

Department of Mathematics and Statistics

Objectives

The undergraduate programs in Mathematics and Statistics have the following objectives:

1. Students in algebra courses develop the algebra skills needed in later courses.
2. Students in general education courses gain an understanding of mathematics as a language in which to express, define and answer questions about the world.
3. Students in courses that serve the sciences and engineering, particularly calculus and linear algebra courses, develop technical skills, learn to apply mathematical tools and develop an understanding of the mathematical basis for those tools.
4. Students in statistics courses develop an understanding of the basic concepts of probability and statistics and learn how to use statistical tools in real-life problems.
5. Education students with a mathematics teaching major or minor gain a basic understanding of several areas of mathematics, develop a sense for exploring mathematics and learn to read, write and present mathematics.
6. Mathematics majors become acquainted with the major branches of the discipline, learn to read and write mathematics and develop the mathematical skills and general knowledge necessary for employment or for graduate work in mathematics or other fields.

Faculty

Chair and Professor

(To Be Determined)

Assistant Chair and Professor

Laquer, H. Turner,* Assistant Department Chair and Professor, Mathematics. B.S. 1977, University of New Mexico; M.A. 1979, Ph.D. 1982, Harvard University. (1989)

Professors

Chen, Shu-Chuan 'Grace', Professor, Statistics. B.A. 1994, National Chung-Hsing University (Taiwan); M.S. 1996, National Donghua University (Taiwan); Ph.D. 2003, Pennsylvania State University. (2012)

Chen, Yu,* Professor, Mathematics. M.S. 1994, Tongji University, PRC; D.S. 1997, East China Normal University; Ph.D. 2002, The University of Notre Dame. (2003)

Derryberry, DeWayne,* Professor, Statistics. B.S. 1988; M.S. 1990, Arizona State University; Ph.D. 1998, Oregon State University. (2006)

Fisher, Robert J., Jr.,* Department Chair and Professor, Mathematics. B.A. 1975, College of the Holy Cross; Ph.D. 1981, University of Massachusetts. (1989)

Hanin, Leonid G.,* Professor, Mathematics. M.S. 1978, University of Leningrad; Ph.D. 1985, Steklov Mathematical Institute. (1997)

Kriloff, Catherine E.,* Professor, Mathematics. B.S. 1990, University of Washington; M.S. 1992, Ph.D. 1995, University of Michigan. (1997)

Palmer, Bennett,* Professor, Mathematics. B.S. 1979, University of Massachusetts, Amherst; Ph.D. 1986, Stanford University. (2002)

Payne, Tracy,* Professor, Mathematics. B.S. 1988, University of Wisconsin; Ph.D. 1995, University of Michigan. (2001)

Wolper, James S.,* Professor, Mathematics. A.B. 1976, Harvard University; Ph.D. 1981, Brown University. (1991)

Associate Professors

Gryazin, Yuriy A.,* Associate Professor, Mathematics. M.S. 1986, M.S. 1991, Ph.D. 1996, Novosibirsk State University. (2001)

Zhu, Wenxiang,* Associate Professor, Mathematics. B.S. 1997, M.S. 1995, Fudan University, China; Ph.D. 2002, Iowa State University. (2006)

Zhu, Yunrong,* Associate Professor, Mathematics. B.S. 2000, M.S. 2003, Southeast University (China); Ph.D. 2008, Pennsylvania State University. (2012)

Assistant Professor

Xie, Xiao Xia 'Jessica', At Rank Assistant Professor, Mathematics. B.S. 2006, M.S. 2009, Lanzhou University (China); Ph.D. 2014, Auburn University. (2016)

Visiting Assistant Professor

Yeroshkin, Dmytro, Visiting Assistant Professor, Mathematics. B.S. 2009, St Joseph's University; Ph.D. 2014, University of Pennsylvania. (2016)

Senior Lecturers

Martin, Annik, Senior Lecturer, Mathematics. B.A. 1998, Bishops University; M.S. 1999, Dalhousie University. (2001)

Reed, Jason D., Senior Lecturer, Mathematics. B.S. 2001, M.S. 2003, Idaho State University. (2003)

Associate Lecturers

Bowen, Randy, Associate Lecturer, Mathematics. B.S. 1999, M.S. 2001, Idaho State University. (2005)

Jones, Pageant L., Associate Lecturer, Mathematics. B.A., 1992, B.S. 1998, M.S. 2000, Idaho State University. (2001)

Kress, Randa L., Associate Lecturer/Course Coordinator, Mathematics. B.A. 1997, M.S. 1999, Idaho State University. (1995)

Mills, Amy Lea, Associate Lecturer, Mathematics. B.S. 1999, Colorado State University; M.N.S. 2000, Idaho State University. (2000)

Potter, Russell T., Associate Lecturer, Mathematics. M.N.S. 1997, D.A. 2003, Idaho State University. (2002)

Qu, Qingqin, Associate Lecturer, Mathematics. B.S. 2001, Shandong Normal University, China; M.S. 2004, Southeast University, China; Ph.D. 2012, Pennsylvania State University. (2012)

Assistant Lecturers

Alexander, Linda, Assistant Lecturer, Mathematics. BS, South Dakota School of Mines & Technology; MS, Idaho State University. (2010)

Christensen, Tony, Assistant Lecturer, Mathematics. BS, MS, Idaho State University. (2014)

Jacobsen, Michael, Assistant Lecturer, Mathematics. BS, MS, Idaho State University. (2014)

Lundeen, Suzanne R., Associate Lecturer, Mathematics. B.S., 2000, M.S. 2004, Idaho State University (2010)

Adjunct Instructors

Barclay, Bryan

Dewey, David

Engle, Linda

Frischmann, Julie

Harmon, Kenneth

Judy, Kathleen

Larish, Janalyn

Mayes, Bill

Emeriti

Cresswell, Don

Ford, Lawrence C.,* Associate Vice President for Special Programs and Enrollment Management; Associate Professor, Mathematics. 1984-2009

Gironella, Ann Inez,* Associate Professor, Mathematics. 2003-2015

Hill, Linda Charlotte, Associate Professor, Mathematics. 1976-2006

Hill, Richard D.,* Professor, Mathematics. 1967-2012

Kratz, Lawrence J.,* Professor, Mathematics. 1966-2010

Lang, Patrick M., Professor, Mathematics. 1985-2012

Parker, Stephen K., Associate Professor, Mathematics. 1972-2002

Stowe, Dennis C.,* Professor, Mathematics. 1988-2015

Mathematics Core

All bachelor degrees offered in the Department of Mathematics have a common core consisting of the following six courses:

CS 1181	Computer Science and Programming I ¹	3
MATH 1170	Calculus I	4
MATH 1175	Calculus II	4
MATH 2275	Calculus III	4
MATH 2240	Linear Algebra	3
MATH 3326	Elementary Analysis	3
Total Credits		21

¹ The two courses, ME 1165, Structured Programming, and ME 2266, Symbolic Programming, may be substituted for CS 1181.

Bachelor of Science in Mathematics

The Bachelor of Science program in Mathematics is designed to prepare students to take positions in industry, to pursue graduate training, or to enter the teaching profession. It allows some flexibility in course work which necessitates close

cooperation with a mathematics department advisor who should be selected early in the student's career.

Students must fulfill the university's General Education Requirements (a minimum of 36 credits--see the General Education Requirements (<http://coursecat.isu.edu/undergraduate/academicinformation/generaleducation>) in the Academic Information section of this catalog).

Required Courses:

Math Core (See above)		21
MATH 2287	Foundations of Mathematics	3
MATH 3360	Differential Equations	3
MATH 4407	Modern Algebra I	3
MATH 4423	Introduction to Real Analysis I	3
Plus ONE of the following courses:		3
MATH 3327	Vector Analysis	
MATH 3335	Elementary Number Theory	
MATH 3343	Modern Geometry I	
MATH 3352	Introduction to Probability	
MATH 3362	Introduction to Complex Variables	
Plus 12 more credits of 4000-level mathematics coursework, which includes completing two of the following sequences:		12
MATH 4407 & MATH 4408	Modern Algebra I and Modern Algebra II	
MATH 4423 & MATH 4424	Introduction to Real Analysis I and Introduction to Real Analysis II	
MATH 4441 & MATH 4442	Introduction to Numerical Analysis I and Introduction to Numerical Analysis II	
MATH 4450 & MATH 4451	Mathematical Statistics I and Mathematical Statistics II	

Bachelor of Science in Statistics

The Bachelor of Science program in Statistics is designed to prepare students to take positions in industry or pursue graduate training.

Students must fulfill the university's General Education Requirements (a minimum of 36 credits--see the General Education Requirements (<http://coursecat.isu.edu/undergraduate/academicinformation/generaleducation>) in the Academic Information section of this catalog.)

Required Courses (39 credits):

Mathematics Core (Shown above)		21
MATH 3350	Statistical Methods	3
MATH 3352	Introduction to Probability	3
MATH 4450 & MATH 4451	Mathematical Statistics I and Mathematical Statistics II	6
MATH 4457	Applied Regression Analysis	3
MATH 4458	Experimental Design	3

Additional Courses (9 credits):

A student must take 9 additional credits from the following list to complete the degree. With departmental approval, 3 of the 9 credits may be completed by taking an appropriate advanced course (4000-level) in another field such as Biology, Economics, etc.

MATH 3360	Differential Equations	
MATH 4406	Advanced Linear Algebra	

MATH 4423	Introduction to Real Analysis I
MATH 4424	Introduction to Real Analysis II
MATH 4441	Introduction to Numerical Analysis I
MATH 4442	Introduction to Numerical Analysis II
MATH 4453	Topics in Statistics ¹
MATH 4459	Applied Multivariate Analysis

¹ This is a 1-3 credit course, repeated for up to 3 credits.

Associate of Science in Mathematics

Students seeking an Associate of Science degree in Mathematics must complete the following:

General Education Objectives for the Bachelor of Science (minimum 36 cr) ¹

One of the two tracks described below. Track A is designed to provide the student with a broad overview of basic topics in mathematics.

Track B is designed to provide the student with lower-division coursework generally expected for a major or minor in mathematics.

Track A

MATH 1123	Mathematics in Modern Society	3
MATH 1127	The Language of Mathematics	3
MATH 1130	Finite Mathematics	3
MATH 1144	Trigonometry ²	2
MATH 1160	Applied Calculus	3
MATH 1153	Introduction to Statistics	3
CS 1181	Computer Science and Programming I	3

Track B

CS 1181	Computer Science and Programming I	3
MATH 1170	Calculus I	4
MATH 1175	Calculus II	4
MATH 2275	Calculus III	4
MATH 2287	Foundations of Mathematics	3
Approved MATH electives		3
Electives to bring total to 60 credits		

¹ The number of credits required for the General Education requirements varies depending on the student's performance on proficiency or placement tests in English, foreign languages, and mathematics.

² MATH 1144 may be waived given a sufficient score on the Mathematics Placement Exam or the Mathematics Sub-Test of the ACT or SAT.

Minor in Applied Mathematics

Mathematics Core (See above)		21
MATH 3360	Differential Equations	3
Select ONE of the following:		3
MATH 3352	Introduction to Probability	
MATH 4421	Advanced Engineering Mathematics I	
MATH 4441	Introduction to Numerical Analysis I	
MATH 4465	Partial Differential Equations	

Minor in Mathematics

Mathematics Core (See above)		21
Select TWO of the following:		6

MATH 3327	Vector Analysis
MATH 3335	Elementary Number Theory
MATH 3343	Modern Geometry I
MATH 3352	Introduction to Probability
MATH 3360	Differential Equations
MATH 3362	Introduction to Complex Variables
MATH 4407	Modern Algebra I
MATH 4408	Modern Algebra II
MATH 4423	Introduction to Real Analysis I
MATH 4424	Introduction to Real Analysis II
MATH 4444	Modern Geometry II

Minor in Statistics

Required Courses (27 credits):

Mathematics Core (See above)		21
MATH 3350	Statistical Methods	3
MATH 3352	Introduction to Probability	3
Select ONE of the following:		3
MATH 4450	Mathematical Statistics I	
MATH 4451	Mathematical Statistics II	
MATH 4453	Topics in Statistics ¹	
MATH 4457	Applied Regression Analysis	
MATH 4458	Experimental Design	
MATH 4459	Applied Multivariate Analysis	
Total Credits		30

¹ This is a 1-3 credit course, repeated for up to 3 credits

Mathematics Courses

All mathematics courses except MATH 0015 have prerequisites. Students place into a course either by completing the prerequisite courses with a grade of C- or better or by achieving appropriate scores on the ACT Mathematics exam, SAT Mathematics exam, or other accepted exam. For placement purposes, prerequisite coursework or placement examinations must have been taken within the last seven years. See the Mathematics Department (<http://isu.edu/math>) for further information.

Students must pass a mathematics course with a grade of C- or better before using that course as a prerequisite for another mathematics or statistics course.

Courses

MATH 0015 Arithmetic and Pre-Algebra: 3 semester hours.

Arithmetic of integers and rational numbers. Decimals; introduction to variables; linear equations; problems involving rates, ratios, proportions and percentages. Not eligible for academic credit. F, S, Su

MATH 0025 Elementary Algebra: 3 semester hours.

Variables and algebraic expressions. Absolute value; linear equations and inequalities and their applications; expansion and factorization of polynomials; rational expressions; radical expressions; the real number line; the Cartesian coordinate system and graphing of linear equations. Equivalent to TGE 0100A. PREREQ: C- in MATH 0015, a Math ACT score of 16 or higher, an SAT score of 390 or higher, or 46 or higher on the Pre-algebra section (MAPL 1). F, S, Su

MATH 0090 Accelerated Mathematics Placement: 3 semester hours.

Self-paced alternative to any subsequence of MATH 0015, MATH 0025, MATH 1108, MATH 1143, or MATH 1144. Starting with MATH 0015, students sequentially complete modules and then take a mastery exam for each course. Scoring 90% or above on each exam earns placement equivalent to having passed the corresponding course. Intended for students with enough mathematics background to work independently. Credits earned do not count toward graduation credits. Graded S/U. F, S

MATH 0099 Experimental Course: 1-6 semester hours.

This course is not described in the catalog. The course title and number of credits are announced in the class schedule by the scheduling department. Experimental courses may be offered no more than three times. May be repeated.

MATH 1108 Intermediate Algebra: 4 semester hours.

Topics in algebra, with an emphasis on solving equations and inequalities. Systems of linear equations; quadratic equations and the quadratic formula; polynomial, absolute value, rational, and radical equations and inequalities. Radical and rational exponents. Parabolas, distance formula and circles. PREREQ: C- in MATH 0025, a Math ACT score of 17 or higher, an SAT score of 420 or higher, or 35 on the Algebra section (MAPL 2). F, S, Su

MATH 1123 Mathematics in Modern Society: 3 semester hours.

Survey of applications of mathematics to real-world problems. Topics from graph theory, management science, political science, statistics, geometry, and computer science. PREREQ: MATH 0025. Satisfies Objective 3 of the General Education Requirements. F, S, Su

MATH 1127 The Language of Mathematics: 3 semester hours.

Introduction to the precise language used throughout mathematics. Development of skills including reading with comprehension, expressing mathematical thoughts clearly, reasoning logically, and employing common patterns of mathematical thought. PREREQ: MATH 0025. Satisfies Objective 3 of the General Education Requirements. S

MATH 1130 Finite Mathematics: 3 semester hours.

Introduction to probability, linear systems, inequalities, and linear programming. Applications directed to non-physical science areas. PREREQ: MATH 1108. Satisfies Objective 3 of the General Education Requirements. F, S

MATH 1143 College Algebra: 3 semester hours.

Functions and their graphs. Notation, domain, range, composition, and inverses. Basic transformations of graphs. Polynomial, rational, exponential, and logarithmic functions and their graphs, with applications. Theory of polynomial functions and equations. PREREQ: MATH 1108. F, S, Su

MATH 1144 Trigonometry: 2 semester hours.

Circular functions and right triangle approaches to trigonometry. Graphs of trigonometric functions: amplitude, frequency, phase shift. Trigonometric identities, inverse functions, and equations. Introduction to vectors in the plane, polar coordinates, and polar representation of complex numbers. PREREQ: MATH 1143. F, S, Su

MATH 1147 Precalculus: 5 semester hours.

A single one-semester course equivalent to College Algebra (MATH 1143) plus Trigonometry (MATH 1144). Credit cannot be granted in both MATH 1143 and MATH 1147, or in both MATH 1144 and MATH 1147. PREREQ: MATH 1108. F, S

MATH 1153 Introduction to Statistics: 3 semester hours.

Descriptive statistics, probability, confidence intervals, and hypothesis testing for one and two parameters. Emphasis on applications to a wide variety of disciplines. PREREQ: MATH 1108. Satisfies Objective 3 of General Education Requirements. F, S, Su

MATH 1160 Applied Calculus: 3 semester hours.

Course in differential and integral calculus designed primarily for students in biological sciences, social sciences, business, education, and humanities. Credit cannot be granted in both MATH 1160 and MATH 1170. PREREQ: MATH 1143 or MATH 1147. Satisfies Objective 3 of the General Education Requirements. F, S, Su

MATH 1170 Calculus I: 4 semester hours.

First course in the sequence MATH 1170, MATH 1175, and MATH 2275. Real-valued functions of one real variable: limits, continuity, derivatives, integrals, applications. Credit cannot be granted in both MATH 1160 and MATH 1170. PREREQ: MATH 1144 or MATH 1147. Satisfies Objective 3 of the General Education Requirements. F, S, Su

MATH 1175 Calculus II: 4 semester hours.

Second course in the sequence MATH 1170, MATH 1175, and MATH 2275. Techniques of integration, trigonometric integrals, improper integrals. Applications of definite integrals. Sequences and series. Parametric curves in the plane, polar coordinates. PREREQ: MATH 1170. F, S, Su

MATH 1187 Applied Discrete Structures: 3 semester hours.

Discrete structures in CS and EE. Boolean algebra and logic; sets, functions, and relations; iteration, recursion, and induction; algorithms; programming in pseudocode; basic counting principles; graphs and trees; and other selected topics from discrete mathematics. Equivalent to CS 1187. PREREQ: CS 1181. S

MATH 1199 Experimental Course: 1-6 semester hours.

This course is not described in the catalog. The course title and number of credits are announced in the class schedule by the scheduling department. Experimental courses may be offered no more than three times. May be repeated.

MATH 2240 Linear Algebra: 3 semester hours.

Introduction to linear algebra. Linear systems, matrices, determinants, vector spaces, linear transformations, linear independence, eigenvalues and eigenvectors, orthogonalization. PREREQ: MATH 1170. F, S, Su

MATH 2256 Structure of Arithmetic for Elementary School Teachers: 3 semester hours.

Development of number systems. Emphasis on principles, representations, and concept development. For elementary education majors. PREREQ: MATH 1143. Satisfies Objective 3 of the General Education Requirements. F

MATH 2257 Structure of Geometry and Probability for Elementary School Teachers: 3 semester hours.

Topics from geometry, probability, and statistics. Emphasis on principles, representations, and concept development. For elementary education majors. PREREQ: MATH 1143. Satisfies Objective 3 of the General Education Requirements. S

MATH 2275 Calculus III: 4 semester hours.

Third course in the sequence MATH 1170, MATH 1175, and MATH 2275. Multivariable calculus. Vector algebra and geometry. Functions of several variables. Differentiation. Optimization. Multiple Integrals. Parametric curves and surfaces. Line and surface integrals. Vector fields. Green's, Stokes', and divergence theorems. PREREQ: MATH 1175. F, S

MATH 2287 Foundations of Mathematics: 3 semester hours.

Logic and proofs, sets, functions, relations, mathematical induction, and the cardinality of sets. PREREQ: MATH 1170. D

MATH 3326 Elementary Analysis: 3 semester hours.

A beginning course in analysis on the real line. Proof writing and the underlying logic are emphasized throughout the course. Topics include sets and functions, sequences, convergence, limits, continuity, and infinite series. PREREQ: MATH 1175 and either MATH 2240 or MATH 2287. F, S

MATH 3327 Vector Analysis: 3 semester hours.

Calculus of vector functions of several variables, derivative matrix, chain rule, inverse function theorem, multiple integration. Change of variables. Integrals over curves and surfaces. Green's, Stokes' and divergence theorems. Applications to physics. PREREQ: MATH 2275. F

MATH 3335 Elementary Number Theory: 3 semester hours.

Divisibility, prime numbers, congruences, Diophantine equations and other topics. PRE-REQ: MATH 2287 or permission of instructor. D

MATH 3343 Modern Geometry I: 3 semester hours.

Planar Euclidian geometry. Rigid motions and symmetry in the plane. PREREQ: MATH 2240 or MATH 2287. F

MATH 3350 Statistical Methods: 3 semester hours.

A calculus-based introduction to statistical procedures, including simple regression, basic experimental design, and non-parametric methods. PREREQ: MATH 1160 or MATH 1170. F, S

MATH 3352 Introduction to Probability: 3 semester hours.

Fundamentals of probability, discrete and continuous random variables, distributions such as binomial, uniform, Poisson, hypergeometric, normal, gamma; expectation; joint, marginal, conditional distributions; central limit theorem; applications to statistics. Emphasizes material needed to develop statistical inference methods. PREREQ: MATH 1175 or permission of instructor. F, S

MATH 3355 Operations Research: 3 semester hours.

Deterministic problems in operations research oriented towards business. Includes linear programming, transportation problems, network analysis, PERT, dynamic programming, and elementary game theory. PREREQ: MATH 1130 or MATH 2240, or permission of instructor. D

MATH 3356 Operations Research II: 3 semester hours.

Probabilistic models oriented towards business are treated. Selections from stochastic processes, Markov chains, queuing theory, inventory theory, reliability, decision analysis and simulation. PREREQ: MATH 3355. D

MATH 3360 Differential Equations: 3 semester hours.

Theory and applications of ordinary differential equations. First order equations, higher order linear equations, systems, Laplace transforms, power series methods. PREREQ: MATH 1175; MATH 2240 or MATH 2275 recommended. F, S

MATH 3362 Introduction to Complex Variables: 3 semester hours.

Introduction to the study of functions of a complex variable including the algebra and geometry of complex numbers, analytic functions, power series, integral theorems, and applications. PREREQ: MATH 2275. F

MATH 3399 Experimental Course: 1-6 semester hours.

This is an experimental course. The course title and number of credits are announced in the class schedule by the scheduling department. Experimental courses may be offered no more than three times with the same title and content.

MATH 4403 Survey of Combinatorics and Graph Theory: 3 semester hours.

Enumeration techniques, including generating functions. Applications. Introductory graph theory. PREREQ: MATH 1175 and MATH 2240. D

MATH 4404 Topics in Combinatorics and Graph Theory: 3 semester hours.

Continuation of MATH 4403. Application of algebraic, analytic, and/or probabilistic methods to combinatorial, graph-theoretic, and algorithmic problems. PREREQ: MATH 4403 or permission of instructor. D

MATH 4406 Advanced Linear Algebra: 3 semester hours.

Advanced linear algebra with a strong emphasis on proof. Real and complex vector spaces, linear transformations, polynomials associated to matrices, determinants, canonical forms, inner product spaces. PREREQ: MATH 2240. D

MATH 4407 Modern Algebra I: 3 semester hours.

Rings, fields, groups, algebras, and selected topics in abstract algebra. PREREQ: MATH 2240 and MATH 2287. F

MATH 4408 Modern Algebra II: 3 semester hours.

Rings, fields, groups, algebras, and selected topics in abstract algebra. PREREQ: MATH 4407. S

MATH 4421 Advanced Engineering Mathematics I: 3 semester hours.

Analysis of complex linear and nonlinear engineering systems using advanced techniques, including Laplace transforms, Fourier series and classical partial differential equations. PREREQ: MATH 3360. F

MATH 4422 Advanced Engineering Mathematics II: 3 semester hours.

Analysis of complex linear and nonlinear engineering systems using advanced techniques, including probability and statistics, advanced numerical methods and variational calculus. PREREQ: MATH 4421. S

MATH 4423 Introduction to Real Analysis I: 3 semester hours.

The real number system, limits, sequences, series and convergence; metric spaces; completeness; and selected topics on measure and integration theory. PREREQ: MATH 2240, MATH 3326, and MATH 3360. F

MATH 4424 Introduction to Real Analysis II: 3 semester hours.

The real number system, limits, sequences, series and convergence; metric spaces; completeness; and selected topics on measure and integration theory. PREREQ: MATH 4423. S

MATH 4441 Introduction to Numerical Analysis I: 3 semester hours.

Introduction to numerical techniques for solving problems dealing with nonlinear equations, systems of linear equations, differential equations, interpolation, numerical integration, and differentiation. PREREQ: MATH 2240, MATH 3326, and MATH 3360 or permission of instructor. F

MATH 4442 Introduction to Numerical Analysis II: 3 semester hours.

Extension of MATH 4441 for students who wish to pursue more advanced techniques with emphasis on analysis. Typical topics covered include numerical methods applied to partial differential equations, integral equations, and in-depth treatment of topics covered in MATH 4441. PREREQ: MATH 4441. S

MATH 4444 Modern Geometry II: 3 semester hours.

Transformation groups. Topics from hyperbolic, projective, and other geometries. D

MATH 4450 Mathematical Statistics I: 3 semester hours.

Probability, random variables, discrete and continuous distributions, order statistics, limit theorems, point and interval estimation, uniformly most powerful tests, likelihood ratio tests, chi-square and F tests, nonparametric tests. PREREQ: MATH 3326 and MATH 3352. F

MATH 4451 Mathematical Statistics II: 3 semester hours.

Probability, random variables, discrete and continuous distributions, order statistics, limit theorems, point and interval estimation, uniformly most powerful tests, likelihood ratio tests, chi-square and F tests, nonparametric tests. PREREQ: MATH 4450. S

MATH 4453 Topics in Statistics: 1-3 semester hours.

Content varies. May be repeated for up to 6 credits. PREREQ: Permission of instructor. D

MATH 4457 Applied Regression Analysis: 3 semester hours.

Simple and multiple linear regression, polynomial regression, diagnostics, model selection, models with categorical variables. PREREQ: MATH 3350 or MATH 3352 or permission of instructor. D

MATH 4458 Experimental Design: 3 semester hours.

The linear model for experimental designs, analysis of variance and covariance, block designs, factorial designs, nested designs, choice of sample size. PREREQ: MATH 3350 or MATH 3352 or permission of instructor. D

MATH 4459 Applied Multivariate Analysis: 3 semester hours.

Matrix computation of summary statistics, graphical analysis of multivariate procedures, multivariate normal distribution, MANOVA, multivariate linear regression, principal components, factor analysis, canonical correlation analysis. PREREQ: MATH 2240 and one of the following: MATH 3350, MATH 4457, MATH 4458, or permission of instructor. D

MATH 4465 Partial Differential Equations: 3 semester hours.

Equations of the first and second orders, methods of solution, Laplace's Equation, heat equation, and wave equation. Emphasis on applications in physical sciences and engineering. PREREQ: MATH 2275 and MATH 3360. D

MATH 4481 Directed Readings and Problems: 1-3 semester hours.

Individual work under the direction of a professor. May be repeated for up to 6 credits. PREREQ: Senior or graduate student in good standing. D

MATH 4491 Mathematics Seminar: 1-3 semester hours.

Advanced reading and discussion on selected topics in mathematics. May be repeated. PREREQ: 90 credits or equivalent. D

MATH 4499 Experimental Course: 1-6 semester hours.

This is an experimental course. The course title and number of credits are announced in the class schedule by the scheduling department. Experimental courses may be offered no more than three times with the same title and content.