AMS

Applied Mathematics and Statistics

AMS 501: Differential Equations and Boundary Value Problems I
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 502: Differential Equations and Boundary Value Problems II
Analytic solution techniques for, and properties of solutions of, partial differential equations, with concentration on second order PDEs. Techniques covered include: method of characteristics, separation of variables, eigenfunction expansions, spherical means. Green's functions and fundamental solutions, and Fourier transforms. Solution properties include: energy conservation, dispersion, dissipation, existence and uniqueness, maximum and mean value principles.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 503: Applications of Complex Analysis
A study of those concepts and techniques in complex function theory that are of interest for their applications. Pertinent material is selected from the following topics: harmonic functions, calculus of residues, conformal mapping, and the argument principle. Application is made to problems in heat conduction, potential theory, fluid dynamics, and feedback systems.
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 504: Foundations of Applied Mathematics
An introductory course for the purpose of developing certain concepts and techniques that are fundamental in modern approaches to the solution of applied problems. An appropriate selection of topics is based on the concepts of metric spaces, compactness, sequences and convergence, continuity, differentiation and integration, function sequences, contraction mapping theorem. Strong emphasis on proofs.
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 505: Applied Linear Algebra
Review of matrix operations. Elementary matrices and reduction of general matrices by elementary operations, canonical forms, and inverses. Applications to physical problems. Offered as AMS 505 or HPH 695.
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 506: Finite Structures
Problem solving in combinatorial analysis and graph theory using generating functions, recurrence relations, Polya's enumeration formula, graph coloring, and network flows.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 507: Introduction to Probability
The topics include sample spaces, axioms of probability, conditional probability and independence, discrete and continuous random variables, jointly distributed random variables, characteristics of random variables, law of large numbers and central limit theorem, Markov chains.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 508: Computational Finance
Introduction to capital markets, securities pricing and modern portfolio theory, including the organization and operation of securities market, the Efficient Market Hypothesis and its implications, the Capital Asset Pricing Model, the Arbitrage Pricing Theory and more general factor models. Common stocks and their valuation, statistical analysis, and portfolio selection in a single-period, mean-variance context will be explored along with its solution as a quadratic program. Fixed income securities and their valuation, statistical analysis, and portfolio selection. Discussion of the development and use of financial derivatives. Introduction to risk neutral pricing, stochastic calculus and the Black-Scholes Formula. Whenever practical examples will use real market data. Numerical exercises and projects in a high-level programming environment will also be assigned.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 510: Analytical Methods for Applied Mathematics and Statistics
Review of techniques of multivariate calculus, convergence and limits, matrix analysis, vector space basics, and Lagrange multipliers. Prerequisite: A course in linear algebra and in multivariate calculus
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 511: Foundations of Quantitative Finance
Introduction to capital markets, securities pricing and modern portfolio theory, including the organization and operation of securities market, the Efficient Market Hypothesis and its implications, the Capital Asset Pricing Model, the Arbitrage Pricing Theory and more general factor models. Common stocks and their valuation, statistical analysis, and portfolio selection in a single-period, mean-variance context will be explored along with its solution as a quadratic program. Fixed income securities and their valuation, statistical analysis, and portfolio selection. Discussion of the development and use of financial derivatives. Introduction to risk neutral pricing, stochastic calculus and the Black-Scholes Formula. Whenever practical examples will use real market data. Numerical exercises and projects in a high-level programming environment will also be assigned.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 512: Capital Markets and Portfolio Theory
Development of capital markets and portfolio theory in both continuous time and multi-period settings. Utility theory and its application to the determination of optimal consumption and investment policies. Asymptotic growth under conditions of uncertainty. Applications to problems in strategic asset allocation over finite horizons and to problems in public finance. Whenever practical, examples will use real market data. Numerical exercises and projects in a high-level programming environment will also be assigned.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 513: Financial Derivatives and Stochastic Calculus
Further development of derivative pricing theory including the use of equivalent martingale measures, the Girsanov Theorem, the Radon-Nikodym Derivative, and a deeper, more general understanding of the Arbitrage Theorem. Numerical approaches to solving stochastic PDE's will be further developed. Applications involving interest rate sensitive securities and more complex options will be introduced. Whenever practical examples will use real market data. Numerical exercises and projects in a high-level programming environment will also be assigned.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 514: Computational Finance
Review of foundations: stochastic calculus, martingales, pricing, and arbitrage. Basic principles of Monte Carlo and the efficiency and effectiveness of simulation estimators. Generation of pseudo- and quasi-random numbers with sampling methods and distributions. Variance reduction techniques such as control variates, antithetic variates, stratified and Latin hypercube sampling, and importance sampling. Discretization methods including first and second order methods, trees, jumps, and barrier crossings. Applications in pricing American options, interest rate sensitive derivatives, mortgage-
backed securities and risk management. Whenever practical examples will use real market data. Extensive numerical exercises and projects in a general programming environment will also be assigned.

3 credits, Letter graded (A, A-, B+, etc.)

3 credits, Letter graded (A, A-, B+, etc.)

AMS 515: Case Studies in Computational Finance

Actual applications of Quantitative Finance to problems of risk assessment, product design, portfolio management and securities pricing will be covered. Particular attention will be paid to data collection and analysis, the design and implementation of software, and, most importantly, to differences the occur between "theory and practice" in model application, and to the development of practical strategies for handling cases in which "model failure" makes the naive use of quantitative techniques dangerous. Extensive use of guest lecturers drawn from the industry will be made.

3 credits, Letter graded (A, A-, B+, etc.)

3 credits, Letter graded (A, A-, B+, etc.)

AMS 516: Statistical Methods in Finance

The course introduces statistical methods in quantitative finance. Financial applications and statistical methodologies are intertwined in all lectures. The course will cover regression analysis and applications to the Capital Asset Pricing Model and multifactor pricing models, principal components and multivariate analysis, statistical methods for financial time series; value at risk, smoothing techniques and estimation of yield curves, and estimation and modeling volatilities.

Prerequisite: AMS 586 or permission of the instructor

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

May be repeated 2 times FOR credit.

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 517: Quantitative Risk Management

Quantitative Methods for risk management problems including market risk, credit risk, operational risk and Basel II accord. Multivariable models; extreme value theory; structure and reduced-form models of default; and copula-based models.

3 credits, Letter graded (A, A-, B+, etc.)

May be repeated 2 times FOR credit.

3 credits, Letter graded (A, A-, B+, etc.)

AMS 519: Internship in Quantitative Finance

Supervised internship in financial institution. Students will typically work at a trading desk, in an asset management group, or in a risk management group. Students will be supervised by a faculty member and a manager at their internship site. Written and oral reports will be made to both supervisors.

3-6 credits, May be repeated 1 times FOR credit.

3-6 credits,
summarizing key methods, topics and papers relevant to Computational Structural Biology. Offered Fall semester. This course is offered as both CHE 535 and AMS 535.  
0-3 credits, Letter graded (A, A-, B+, etc.)  
May be repeated for credit.  
0-3 credits, Letter graded (A, A-, B+, etc.)

AMS 536: Molecular Modeling of Biological Molecules
This course is designed for students who wish to gain hands on experience modeling biological molecules at the atomic level. In conjunction with the individual interests, Molecular Mechanics, Molecular dynamics, Monte Carlo, Docking (virtual screening), or Quantum Mechanics software packages can be used to study relevant biological systems(s). Projects will include setup, execution, and analysis. Course participants will give literature presentations relevant to the simulations being performed and a final project report will be required. Familiarity with Unix (Linux) is desirable.  
Spring, 0-3 credits, Letter graded (A, A-, B+, etc.)  
May be repeated for credit.  
Spring, 0-3 credits, Letter graded (A, A-, B+, etc.)

AMS 537: Dynamical Models of Gene Regulation and Biological Pattern Formation
This is a graduate course in the fundamental theory of genetic function and biological pattern formation in animal development. The course covers dynamical (sometimes called “physiological”) models of these processes at a variety of mathematical levels. Biologically, the emphasis will be on E. coli and the fruit fly Drosophila, with a careful discussion of key experimental results for nonspecialists. We will study the use of both deterministic and stochastic differential equations to solve fundamental scientific problems such as the phage lambda lysis/lysogeny decision, the engineering of artificial gene circuits, and the determination and regulation of the morphogenetic field in animal development, particularly the segmentation field in Drosophila.  
3 credits, Letter graded (A, A-, B+, etc.)  
3 credits, Letter graded (A, A-, B+, etc.)

AMS 538: Methods in Neuronal Modeling
Presentation of the mathematical modeling approach to information processing in nervous systems, from the level of individual ionic channels to large-scale neuronal networks. The course covers kinetic models of synaptic transmission, cable theory and compartment models for neurons, multiple channels and calcium dynamics, spike-train analysis and modeling small neuron networks.  
3 credits, Letter graded (A, A-, B+, etc.)  
May be repeated for credit.  
3 credits, Letter graded (A, A-, B+, etc.)

AMS 540: Linear Programming
3 credits, Letter graded (A, A-, B+, etc.)  
3 credits, Letter graded (A, A-, B+, etc.)

AMS 542: Analysis of Algorithms
Techniques for designing efficient algorithms, including choice of data structures, recursion, branch and bound, divide and conquer, and dynamic programming. Complexity analysis of searching, sorting, matrix multiplication, and graph algorithms. Standard NP-complete problems and polynomial transformation techniques. This course is offered as both AMS 542 and CSE 548.  
Prerequisite for CSE 548: CSE 373  
recommended  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 544: Discrete and Nonlinear Optimization
Theoretical and computational properties of discrete and nonlinear optimization problems: integer programming, including cutting plane and branch and bound algorithms, necessary and sufficient conditions for optimality of nonlinear programs, and performance of selected nonlinear programming algorithms.  
3 credits, Letter graded (A, A-, B+, etc.)  
3 credits, Letter graded (A, A-, B+, etc.)

AMS 545: Computational Geometry
Study of the fundamental algorithmic problems associated with geometric computations, including convex hulls, Voronoi diagrams, triangulation, intersection, range queries, visibility, arrangements, and motion planning for robotics. Algorithmic methods include plane sweep, incremental insertion, randomization, divide-and-conquer, etc. This course is offered as both AMS 545 and CSE 555.  
Prerequisite for CSE 555: CSE 373 or CSE 548  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 546: Network Flows
Theory of flows in capacity-constrained networks. Topics include maximum flow, feasibility criteria, scheduling problems, matching and covering problems, minimum-length paths, minimum-cost flows, and associated combinatorial problems.  
Prerequisite: AMS 540 or permission of instructor  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 547: Discrete Mathematics
This course introduces such mathematical tools as summations, number theory, binomial coefficients, generating functions, recurrence relations, discrete probability, asymptotics, combinatorics, and graph theory for use in algorithmic and combinatorial analysis. This course is offered as both CSE 547 and AMS 547.  
Prerequisite for CSE 547: AMS 301  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)  
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 550: Operations Research: Stochastic Models
Includes Poisson processes, renewal theory, discrete-time and continuous-time Markov processes, Brownian motion, applications to queues, statistics, and other problems of engineering and social sciences.  
3 credits, Letter graded (A, A-, B+, etc.)  
3 credits, Letter graded (A, A-, B+, etc.)

AMS 552: Game Theory I
Elements of cooperative and noncooperative games. Matrix games, pure and mixed strategies, and equilibria. Solution concepts such as core, stable sets, and bargaining sets. Voting games, and the Shapley and Banzhaff power indices. This course is offered as both ECO 604 and AMS 552.  
3 credits, Letter graded (A, A-, B+, etc.)  
3 credits, Letter graded (A, A-, B+, etc.)

AMS 553: Simulation and Modeling
A comprehensive course in formulation, implementation, and application of simulation
models. Topics include data structures, simulation languages, statistical analysis, pseudo-random number generation, and design of simulation experiments. Students apply simulation modeling methods to problems of their own design. This course is offered as CSE 529, AMS 553 and MBA 553.

3 credits, Letter graded (A, A-, B+, etc.)

AMS 554: Queuing Theory

Prerequisite: AMS 507
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 555: Game Theory II
Refinements of strategic equilibrium, games with incomplete information, repeated games with and without complete information, and stochastic games. The Shapley value of games with many players, and NTU-values. This course is offered as both ECO 605 and AMS 555.

Prerequisite for AMS 555: AMS 552/ECO 604.
Spring, 0-3 credits, Letter graded (A, A-, B+, etc.)

Spring, 0-3 credits, Letter graded (A, A-, B+, etc.)

AMS 556: Dynamic Programming

3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 562: Numerical Hydrology
Numerical solution methods for the equations of incompressible flow in porous media with special emphasis on groundwater flow. Finite difference and finite element methods for steady-state and transient flows-boundary conditions, range of validity and stability of the numerical schemes, and numerical artifacts. The approach is hands on, with example problems being computed. This course is offered as both GEO 564 and AMS 562.

Prerequisite: AMS 526 or permission of instructor
Fall, 3 credits, Letter graded (A, A-, B+, etc.)
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 565: Wave Propagation

3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 566: Compressible Fluid Dynamics
Physical, mathematical, and computational description in compressible fluid flows. Integral and differential forms of the conservation equations, one-dimensional flow, shocks and expansion waves in two and three dimensions, quasi-one-dimensional flow, transient flow, numerical methods for steady supersonic flow, numerical methods for transient flow.

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 569: Probability Theory I

3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 570: Introduction to Mathematical Statistics
Probability and distributions; multivariate distributions; distributions of functions of random variables; sampling distributions; limiting distributions; point estimation; confidence intervals; sufficient statistics; Bayesian estimation; maximum likelihood estimation; statistical tests.

3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 571: Mathematical Statistics
Sampling distribution; convergence concepts; classes of statistical models; sufficient statistics; likelihood principle; point estimation; Bayes estimators; consistency; Neyman-Pearson Lemma; UMP tests; UMPU tests; Likelihood ratio tests; large sample theory. Offered as HPH 697 or AMS 571.

3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 572: Data Analysis I
Introduction to basic statistical procedures. Survey of elementary statistical procedures such as the t-test and chi-square test. Procedures to verify that assumptions are satisfied. Extensions of simple procedures to more complex situations and introduction to one-way analysis of variance. Basic exploratory data analysis procedures (stem and leaf plots, straightening regression lines, and techniques to establish equal variance). Offered as AMS 572 or HPH 698.

Prerequisite: AMS 312 or permission of instructor
Fall, 3 credits, Letter graded (A, A-, B+, etc.)
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 573: Design and Analysis of Categorical Data
Measuring the strength of association between pairs of categorical variables. Methods for evaluating classification procedures and inter-rater agreement. Analysis of the associations among three or more categorical variables using log linear models. Logistic regression.

Prerequisite: AMS 572
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 575: Internship in Statistical Consulting
Directed quantitative research problem in conjunction with currently existing research programs outside the department. Students specializing in a particular area work on a problem from that area; others work on problems related to their interests, if possible. Efficient and effective use of computers. Each student gives at least one informal lecture to his or her colleagues on a research problem and its statistical aspects.

3-4 credits, Letter graded (A, A-, B+, etc.)
3-4 credits, Letter graded (A, A-, B+, etc.)

AMS 577: Multivariate Analysis

3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)
AMS 578: Regression Theory
3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 581: Analysis of Variance
Analysis of models with fixed effects. The Gauss-Markov theorem; construction of confidence ellipsoids and tests with Gaussian observations. Problems of multiple tests of hypotheses. One-way, two-way, and higher-way layouts. Analysis of incomplete designs such as Latin squares and incomplete blocks. Analysis of covariance problems.
3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 582: Design of Experiments
Discussion of the accuracy of experiments, partitioning sums of squares, randomized designs, factorial experiments, Latin squares, confounding and fractional replication, response surface experiments, and incomplete block designs. Offered as AMS 582 or HPH 699.
3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 586: Time Series
3 credits, Letter graded (A, A-, B+, etc.)
3 credits, Letter graded (A, A-, B+, etc.)

AMS 587: Nonparametric Statistics
This course covers the applied nonparametric statistical procedures; one-sample Wilcoxon tests, two-sample Wilcoxon tests, runs test, Kruskal-Wallis test, Kendall's tau, Spearman's rho, Hodges-Lehman estimation, Friedman analysis of variance on ranks. The course gives the theoretical underpinnings to these procedures, showing how existing techniques may be extended and new techniques developed. An excursion into the new problems of multivariate nonparametric inference is made.

AMS 588: Biostatistics
Statistical techniques for planning and analyzing medical studies. Planning and conducting clinical trials and retrospective and prospective epidemiological studies. Analysis of survival times including singly censored and doubly censored data. Quantitative and quantal bioassays, two-stage assays, routine bioassays. Quality control for medical studies.
Prerequisite: AMS 572 or permission of instructor
Fall, 3 credits, Letter graded (A, A-, B+, etc.)
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 589: Quantitative Genetics
Definition of relevant terminology. Statistical and genetic models for inheritance of quantitative traits. Estimation of effects of selection, dominance polygenes, epistasis, and environment. Linkage studies and threshold characteristics.
Spring, 3 credits, Letter graded (A, A-, B+, etc.)
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 591: Topics for M.S. Students
Various topics of current interest in applied mathematics will be offered if sufficient interest is shown. Several topics may be taught concurrently in different sections.
3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.
3 credits, Letter graded (A, A-, B+, etc.)

AMS 592: Mathematical Methods of Finance and Investments I
A broad-based course in mathematical modeling and quantitative analysis of financial transactions and investment management issues such as debt and equity, measures of risk and returns, efficient markets and efficient set mathematics and empirical finance, e.g., estimation theory, linear and nonlinear regression, time series analysis, modeling and simulation to examine critically various models of prediction for asset-pricing, pricing of derivative products and term-structure of interest rates assuming stochastic volatility. Statistics necessary for analysis is incorporated in the course.
Prerequisite: AMS 592
Fall, 3 credits, Letter graded (A, A-, B+, etc.)
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 593: Financial Mathematics
Accumulation functions, yield rates, annuities, loan repayment, term structure of interest rates/spot rates/forward rates, options, duration/convexity. This course follows the syllabus for Financial Mathematics (FM) Exam of the Society of Actuaries and prepares students to pass the FM Exam.
Offered Fall and Summer, 3 credits, Letter graded (A, A-, B+, etc.)
Summer, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 594: Mathematical Methods of Finance and Investments II
This course employs the techniques of mathematical statistics and empirical finance, e.g., estimation theory, linear and nonlinear regression, time series analysis, modeling and simulation to examine critically various models of prediction for asset-pricing, pricing of derivative products and term-structure of interest rates assuming stochastic volatility. Statistics necessary for analysis is incorporated in the course.
Prerequisite: AMS 592
Fall, 3 credits, Letter graded (A, A-, B+, etc.)
Fall, 3 credits, Letter graded (A, A-, B+, etc.)

AMS 595: Fundamentals of Computing
Introduction to UNIX operating system, C language, graphics, and parallel supercomputing.
Fall, 1 credit, Letter graded (A, A-, B+, etc.)
Fall, 1 credit, Letter graded (A, A-, B+, etc.)

AMS 596: Fundamentals of Large-Scale Computing
Overview of the design and maintenance of large scale computer projects in applied mathematics, including basic programming techniques for massively parallel supercomputers.
Prerequisite: AMS 595 or permission of instructor
Spring, 1 credit, Letter graded (A, A-, B+, etc.)
Spring, 1 credit, Letter graded (A, A-, B+, etc.)

AMS 597: Statistical Computing
Introduction to statistical computing using SAS and S plus.
Fall, 1 credit, Letter graded (A, A-, B+, etc.)
Fall, 1 credit, Letter graded (A, A-, B+, etc.)

AMS 599: Research
May be repeated for credit.

AMS 605: Probability Theory II
AMS 621: Finite Element Methods for Partial Differential Equations

Variational form of the problem, Ritz Galerkins, collocation, and mixed methods; triangular, rectangular (2-D), and tetrahedral (3-D) elements; accuracy, convergence, and stability; solutions of linear, nonlinear steady-state, and dynamic problems; implicit and explicit time integration; equivalence of finite-element and finite-difference methods.

AMS 641: Special Topics in Mathematical Programming

The course is designed for second- and third-year graduate students with a strong foundation in linear algebra and analysis who wish to pursue research in applied mathematics. Varying topics from nonlinear programming and optimization to applied graph theory and applied combinatorics may be offered concurrently.

AMS 644: Special Topics in Applied Probability

The course is designed for second- and third-year graduate students with a background in probability and stochastic modeling who wish to pursue research in applications of the probability theory. Several topics may be taught concurrently in different sections.

AMS 645: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and mathematical statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 646: Special Topics in Mathematical Software

Directed research and/or practical experience in industry, financial and consulting firms, and research institutions. Students are required to have a department faculty adviser who coordinates and supervises the internship. Submission of the final report is required.

AMS 647: Special Topics in Numerical Analysis

Several topics may be taught concurrently in different sections.

AMS 648: Special Topics in Mathematical Programming

Several topics may be taught concurrently in different sections.

AMS 649: Special Topics in Applied Mathematics

Several topics may be taught concurrently in different sections.

AMS 650: Special Topics in Probability and Mathematical Statistics

Several topics may be taught concurrently in different sections.

AMS 651: Nonlinear Analysis and Optimization


AMS 652: Special Topics in Game Theory

The course is designed for second- and third-year graduate students who wish to specialize in the mathematical theory of games.

AMS 653: Biological Physics & Biophysical Chemistry: Theoretical Perspectives

This course will survey a selected number of topics in biological physics and biophysical chemistry. The emphasis is on the understanding of physical organization principles and fundamental mechanisms involved in the biological process. The potential topics include: Protein Folding, Protein Dynamics, Biomolecular Interactions and Recognition, Electron and Proton Transfer, Motors, Membranes, Single Molecules and Single Cells, Cellular Networks, Development and Differentiation, Brains and Neural Systems, Evolution. There will be no homework or exams. The grades will be based on the performance of the term projects. Crosslisted with PHY 680 and CHE 683.

AMS 654: Special Topics in Partial Differential Equations

A strong foundation in analysis and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 655: Special Topics in Probability and Mathematical Statistics

Several topics may be taught concurrently in different sections.

AMS 656: Special Topics in Differential Equations and Applied Analysis

The course is designed for second- and third-year graduate students with a strong foundation in analysis who wish to pursue research in applied mathematics. Several topics may be taught concurrently in different sections.

AMS 657: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 658: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 659: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 660: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 661: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 662: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 663: Special Topics in Numerical Analysis and Scientific Computing

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AMS 664: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 665: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 666: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 667: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 668: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 669: Special Topics in Numerical Analysis and Scientific Computing

Analysis and Scientific Computing

AMS 670: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 671: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 672: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 673: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 674: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 675: Special Topics in Probability and Mathematical Statistics

The course is designed for second- and third-year graduate students with a strong foundation in probability and statistics who wish to pursue research in mathematical statistics. Several topics may be taught concurrently in different sections.

AMS 676: Internship in Applied Mathematics

Directed research and/or practical experience in industry, financial and consulting firms, and research institutions. Students are required to have a department faculty adviser who coordinates and supervises the internship. Submission of the final report is required.

AMS 677: Internship in Applied Mathematics

Directed research and/or practical experience in industry, financial and consulting firms, and research institutions. Students are required to have a department faculty adviser who coordinates and supervises the internship. Submission of the final report is required.

AMS 678: Biological Physics & Biophysical Chemistry: Theoretical Perspectives

This course will survey a selected number of topics in biological physics and biophysical chemistry. The emphasis is on the understanding of physical organization principles and fundamental mechanisms involved in the biological process. The potential topics include: Protein Folding, Protein Dynamics, Biomolecular Interactions and Recognition, Electron and Proton Transfer, Motors, Membranes, Single Molecules and Single Cells, Cellular Networks, Development and Differentiation, Brains and Neural Systems, Evolution. There will be no homework or exams. The grades will be based on the performance of the term projects. Crosslisted with PHY 680 and CHE 683.
students must enroll in one of the graduate student insurance plans and should be advised by an International Advisor.

AMS 701: Dissertation Research off Campus - International

Prerequisite: Must be advanced to candidacy (G5). Major portion of research will take place outside of the United States and/or U.S. provinces. Domestic students have the option of the health plan and may also enroll in MEDEX. International students who are in their home country are not covered by mandatory health plan and must contact the Insurance Office for the insurance charge to be removed. International students who are not in their home country are charged for the mandatory health insurance. If they are to be covered by another insurance plan they must file a waiver by second week of classes. The charge will only be removed if other plan is deemed comparable.

All international students must received clearance from an International Advisor.

AMS 800: SUMMER RESEARCH

May be repeated for credit.