Department of Mathematics

2018 - Spring Semester

GRADUATE COURSE SPRING 2018

This schedule is subject to changes. Please contact the Course Instructor for confirmation.

SENIOR UNDERGRADUATE COURSES

Course	Sec #	Course Title	Course Day & Time	Rm #	Instructor
Math 4309	15452	Mathematical Biology	TuTh, 4—5:30pm	SEC 104	R. Azevedo
Math 4315	23485	Graph Theory w/Applications	TuTh, 4—5:30pm	C 104	K. Josic
Math 4332/6313	11974/13537	Introduction to Real Analysis II	TuTh, 8:30—10am	C 106	B. Bodmann
Math 4364	18808	Intro. to Numerical Analysis in Scientific Computing	MW, 4—5:30pm	SW 102	T.W. Pan
Math 4365	17019	Numerical Methods for Differential Equations	TuTh, 11:30am—1pm	AH 301	J. He
Math 4377/6308	14343/13538	Advanced Linear Algebra I	MWF, Noon—1pm	GAR 201	M. Kalantar
Math 4377/6308	18001/18002	Advanced Linear Algebra I (online)	Online	Online	J. Morgan
Math 4378/6309	11975/13539	Advanced Linear Algebra II	TuTh, 1—2:30pm	F 154	A. Mamonov
Math 4380	11976	A Mathematical Introduction to Options	TuTh, 1—2:30pm	CBB 108	M. Papadakis
Math 4383	23486	Number Theory	TuTh, 10—11:30am	CV N115	M. Ru
Math 4389	11977	Survey of Undergraduate Mathematics	MWF, 11am—Noon	GAR 201	D. Blecher
Math 4397	26700	Mathematical Methods for Physics	TuTh, 5:30-7pm	SR 606	A. Weglein

GRADUATE ONLINE COURSES

Course	Section	Course Title	Course Day & Time	Instructor
Math 5330	13363	Abstract Algebra	Arrange (online course)	K. Kaiser
Math 5332	11996	Differential Equations	Arrange (online course)	G. Etgen

Math 5333	23487	Analysis	Arrange (online course)	S. Ji
Math 5386	15109	Regression and Linear Models	Arrange (online course)	C. Peters
Math 5397	23488	Dynamical Systems	Arrange (online course)	A. Török

GRADUATE COURSES

Course	Section	Course Title	Course Day & Time	Rm #	Instructor
Math 6303	12003	Modern Algebra II	MWF, 11am—Noon	SW 423	A. Haynes
Math 6308	13538	Advanced Linear Algebra I	MW F, Noon—1pm	GAR 201	M. Kalantar
Math 6308	18002	Advanced Linear Algebra I (online)	Online	Online	J. Morgan
Math 6309	13539	Advanced Linear Algebra II	TuTh, 1—2:30pm	F 154	A. Mamonov
Math 6313	13537	Introduction to Real Analysis	TuTh, 8:30—10am	C 106	B.Bodmann
Math 6321	12020	Theory of Functions of a Real Variable	MWF, 9—10am	SEC 201	V. Climenhaga
Math 6327	23489	Partial Differetial Equations	TuTh, 4—5:30pm	AH 15	G. Auchmuty
Math 6357	23491	Design of Experiments	MW, 2:30—4pm	SW 423	B. Manandhar
Math 6361	13541	Applicable Analysis	TuTh, 8:30—10am	AH 7	Y. Gorb
Math 6365	23493	Automatic Learning and Data Mining	TuTh, 11:30am—1pm	M 109	R. Azencott
Math 6367	12021	Optimization Theory	MW, 2:30-4pm	SEC 203	R. Hoppe
Math 6371	12022	Numerical Analysis	MW, 4—5:30pm	SW 229	M. Olshanskiy
Math 6374	23490	Numerical Partial Differential Equations	MW, 1—2:30pm	SW 219	Y. Kuznetsov
Math 6383	12023	Probability Statistics	MW, 4—5:30pm	SW 423	W. Fu
Math 6385	23492	Continuous-Time Models in Finance	TuTh, 2:30—4pm	AH 301	E. Kao
Math 6397	23497	Biomedical Modeling	TuTh, 2:30—4pm	SW 423	A. Skripnikov
Math 6397	23498	Multivariate Statistical Analysis	TuTh, 4—5:30pm	AH 11	W. Fu
Math 6397	23499	Financial & Energy Time Series Analysis	TuTh, 10—11:30am	CV N115	E. Kao
Math 7352	23494	Riemannian Geometry	MWF, Noon—1pm	C 102	V. Climenhaga
Math 7381	23495	Stochastic Process	TuTh, 11:30am—1pm	SEC 201	I. Timofeyev

---Course Details--

SENIOR UNDERGRADUATE COURSES

Math 4309 (15672) - Mathematical Biology

Prerequisites:	MATH 3331 and BIOL 3306 or consent of instructor.
Text(s):	A Biologist's Guide to Mathematical Modeling in Ecology and Evolution by Sarah P. Otto and Troy Day; ISBN-13:9780691123448

Description: Topics in mathematical biology, epidemiology, population models, models of genetics and evolution, network theory, pattern formation, and neuroscience. Students may not receive credit for both MATH 4309 and BIOL 4309.

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Math 4315 (23485) - Graph Theory w/Applications

Prerequisites: Either MATH 3330 or MATH 3336 and three additional hours of 3000-4000 level Mathematics

Text(s): Networks, Crowds, and Markets: Reasoning About a Highly Connected World. By David Easley and Jon Kleinberg. This text is availabe at this link: https://www.cs.cornell.edu/home/kleinber/networks-book/

Description: Introduction to basic concepts, results, methods, and applications of graph theory.

Additional Description: How does information propagate between friends and acquaintances on social media? How do diseases spread, and when do epidemics start? How should we design power grids to avoid failures, and systems of roads to optimize traffic flow? These questions can be addressed using network theory . Students in the course will develop a sound knowledge of the basics of graph theory, as well as some of the computational tools used to address the questions above. Course topics include basic structural features of networks, generative models of networks, centrality, random graphs, clustering, and dynamical processes on graphs.

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Math 4332 (11974) - Introduction to Real Analysis II

Prerequisites: MATH 4331 or consent of instructor

Text(s): Real Analysis with Real Applications | Edition: 1; Allan P. Donsig, Allan P. Donsig; ISBN: 9780130416476

Description: Further development and applications of concepts from MATH 4331. Topics may vary depending on the instructor's choice. Possibilities include: Fourier series, point-set topology, measure theory, function spaces, and/or dynamical systems.

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Math 4364 (18808)- Numerical Analysis in Scientific Computing

Prerequisites:	MATH 3331 and COSC 1410 or equivalent or consent of instructor. **Instructor's Prerequisite Notes:** 1. MATH 2331, In depth knowledge of Math 3331 (Differential Equations) or Math 3321 (Engineering Mathematics) 2. 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, ISBN: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 4365 (17019) - Numerical Methods for Differential Equations

Prerequisites:	MATH 3331, or equivalent, and three additional hours of 3000–4000 level Mathematics.
Text(s):	TITLE:TBA, AUTHOR:TBA, ISBN:TBA
Description:	Numerical differentiation and integration, multi-step and Runge-Kutta methods for ODEs, finite difference and finite element methods for PDEs, iterative methods for linear algebraic systems and eigenvalue computation.

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Math 4377 (14343) - Advanced Linear Algebra I

Prerequisites:	MATH 2331 or equivalent, and three additional hours of 3000–4000 level Mathematics.
Text(s):	Linear Algebra | Edition: 4; Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; ISBN: 9780130084514
Description:	Linear systems of equations, matrices, determinants, vector spaces and linear transformations, eigenvalues and eigenvectors. **Additional Notes:** This is a proof-based course. It 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.

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Math 4377 (18001) - Advanced Linear Algebra I *(Online)*

Prerequisites:	MATH 2331 or equivalent, and six additional hours of 3000–4000 level Mathematics.
Text(s):	Linear Algebra | Edition: 4; Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; ISBN 0-13-008451-4; 9780130084514

Linear systems of equations, matrices, determinants, vector spaces and linear transformations, eigenvalues and eigenvectors.

Description: **Additional Description**: In addition to the material listed, I will cover diagonalization, inner products and norms, orthogonality, the Gram-Schmidt process and orthogonal projection.

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Math 4378 (11975) - Advanced Linear Algebra II

Prerequisites: MATH 4377

Text(s): Linear Algebra, Fourth Edition, by S.H. Friedberg, A.J Insel, L.E. Spence,Prentice Hall, ISBN 0-13-008451-4; 9780130084514

Description: Similarity of matrices, diagonalization, Hermitian and positive definite matrices, normal matrices, and canonical forms, with applications.

Instructor's Additional notes: This is the second semester of Advanced Linear Algebra. I plan to cover Chapters 5, 6, and 7 of textbook. These chapters cover Eigenvalues, Eigenvectors, Diagonalization, Cayley-Hamilton Theorem, Inner Product spaces, Gram-Schmidt, Normal Operators (in finite dimensions), Unitary and Orthogonal operators, the Singular Value Decomposition, Bilinear and Quadratic forms, Special Relativity (optional), Jordan Canonical form.

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Math 4380 (12062) - A Mathematical Introduction to Options

Prerequisites: MATH 2433 and MATH 3338.

Text(s): An Introduction to Financial Option Valuation: Mathematics, Stochastics and Computation | Edition: 1; Desmond Higham; 9780521547574

Description: Arbitrage-free pricing, stock price dynamics, call-put parity, Black-Scholes formula, hedging, pricing of European and American options.

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Math 4383 (23486) - Number Theory

Prerequisites: MATH 3330

Text(s): Beginning Number Theory, 2nd Edition by Neville Robbins, ISBN:9780763737689

Description: Perfect numbers, quadratic reciprocity, quadratic residues, algebraic numbers, and continued fractions.

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Math 4389 (11977) - Survey of Undergraduate Mathematics

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

Text(s): Instructor will use his own notes

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

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Math 4397 (26700) - Mathematical Methods for Physics

Prerequisites:	MATH 3333 or consent of instructor
Text(s):	TBD
Description:	Selected topics in Mathematics. May be repeated with approval of chair.

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ONLINE GRADUATE COURSES

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MATH 5330 (13363) - Abstract Algebra

Prerequisites:	Graduate standing.
Text(s):	*Abstract Algebra , A First Course* by Dan Saracino. Waveland Press, Inc. ISBN 0-88133-665-3 (You can use the first edition. The second edition contains additional chapters that cannot be covered in this course.)
Description:	Groups, rings and fields; algebra of polynomials, Euclidean rings and principal ideal domains. Does not apply toward the Master of Science in Mathematics or Applied Mathematics. **Other Notes:** This course is meant for students who wish to pursue a Master of Arts in Mathematics (MAM). Please contact me in order to find out whether this course is suitable for you and/or your degree plan. *Notice that this course* ***cannot*** *be used for MATH 3330, Abstract Algebra.*

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MATH 5332 (11996) - Differential Equations

Prerequisites:	Graduate standing. MATH 5331.
Text(s):	TBA
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 projects. Applies toward the Master of Arts in Mathematics degree; does not apply toward the Master of Science in Mathematics or the Master of Science in Applied Mathematics degrees.

MATH 5333 (23487) - Analysis

Prerequisites:	Graduate standing. and two semesters of calculus.
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.

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MATH 5386 (15109) - Regression and Linear Models *(VEE approved course)*

Prerequisites: Graduate standing. Two semesters of calculus, one semester of linear algebra, and MATH 5385, or consent of instructor.

Text(s): Introduction to Linear Regression Analysis | Edition:5; Montgomery, Peck, Vining; ISBN: 9780470542811; Wiley

Description: Simple and multiple linear regression, linear models, inferences from the normal error model, regression diagnostics and robust regression, computing assignments with appropriate software. Applies toward Master of Arts in Mathematics degree; does not apply toward the Master of Science in Mathematics or the Master of Science in Applied Mathematics degrees.

Note: This course is VEE approved for the regression component only. Approval Code: 4458-11008. For more information on VEE approved courses, click here.

MATH 5397 (23488) - Dynamical Systems

Prerequisites: Graduate standing. Three semesters of Calculus or consent of instructor. Basic knowledge of ODE's is helpful, but not required

Text(s): Steven H. Strogatz: Nonlinear Dynamics and Chaos (with Applications to Physics, Biology, Chemistry, and Engineering) Second Edition, 2014.

Print ISBN: 9780813349107

Ebook ISBN: 9780813349114

Description: We will discuss applications of nonlinear dynamics, following the book by Strogatz. Topics that will be considered include (for more details, check the book's table of contents): an introduction to Ordinary Differential Equations (ODE's), one-dimensional ODE's and their bifurcations; two-dimensional ODE's (linear case, limit cycles and the Poincare-Bendixson Theorem, the Hopf bifurcation), chaotic systems (logistic family, Lorenz equations, Henon map).For visualization we will use tools that do not require programming, with the option to additionally run/write Matlab code.

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MATH 6303 (12003) - Modern Algebra II

Prerequisites: Graduate standing. MATH 4333 or MATH 4378

Additional Prerequisites: students should be comfortable with basic measure theory, groups rings and fields, and point-set topology

Text(s): No textbook is required.

Description:	Topics from the theory of groups, rings, fields, and modules. **Additional Description:** This is primarily a course about analysis on topological groups. The aim is to explain how many of the techniques from classical and harmonic analysis can be extended to the setting of locally compact groups (i.e. groups possessing a locally compact topology which is compatible with their algebraic structure). In the first part of the course we will review basic point set topology and introduce the concept of a topological group. The examples of p-adic numbers and the Adeles will be presented in detail, and we will also spend some time discussing SL_2(R). Next we will talk about characters on topological groups, Pontryagin duality, Haar measure, the Fourier transform, and the inversion formula. We will focus on developing details in specific groups (including those mentioned above), and applications to ergodic theory and to number theory will be discussed.

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MATH 6308 (13538) - Advanced Linear Algebra I

Prerequisites:	Graduate standing. MATH 2331 and a minimum of 3 semester hours transformations, eigenvalues and eigenvectors.
Text(s):	Linear Algebra | Edition: 4; Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; ISBN: 9780130084514
Description:	Transformations, eigenvalues and eigenvectors. **Additional Notes:** This is a proof-based course. It 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.

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MATH 6308 (18002) - Advanced Linear Algebra I *(online)*

Prerequisites:	Graduate standing. MATH 2331 and a minimum of 3 semester hours transformations, eigenvalues and eigenvectors.
Text(s):	Linear Algebra | Edition: 4; Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; ISBN: 9780130084514
Description:	Transformations, eigenvalues and eigenvectors. An expository paper or talk on a subject related to the course content is required Syllabus

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MATH 6309 (13539) - Advanced Linear Algebra II

Prerequisites:	Graduate standing and MATH 6308
Text(s):	Linear Algebra, Fourth Edition, by S.H. Friedberg, A.J Insel, L.E. Spence,Prentice Hall, ISBN 0-13-008451-4; 9780130084514
Description:	Similarity of matrices, diagonalization, hermitian and positive definite matrices, canonical forms, normal matrices, applications. An expository paper or talk on a subject related to the course content is required.

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MATH 6313 (13537)- Introduction to Real Analysis II

Prerequisites: Graduate standing and MATH 6312.

Text(s): TBA

Description: Properties of continuous functions, partial differentiation, line integrals, improper integrals, infinite series, and Stieltjes integrals. An expository paper or talk on a subject related to the course content is required.

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MATH 6321 (12020) - Theory of Functions of a Real Variable II

Prerequisites: Graduate standing. MATH 4332 or consent of instructor.

Instructor's Prerequisite Notes: MATH 6320

Text(s): Primary (Required): Real Analysis for Graduate Students, Richard F. Bass

Supplementary (Recommended): Real Analysis: Modern Techniques and Their Applications, Gerald Folland (2nd edition); ISBN: 9780471317166.

Description: Lebesque measure and integration, differentiation of real functions, functions of bounded variation, absolute continuity, the classical Lp spaces, general measure theory, and elementary topics in functional analysis.

Instructor's Additional Notes: Math 6321 is the second course in a two-semester sequence intended to introduce the theory and techniques of modern analysis. The core of the course covers elements of functional analysis, Radon measures, elements of harmonic analysis, the Fourier transform, distribution theory, and Sobolev spaces. Additonal topics will be drawn from potential theory, ergodic theory, and the calculus of variations.

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MATH 6327 (23489) - Partial Differential Equations

Prerequisites: Graduate standing. MATH 4331

Text(s): *No required text.*

Some topics are covered in:
-R.E. Showalter, Hilbert Space methods in Partial Differential equations. Dover.

-E. Zeidler, Nonlinear Functional Analysis and its Applications, Vol IIA, Springer.

Description:	Existence and uniqueness theory in partial differential equations; generalized solutions and convergence of approximate solutions to partial differential systems. **Additional Description**: This course will develop the basic tools needed to prove existence uniqueness results for weak solutions of linear evolution problems. The results will be obtained using Galerkin and spectral methods in a Hilbert space setting. This will be used to study linear initial boundary value problems for parabolic equations (heat and diffusion equations). Also some properties of the solutions including regularity results and maximum principles. If time permits, some results on linear hyperbolic equations will also be described.

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MATH 6357 (23491) - Design of Experiments

Prerequisites:	Graduate standing. MATH 2433, MATH 3338, MATH 3339, and MATH 6308
Text(s):	Design and Analysis of Experiments, 8th Ed., Douglas C. Montgomery, ISBN: 9781118146927
Description:	Linear regressions, model adequacy, completely randomized design, randomized complete block design, fixed effects and random effects design and analysis, Latin square design, factorial designs, etc.

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MATH 6361 (13541) - Applicable Analysis

Prerequisites:	Graduate standing. MATH 4332 or consent of instructor.
Text(s):	The instructor will provide lecture notes on the material. A reference text is L.D. Berkowitz, Convexity and Optimization in Rn, Wiley-Interscience 2002.
Description:	This course provides an introduction to the mathematical analysis of finite dimensional optimization problems. Topics to be studied include the existence of, and the extremality conditions that hold at, solutions of constrained and unconstrained optimaization problems. Elementary theory of convex sets, functions and constructions from convex analysis will be introduced and used. Concepts include subgradients, conjugate functions and some duality theory. Specific problems to be studied include energy and least squares methods for solving linear equations, important inequalities, eigenproblems and some nonlinear programming problems from applications.

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MATH 6365 (23493) - Automatic Learning and Data Mining

Prerequisites:	Graduate standing. MATH 3338 and MATH 3339.
Text(s):	The instructor will provide lecture notes on the material. A reference text is L.D. Berkowitz, Convexity and Optimization in Rn, Wiley-Interscience 2002.
Description:	Automatic learning and data mining cluster high-dimension inputs to predict their impact on decision outputs. Kernel based Clustering and Learning enable dictionary generation, pattern classification, non linear regression. Applications: shape recognition, genes expression analysis, etc.

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MATH 6367 (12021)- Optimization Theory

Prerequisites: Graduate standing. MATH 4331 and MATH 4377.

Text(s):

- D.P. Bertsekas; Dynamic Programming and Optimal Con- trol, Vol. I, 4th Edition. Athena Scientific, 2017, ISBN-10: 1-886529-43-4

- J.R. Birge and F.V. Louveaux; Introduction to Stochastic Programming. Springer, New York, 1997, ISBN: 0-387-98217-

Description:

Constrained and unconstrained finite dimensional nonlinear programming, optimization and Euler-Lagrange equations, duality, and numerical methods. Optimization in Hilbert spaces and variational problems. Euler-Lagrange equations and theory of the second variation. Application to integral and differential equations.

Additional Description: This course consists of two parts. The first part is concer- ned with an introduction to Stochastic Linear Programming (SLP) and Dynamic Programming (DP). As far as DP is concerned, the course focuses on the theory and the appli- cation of control problems for linear and nonlinear dynamic systems both in a deterministic and in a stochastic frame- work. Applications aim at decision problems in finance. In the second part, we deal with continuous-time systems and optimal control problems in function space with em- phasis on evolution equations.

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MATH 6371 (12022) - Numerical Analysis

Prerequisites: Graduate standing.

Text(s): **Numerical Mathematics (Texts in Applied Mathematics)**, 2nd Ed., V.37, Springer, 2010. By A. Quarteroni, R. Sacco, F. Saleri. ISBN: 9783642071010

Description: Ability to do computer assignments. Topics selected from numerical linear algebra, nonlinear equations and optimization, interpolation and approximation, numerical differentiation and integration, numerical solution of ordinary and partial differential equations.

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MATH 6374 (23490) - Numerical Partial Differential Equations

Prerequisites: Graduate standing.MATH 6371

Text(s): Instructor will provide his own notes.

Description: Finite difference, finite element, collocation and spectral methods for solving linear and nonlinear elliptic, parabolic, and hyperbolic equations and systems with applications to specific problems.

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MATH 6383 (12023) - Probability Statistics

Prerequisites:	Graduate standing. MATH 3334, MATH 3338 and MATH 4378.
Text(s):	**Recommended Text**: John A. Rice : Mathematical Statistics and Data Analysis, 3rd editionBrooks / Cole, 2007. ISBN-13: 978-0-534-39942-9. **Reference Texts:** -P. MuCullagh and J.A. Nelder: Generealized Linear Models, 2nd ed. 1999 Chapman Hall/CRC. ISBN: 978-0412317606 -Raymond H. Myers, Douglas C. Montgomery, G. Geoffrey Vining, Timothy J. Robinson, Generalized Linear Models: with Applications in Engineering and the Sciences, 2nd ed. Wiley, 2010. ISBN: 978-0-470-45463-3.
Description:	A survey of probability theory, probability models, and statistical inference. Includes basic probability theory, stochastic processes, parametric and nonparametric methods of statistics. **Instructor's 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 theory and techniques in modelling data of various types, including continuous, binary, counts and others. The selected topics will include basic probability distributions, likelihood function and parameter estimation, hypothesis testing, regression models for continuous and categorical response variables, variable selection methods, model selection, large sample theory, shrinkage models, ANOVA and some recent advances.

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MATH 6385 (23492) - Continuous-Time Models in Finance

Prerequisites:	Graduate Standing. MATH 6384
Text(s):	Arbitrage Theory in Continuous Time, 3rd edition, by Tomas Bjork, Oxford University Press, 2009. (Primary)
Description:	Stochastic calculus, Brownian motion, change of measures, Martingale representation theorem, pricing financial derivatives whose underlying assets are equities, foreign exchanges, and fixed income securities, single-factor and multi-factor HJM models, and models involving jump diffusion and mean reversion. **Additional 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 models involving jump diffusion and mean reversion and the use of levy processes in finance.

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MATH 6397 (23497) - Biomedical Modeling

Prerequisites:

Graduate standing.

Additional Prerequisite: Basic probability and statistics understanding, familiarity with R programming is encouraged.

Text(s):

Clinical Trial Data Analysis Using R and SAS, 2nd Ed., Ding-Geng (Din) Chen, Karl E. Peace, Pinggao Zhang. ISBN: 9781498779524

Description:

May be repeated with approval of chair.

Additional Description: Course will deal with a select variety of statistical methodologies used in medical research. Just to name a few - survival analysis, longitudinal data modeling, logistic regression, sample size calculation, analysis of DNA microarray data. It won't be overly heavy on medical terminology, predominantly focusing on description of main ideas and applications for most ubiquitous statistical techniques and models. Course may come in handy for both the math/statistics/engineering students in order to acquaint themselves with medical applications, and for biology/chemistry students to better understand the statistical approaches used in medical research. The main software used throughout the course will be R Statistical Computing language, for which there will be a brief introduction during the first couple of lectures. All-in-all, at the end of the course, a successful student should:

• have a conceptual grasp of most popular statistical techniques used in medical research problems

• be able to use R statistical programming as a tool for conducting research and data analysis

• feel relatively comfortable when given a data file and asked to carry out particular analysis (be it comparison of medical treatments or performing logistic regression, among others

Software: Make sure to download R and RStudio (which can't be installed without R) before the course starts. Use the link https://www.rstudio.com/products/rstudio/download/ to download it from the mirror appropriate for your platform. Let me know via email in case you encounter diculties.

Syllabus (PDF)

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MATH 6397 (23498) - Multivariate Statistical Anaysis

Prerequisites:

Graduate standing.

Additional Prerequisite: Two years of Calculus, Math 6308 Advanced Linear Algebra I, Math 5386 Regression and Linear Models, or equivalent.

Text(s):

TBD

Description:

May be repeated with approval of chair. A survey of probability distributions, multi-variate normal distributions, principal component analysis, classification, and clustering.

Additional 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 methods and techniques in jointly modelling data of multiple variables. The selected topics will include basic probability distributions, multi-variate normal distributions, principal component analysis, classification, and clustering.

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MATH 6397 (23499) - Financial & Energy Time Series Analysis

Prerequisites: Graduate standing.

Text(s): An Introduction to Analysis of Financial Data with R, by Ruey S. Tsay, Wiley, 2013.

Description:

May be repeated with approval of chair.

Additional Description: The course is about time analysis with special emphases on financial and energy data. The course covers ARIMA models, ARCH/GARCH models, nonlinear models, high frequency data analysis, parameter estimation for diffusion and related processes, multivariate time series, extreme value analysis, Copulas, Levy processes, and an introduction of Markov chain Monte Carlo Methods. We will use R for computing.

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MATH 7352 (23494) - Riemannian Geometry

Prerequisites: Graduate standing.

Text(s): Differential Geometry and Topology: With a View to Dynamical Systems" by Keith Burns and Marian Gidea. (CRC Press, 2005). ISBN: 9781584882534

Description:

Differentiable Manifolds, tangent space, tangent bundle, vector bundle, Riemannian metric, connections, curvature, completeness geodesics, Jacobi fields, spaces of constant curvature, and comparison theorems.

Additional Description: This course is an introduction to the theory of smooth manifolds, with an emphasis on their geometry. The first third of the course will cover the basic definitions and examples of smooth manifolds, smooth maps, tangent spaces, and vector fields. Later in the semester we will use Euclidean, spherical, and hyperbolic geometry to introduce the notion of a Riemannian metric; we will study parallel transport, geodesics, the exponential map, and curvature. Other topics will include Lie theory and differential forms, including exterior differentiation and Stokes theorem.

The textbook highlights connections of this theory to dynamical systems; these may be mentioned in lectures but are not the focus of this course: this is first and foremost a course in differential geometry, which is oriented towards the associated preliminary exam.

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	MATH 7381 (23499) - Selected Topics in Mathematics
Prerequisites:	Graduate standing. MATH 6382
Text(s):	TBD
Description:	Discrete-time and continuous-time Markov chains, poisson process, diffusions and analysis of mutliscale systems

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