Course Descriptions

Mathematics and Applied Mathematics Courses

MATH 5300 Mathematics for Non-Majors (3 semester hours) Algebraic and analytical mathematics for mathematics in the social, behavioral and management sciences. The course also prepares for MATH 5304. No credit allowed to mathematical sciences majors. (3-0) S

MATH 5301 Elementary Analysis I (3 semester hours) Real numbers, differentiation, integration, metric spaces, basic point set topology, power series, analytic functions, Cauchy's theorem. Prerequisite: Multivariable calculus (MATH 2421) and theoretical concept of calculus (MATH 3310) or equivalent. (3-0) Y

MATH 5302 Elementary Analysis II (3 semester hours) Continuation of MATH 5301. Prerequisite: MATH 5301. (3-0) Y

MATH 5304 Applied Mathematical Analysis for Non-Majors (3 semester hours) Techniques of mathematical analysis applicable to the social, behavioral and management sciences. Differential and integral calculus of one and many variables. No credit allowed to mathematical sciences majors. Prerequisite: College Algebra (3-1) S

MATH 5305 Higher Geometry for Teachers (3 semester hours) Topics in modern Euclidean geometry including distinguished points of a triangle, circles including the nine-point circle, cross ratio, transformations; introduction to projective geometry. No credit allowed to mathematical sciences majors except those in M.A.T. program. Prerequisite: Junior level mathematics course. (3-0) T

MATH 5306 Non-Euclidean Geometry for Teachers (3 semester hours) The relations among elliptic, Euclidean and hyperbolic geometries, Euclidean models of elliptic and hyperbolic geometries. No credit allowed to mathematical sciences majors except those in M.A.T. program. Prerequisite: Junior-level mathematics course. (3-0) T

MATH 5313 Modern Algebra for Teachers (3 semester hours) Study of modern algebra involving groups, rings, fields and Galois theory. No credit allowed to mathematical sciences majors except those in M.A.T. program. Prerequisite: Junior-level mathematics course. (3-0) R

MATH 5390 Topics in Mathematics (3 semester hours) May be repeated for credit as topics vary (9 hours maximum). (3-0) R

MATH 6301 Real Analysis (3 semester hours) Measure theory and integration. Hilbert and Banach spaces. Prerequisites: Undergraduate analysis course (e.g., MATH 4301-2 or MATH 5301-2) undergraduate course in linear algebra (MATH 2418) or equivalent. (3-0) Y

MATH 6302 Real and Functional Analysis (3 semester hours) Continuation of MATH 6301, Hilbert and Banach space techniques. Prerequisite: MATH 6301. (3-0) Y

MATH 6303 Theory of Complex Functions I (3 semester hours) Complex integration, Cauchy's theorem, calculus of residues, power series, entire functions, Riemann mapping theorems. Riemann surfaces, conformal mapping with applications. Prerequisite: Undergraduate analysis (e.g., MATH 4301-2). (3-0) Y

MATH 6304 Theory of Complex Functions II (3 semester hours) Continuation of MATH 6303. Prerequisite: MATH 6303. (3-0) T

MATH 6305 Mathematics of Signal Processing (3 semester hours) The course is devoted to a mathematical foundation of some of the key topics in signal processing: discrete and continuous signal transforms, analysis and design of filters [e.g. lattice filters], least square methods and algorithms. Prerequisites: Undergraduate analysis (MATH 4301-2 or MATH 5301-2); undergraduate course in linear algebra (MATH 2418); undergraduate course in complex variables (MATH 3379) or equivalent. (3-0) T

MATH 6306 Topology and Geometry (3 semester hours) Topics in topology, differential geometry and their applications to areas such as biological sciences and engineering. Prerequisite: Undergraduate analysis (MATH 4301-2 or MATH 5301-2). (3-0) T

MATH 6307 Wavelets and Their Applications (3 semester hours) An introduction to windowed Fourier and continuous wavelet transforms, generalized frames, discrete wavelet frames, multiresolution analysis, Daubechies' orthogonal wavelet bases, and their applications in partial differential equations and signal processing. Prerequisite: Undergraduate linear algebra (MATH 2418) and differential equations (MATH 2420) or equivalent (3-0). T

MATH 6308 Inverse Problems and Applications (3 semester hours) Exact and approximate methods of nondestructive inference, such as tomography and inverse scattering theory in one and several dimensions, with applications in physical and biomedical sciences and engineering. Prerequisite: Undergraduate linear algebra (MATH 2418) and differential equations (MATH 2420) or equivalent. (3-0) T

MATH 6311 Abstract Algebra I (3 semester hours) Basic properties of groups, rings, fields, and modules. Topics selected from group representations, Galois theory, local rings, algebraic number theory, classical ideal theory, basic homological algebra, and elementary algebraic geometry. Prerequisite: Undergraduate algebra course (MATH 3311) or equivalent. (3-0) T

MATH 6313 Numerical Analysis (3 semester hours) A study of numerical methods including the numerical solution of non-linear equations, linear systems of equations, interpolation, iterative methods and approximation by polynomials. Prerequisites: Knowledge of a high level programming language, Linear algebra (MATH 2418) and multivariable calculus (MATH 2451). (3-0) T

MATH 6315 Ordinary Differential Equations (3 semester hours) The study of ordinary differential equations with emphasis on existence, uniqueness, linear systems, boundary value problems, and stability. Prerequisites: Undergraduate course in linear algebra (MATH 2418) or equivalent; undergraduate analysis (MATH 4301-2 or Math 5301-2); undergraduate course in ordinary differential equations (MATH 2420). (3-0) Y

MATH 6316 Differential Equations (3 semester hours) Continuation of MATH 6315 and an introduction to partial differential equations. Prerequisite: MATH 6315. (3-0) T

MATH 6318 Numerical Analysis of Differential Equations (3 semester hours) Practical and theoretical aspects of numerical methods for both ordinary and partial differential equations are discussed. Topics selected from: initial value problems for ordinary differential equations, two-point boundary value problems, projection methods, finite difference, finite element and boundary element approximations for partial differential equations. Prerequisites: MATH 6313 or equivalent. (3-0) T

MATH 6319 Principles and Techniques in Applied Mathematics I (3 semester hours) Mathematical methods usually used in applied sciences and engineering. Topics chosen

from basic linear space theory; Hilbert spaces; fixed point theorems and applications to differential and integral equations; spectral theorem; distributions; Sobolev spaces; the Fourier transforms; complex function theory, calculus of residues; exact, approximate and asymptotic solutions to Laplace, heat and wave equations, Eikonal and WKB methods, and special functions. Prerequisite: Undergraduate linear algebra (MATH 2418), and differential equations (MATH 2420) or equivalent. (3-0) T

MATH 6320 Principles and Techniques in Applied Mathematics II (3 semester hours) Continuation of Math 6319. Prerequisite: MATH 6319. (3-0) T

MATH 6321 Optimization (3 semester hours) Introduction to theoretical and practical concepts of optimization in finite and infinite dimensional setting, least-squares estimation, optimization of functionals, local and global theory of constrained optimization, iterative methods. Prerequisites: Undergraduate ordinary differential equations (MATH 2420) and linear algebra (MATH 2418). (3-0) T

MATH 6331 Linear Systems and Signals (3 semester hours) Basic principles of systems and control theory: state space representations, stability, observableness, controllability, realization theory, transfer functions, feedback. Prerequisites: Undergraduate course in linear algebra (MATH 2418) and undergraduate analysis course or MATH 5301-2. (3-0) T

MATH 6332 Advanced Control (3 semester hours) Theoretical and practical aspects of modern control methodologies in state space and frequency domain, in particular LQG and H-infinity control: coprime factorizations, internal stability, Kalman filter, optimal regulator, robust control, sensitivity minimization, loop shaping, model reduction. Prerequisite: MATH 6331. (3-0) T

MATH 6336 Nonlinear Control Systems (3 semester hours) Differential geometric tools, input-output maps, feedback linearization, nonlinear observers, input-output linearization, output tracking, and regulation. Prerequisites: MATH 6315 and MATH 6331. (3-0) T

MATH 6339 Control of Distributed Parameter Systems (3 semester hours) Theoretical and technical issues for control of distributed parameter systems in the context of linear infinite dimensional dynamical systems: Evolution equations and control on Euclidean space, elements of functional analysis, semigroups of linear operators, abstract evolution equations, control of linear infinite dimensional dynamical systems, approximation techniques. Prerequisites: Undergraduate course in partial differential equations (MATH 4362) and analysis (MATH 4301). (3-0) T

MATH 6341 Bioinformatics (3 semester hours) Fundamental mathematical and algorithmic theory behind current bioinformatics techniques are covered and implemented. They include hidden Markov models, dynamic programming, genetic algorithms, simulated annealing, neural networks, cluster analysis, and information theory. Prerequisites: Knowledge of Unix and a high level programming language. (3-0) T

MATH 6343 Computational Biology (3 semester hours) Mathematical and computational methods and techniques to analyze and understand problems in molecular biology are covered. Topics include sequence homology and alignment, genetic mapping, protein folding, and DNA computing. Prerequisite: MATH 2418 or equivalent. (3-0) T

MATH 6345 Mathematical Methods in Medicine and Biology (3 semester hours)

Introduction to the use of mathematical techniques in solving biologically important problems. Some examples of topics that might be covered are biochemical reactions, ion channels, cellular signaling mechanisms, kidney function, nerve impulse propagation. Prerequisites: MATH 2417, MATH 2419,MATH 2420 recommended. (3-0) T

MATH 6364 Stochastic Calculus in Finance (3 semester hours) Brownian Motion, Ito Calculus, Feynman-Kac formula and an outline of Stochastic Control, Black Scholes Analysis, Transaction Costs, Optimal Portfolio Investment. Prerequisites: STAT 4351 or equivalent, and MATH 2451 or equivalent. (3-0) T

MATH 6390 Topics in Mathematics (3 semester hours) May be repeated for credit as topics vary (9 hours maximum). (3-0) R

MATH 6V81 Special Topics in Mathematics (1-9 semester hours) Topics vary from semester to semester. May be repeated for credit as topics vary. ([1-9]-0) S

MATH 7313 Partial Differential and Integral Equations I (3 semester hours) Topics include theory of partial differential and integral equations. Classical and modern solution techniques to linear and nonlinear partial differential equations and boundary value problems. Introduction to the theory of Sobolev spaces. Prerequisite: MATH 6316 recommended. (3-0) T

MATH 7314 Partial Differential and Integral Equations II (3 semester hours) Continuation of MATH 7313. General theory of partial differential and integral equations, with emphasis on existence, uniqueness and qualitative properties of solutions. Prerequisite: MATH 7313. (3-0) T

MATH 7316 Wave Propagation with Applications (3 semester hours) Study of the wave equation in one, two and three dimensions, the Helmholtz equation, associated Green's functions, asymptotic techniques for solving the propagation problems with applications in physical and biomedical sciences and engineering. Prerequisites: MATH 6303, MATH 6318. (3-0) T

MATH 7319 Functional Analysis (3 semester hours) Elements of operator theory, spectral theory, topics in Banach and operator algebras. Prerequisites: MATH 6301-2. MATH 6303 recommended. (3-0) T

MATH 7390 Topics in Mathematics (3 semester hours) May be repeated for credit as topics vary (9 hours maximum). (3-0) R

MATH 8V02 Individual Instruction in Mathematics (1-6 semester hours) May be repeated for credit. ([1-6]-0) S

MATH 8V04 Topics in Mathematics (1-6 semester hours) May be repeated for credit. ([1-6]-0) R

MATH 8V07 Research (1-9 semester hours) Open to students with advanced standing subject to approval of the Graduate Adviser. May be repeated for credit. ([1-9]-0) S

MATH 8V98 Thesis (3-9 semester hours) May be repeated for credit. ([3-9]-0) S

MATH 8V99 Dissertation (3-9 semester hours) May be repeated for credit. ([3-9]-0) S

Statistics Courses

STAT 5191 Statistical Computing Packages (1 semester hour) Introduction to use of major statistical packages such as SAS, BMD, and Minitab. Based primarily on self-study materials. No credit allowed to mathematical sciences majors. Prerequisite: One

semester of statistics. (1-0) S

STAT 5351 Probability and Statistics I (3 semester hours) A mathematical treatment of probability theory. Random variables, distributions, conditioning, expectations, special distributions and the central limit theorem. The theory is illustrated by numerous examples. This is a basic course in probability and uses calculus extensively. Prerequisite: Multivariable calculus (MATH 2451). (3-0) T

STAT 5352 Probability and Statistics II (3 semester hours) Theory and methods of statistical inference. Sampling, estimation, confidence intervals, hypothesis testing, analysis of variance, and regression with applications. Prerequisite: STAT 5351. (3-0) T

STAT 5390 Topics in Statistics (3 semester hours) May be repeated for credit as topics vary (9 hours maximum).(3-0) R

STAT 6326 Sampling Theory (3 semester hours) Introduction to survey sampling theory and methods. Topics include simple random, stratified, systematic, cluster, unequal probability, multistage, spatial sampling designs. Estimation of means, proportions, variances, ratios, and other parameters for a finite population, optimal allocation, detectability, multiplicity. Prerequisite: STAT 5351. (3-0) T

STAT 6329 Applied Probability and Stochastic Processes (3 semester hours) Basic random processes used in stochastic modeling, including Poisson, Gaussian, and Markov processes with an introduction to queuing theory. Measure theory not required. Prerequisite: STAT 5351. (3-0) T

STAT 6331 Statistical Inference I (3 semester hours) Introduction to fundamental concepts and methods of statistical modeling and decision making. Exponential families of models, sufficiency, estimation, hypothesis testing, likelihood methods, optimality, analysis of variance, linear models, decision theory. Prerequisites: Undergraduate analysis MATH 4301-2, STAT 5351 or equivalent and MATH 5302 or equivalent. STAT 5352 strongly recommended. (3-0) Y

STAT 6332 Statistical Inference II (3 semester hours) Topics chosen from elementary and advanced asymptotic methods, including sample quantiles, U-statistics, differentiable statistical functions, the MLE, L-statistics, M-statistics, the bootstrap, advanced aspects of statistical inference, likelihood-based inference, robust statistics, linear models and the analysis of discrete data.. Prerequisites: STAT 6331 and STAT 6344 should be taken either before or concurrently. (3-0) T

STAT 6337 Advanced Statistical Methods I (3 semester hours) Statistical methods most often used in the analysis of data. Study of statistical models, including multiple regression, nonlinear regression, stepwise regression, balanced and unbalanced analysis of variance, analysis of covariance and log-linear analysis of multiway contingency tables. Prerequisites: MATH 2451 and STAT 5352 or STAT 6331. (3-0) T

STAT 6338 Advanced Statistical Methods II (3 semester hours) Continuation of STAT 6337. Prerequisite: STAT 6337. (3-0) T

STAT 6339 Linear Statistical Models (3 semester hours) Vectors of random variables, multivariate normal distribution, quadratic forms. Theoretical treatment of general linear models, including the Gauss-Markov theorem, estimation, hypotheses testing, and polynomial regression. Introduction to the analysis of variance and analysis of covariance. Prerequisites: STAT 6331 and MATH 2418 or equivalent. (3-0) T

STAT 6341 Numerical Linear Algebra and Statistical Computing (3 semester hours) A study of computational methods used in statistics. Topics to be covered include the

simulation of stochastic processes, numerical linear algebra, and graphical methods. Prerequisite: STAT 5352 or STAT 6337. (3-0) T

STAT 6343 Experimental Design (3 semester hours) This course focuses on the planning, development, implementation and analysis of data collected under controlled experimental conditions. Repeated measures designs, Graeco-Latin square designs, randomized block designs, balanced incomplete block designs, partially balanced incomplete block designs, fractional replication and confounding. The course requires substantive use of computer facilities. Prerequisite: STAT 6338 or equivalent knowledge of fixed and random effects crossed ANOVA designs. (3-0) T

STAT 6344 Probability Theory I (3 semester hours) A measure theoretic coverage of probability theory. Measure, integration, Fubini's theorem, random variables, distribution functions, characteristic functions, independence, laws of large numbers, central limit theorem, three-series theorem, Glivenko-Cantelli theorem, conditional probability and expectation, introduction to martingales. Prerequisite: MATH 6301. (3-0) T

STAT 6347 Applied Time Series Analysis (3 semester hours) Methods and theory for the analysis of data collected over time. The course covers techniques commonly used in both the frequency domain (harmonic analysis) and the time domain (autoregressive, moving average models). Prerequisite: STAT 6337 or STAT 6339 or equivalent. (3-0) T

STAT 6348 Applied Multivariate Analysis (3 semester hours) The most frequently used techniques of multivariate analysis. Topics include T/T2, MANOVA, principal components, discriminant analysis and factor analysis. Prerequisite: STAT 5352 or STAT 6331. (3-0) T

STAT 6365 Statistical Quality and Process Control (3 semester hours) Statistical methodology of monitoring, testing, and improving the quality of goods and services is developed at the intermediate level. Topics include control charts for variables and attributes, assessment of process stability and capability, construction and interpretation of CUSUM, moving average charts and V-masks, optimal sampling techniques, and evaluation of operating-characteristic curves and average time to detection. Prerequisite: STAT 5311, or STAT 5351, or equivalent. (3-0) T

STAT 6390 Topics in Statistics (3 semester hours) May be repeated for credit as topics vary (9 hours maximum). (3-0) R

STAT 6V99 Statistical Consulting (1-3 semester hours) Practical experience in collaboration with individuals who are working on problems which are amenable to statistical analysis. Problem formulation, statistical abstraction of the problem, and analysis of the data. Course may be repeated but a maximum of three hours may be counted toward the requirements for the master's degree. Prerequisite: Consent of instructor. ([1-3]-0) T

STAT 7330 Decision Theory and Bayesian Inference (3 semester hours) Statistical decision theory and Bayesian inference are developed at an intermediate mathematical level. Prerequisites: MATH 4301 and MATH 4302 or MATH 5302 and either STAT 6331 or STAT 6338. (3-0) T

STAT 7331 Multivariate Analysis (3 semester hours) Vector space foundations and geometric considerations. The multivariate normal distribution: properties, estimation, and hypothesis testing. Multivariate t-test. Classification problems. The Wishart distribution. General linear hypothesis and MANOVA. Principal components, canonical correlations, factor analysis. Multivariate nonparametric methods. Prerequisite: STAT

6331 or equivalent. (3-0) T

STAT 7334 Nonparametric and Robust Statistical Methods (3 semester hours) Topics chosen from Order statistics, ranks, L-statistics, M-statistics, R-statistics. One- and multi-sample location and scale problems. Nonparametric ANOVA. Pitman asymptotic relative efficiency. Minimax asymptotic variance and minimum bias criteria for robust estimation. Robust confidence limits. Optimal influence curves. Nonparametric/robust density and regression estimation. Nonparametric inference for counting processes. Prerequisite: STAT 6331 or equivalent. (3-0) T

STAT 7338 Time Series Modeling and Filtering (3 semester hours) Theory of correlated observations observed sequentially in time. Stationary processes, power spectra, stationary models fitting, correlation analysis and regression. Prerequisite: STAT 6331 or equivalent. (3-0) T

STAT 7345 Advanced Probability and Stochastic Processes (3 semester hours) Possible topics include Martingales, Kolmogorov's existence theorem, random walk, Markov chains, the Poisson process, the general birth and death process, other Markov processes, renewal processes, Brownian motion and diffusion, and stationary processes. Prerequisite: STAT 6344. (3-0) T

STAT 7390 Topics in Statistics (3 semester hours) May be repeated for credit as topics vary (9 hours maximum). (3-0) R

STAT 8V02 Individual Instruction in Statistics (1-6 semester hours) May be repeated for credit. ([1-6]-0) S

STAT 8V03 Advanced Topics in Statistics (1-6 semester hours) May be repeated for credit. ([1-6]-0) R

STAT 8V07 Research in Statistics (1-9 semester hours) Open to students with advanced standing, subject to approval of the graduate adviser. May be repeated for credit. ([1-9]-0) S

STAT 8V98 Thesis (3-9 semester hours) May be repeated for credit. ([3-9]-0) S

STAT 8V99 Dissertation (3-9 semester hours) May be repeated for credit. ([3-9]-0) S