenization is used to find these characteristics and using them to construct the homogenized model approximating the initial one and giving global description of the physical process in strongly heterogeneous media. This course intends to provide a brief introduction to the mathematical theory of homogenization and its application with a view on multiscale modeling and numerical simulation. These will be illustrated by considering various examples from continuum mechanics, physics, or porous media engineering. This course covers the theory of periodic homogenization, homogenization in porous media, numerical methods of homogenization and multiscale finite element methods.

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MATH 6395 - Stochastic Differential Equation

Prerequisites:	Graduate standing. Advanced undergraduate standing requires an approved petition.
Text(s):	We will begin with the notes of L. C. Evans (UC Berkeley), that used to be available on his web-page. Additional material will be handed out or placed on reserve in the library during the course.
Description:	Stochastic differential equations arise when some randomness is allowed in the coefficients of a differential equation. They have many applications, including mathematical biology, theory of partial differential equations, differential geometry and mathematical finance. This is an introduction to the theory and applications of stochastic differential equations. A knowledge of measure theory is strongly recommended but not required. We begin by reviewing measure theory, probability spaces, random variables and stochastic processes. We discuss Brownian motion and its properties, then introduce the Ito integral and relevant aspects of martingale theory. We formulate and solve stochastic differential equations, including numerical schemes. Applications will include mathematical finance (arbitrage and option pricing) and connections to PDE's.

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MATH 6397 - Convexity & Choquet Theory

Prerequisites:	Graduate Standing, consent of instructor. Math 4331-4332 or equivalent. A little topology, a little Real Variables (6321), or a little functional analysis would also be helpful.
Text(s):	- Just the first few chapters of: Alexander Barvinok, "A Course in Convexity (AMS Graduate Studies in Mathematics, V. 54), R. R. Phelps, "Lectures on Choquet's Theorem'' (Springer Lecture Notes in Mathematics) - Instructor will also provide some typed notes, drawn in part from the following texts: Compact Convex Sets and Boundary Integrals (Springer), by E.M. Alfsen, Convexity (Oxford Science Publications), by Roger Webster

Description:	Convexity is a simple idea that is used in very many parts of mathematics, sometimes in surprising ways. The field has a very rich structure and theory, with numerous powerful applications. We will be touching on several topics, namely a subset of the list below (this list will be pruned to fit the needs and mathematical maturity of the class). We also note that some topics in this list may be out of order. For each of these we will develop the basic theory, and illustrate it with selected applications. We will begin with convex sets in finite dimensional spaces, and the theorems of Caratheodary, Radon, and Helly. Supporting and separating hyperplanes. Polyhedra and Polytopes. Applications: Schur-Horn and Birkhoff-von Neumann theorems. Blaschke selection theorem. Duality. Krein-Milman and Milman theorems. Convex functions. The affine function space $A(K)$. Cones and ordered spaces. Application: Positive definite functions and Bochner's theorem. Facial structure of convex sets. Fixed point theorems. Representing measures and maximal measures. Application: Solution of the one-dimensional moment problem. The barycenter formula. The Bishop-Phelps and Choquet-Bishop-deLeeuw theorem. The Choquet and Shilov boundary. The noncommutative Choquet boundary. Structure of compact convex sets and separation theorems. Choquet (and other) simplexes. Applications e.g. to measures and ergodic theory. Some basics of potential theory.

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MATH 6397 - Complex Hyperbolic Manifolds

Prerequisites:	Graduate Standing. Consent of instructor
Text(s):	Instructor's lecture note
Description:	Several topics in complex geometry including the thoery of holomorphic curves (Nevanlinna theory) and complex hyperbolic manifolds will be covered.

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MATH 6397 - Time Series Analysis

Prerequisites:	Graduate Standing. Consent of instructor. MATH 6283, Probability and Statistics.
Text(s):	Time Series Analysis, by James D. Hamilton, Princeton Univerisity Press, 1994.
Description:	The course covers the foundation of time series analysis. Topics include stationary processes, ARIMA models, nonlinear time series analysis, vector-valued models, cointegration, kalman filters, state space models, and regime-switching paradigms. Students are expected to learn the use of R and Matlab in modling and data analysis. This course will be followed by a course entitled “Analysis of Financial and Energy Time Series” in Spring 2016.

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MATH 6397 - Design of Experiments

Prerequisites:	Graduate Standing. Consent of instructor. Two years of Calculus, Math 6308 Advanced Linear Algebra I, Math 5386 Regression and Linear Models, and Mathematical Statistics, Biostatistics or equivalent.
Text(s):	Recommended books: Douglas C. Montgomery: Design and Analysis of Experiments, Wiley ISBN-13: 978-1118146927 ISBN-10: 1118146921 Edition: 8th

This course is designed for graduate students who have been exposed to basic probability and statistics and would like to learn more advanced topics of design and analysis of experiments with applications to biological studies, public health and industries. The selected topics will include review of linear regressions, completely randomlized design, randomized block design, factorial designs, etc.. The instructor reserves the right to exclude certain topics from the textbook and add other topics not covered in the textbook.

Description:

Grading. Final grades will be based on class attendance and in-class discussion (10%), assignment (30%), midterm exams (30% each), the final research project (written report,30%).

R software
R is a open source statistical analysis software, and can be downloaded for free
At http://www.r-project.org/ .
SAS is an industry-standard software that are used and recommended by pharmaceutical companies for analzing clinical trial data for reports to the FDA.

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MATH 6397 - Statistcal Computing

Prerequisites:

Graduate Standing. Consent of instructor. Two years of Calculus, Math 6308 Advanced Linear Algebra I, Math 5386 Regression and Linear Models, and Math Mathematical Statistics or equivalent.

Text(s):

Recommended book(s):
Maria Rizzo: Statistical Computing with R (Chapman & Hall/CRC The R Series) 2007
ISBN-13: 978-1584885450 ISBN-10: 1584885459 Edition: 1st

References:
Efron, B and Tibshirani, R. An Introduction to the Bootstrap, Chapman Hall / CRC

Description:

This course is designed for graduate students who have been exposed to basic probability and statistics and would like to learn more advanced statistical computing techniques in modelling data. The selected topics will include basic sampling techniques from known probability distributions, Monte Carlo estimation and testing, bootstrapping and jackknife, permutation methods for testing, etc. The instructor reserves the right to exclude certain topics from the textbook and add other topics not covered in the textbook.

Grading. Final grades will be based on class attendance and in-class discussion (10%), assignment (30%), midterm exams (30% each), the final research project (written report,30%).

R software
R is a open source statistical analysis software, and can be downloaded for free
At http://www.r-project.org/ .

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