DEPARTMENT OF MATHEMATICS

Programs
Undergraduate
Major
• Mathematics Major (https://catalog.tulane.edu/science-engineering/mathematics/mathematics-major/)

Minor
• Mathematics Minor (https://catalog.tulane.edu/science-engineering/mathematics/mathematics-minor/)

Graduate
• Applied Mathematics, MS (https://catalog.tulane.edu/science-engineering/mathematics/applied-mathematics-ms/)
• Mathematics, MS (https://catalog.tulane.edu/science-engineering/mathematics/mathematics-ms/)
• Mathematics, PhD (https://catalog.tulane.edu/science-engineering/mathematics/mathematics-phd/)
• Statistics, MS (https://catalog.tulane.edu/science-engineering/mathematics/statistics-ms/)

Courses
Mathematics (MATH)

MATH 1001 College Mathematics Prep (1)
A five week review of algebra, trigonometry and other pre-calculus concepts relevant to success in calculus and statistics using an artificially intelligent assessment and learning system. This course is open only to students participating in the Newcomb-Tulane College Summer Experience program.

MATH 1005 Explore Experiment Math (3)
An introduction to selected topics in mathematics through inquiry-based discovery. Students will make novel calculations, search for patterns, formulate conjectures, and ultimately prove theorems based on their exploration. The emphasis of the course is on the search for structures in mathematics through guided discovery. This course is open only to high school students participating in the Tulane Science Scholars program.

MATH 1110 Probability & Statistics I (3)
Elementary probability theory with applications; random variables; distributions including a thorough discussion of the binomial, and normal distributions; central limit theorem; histograms; sampling distributions; confidence intervals; tests of hypotheses; linear models; regression and correlation; chi-square test; non-parametric statistics. 1110 is a prerequisite for 1120. These courses do not count toward the Mathematics B.S. requirement in SSE. Students may receive credit for only one of MATH 1110, 1140 or 1230.

MATH 1140 Statistics For Business (4)
An introductory statistics course for BSM students using MSExcel. Includes confidence intervals and hypothesis tests for one and two populations and introduction to linear regression. Extensive coverage of data collection and analysis as needed to evaluate statistical results and to make good decisions in business. In comparison to Math 1110, the course spends more time on statistical inference problems, less on probability. This course does not count toward the Mathematics B.S. requirement. Students may receive credit for only one of MATH 1110, 1140 or 1230.

MATH 1150 Long Calculus I (3)
The material of Calculus 1210 is covered in two semesters, with diversions for topics in algebra, trigonometry, complex numbers as the need for these topics arises. Mathematics 1150 is a prerequisite for 1160. Students finishing the course sequence 1150-1160 may continue with 1220 or any other course having Calculus 1201 as a prerequisite. The combination of 1150 and 1160 may count as one course toward the B.S. degree requirement.

MATH 1160 Long Calculus II (3)
The material of Calculus 1210 is covered in two semesters, with diversions for topics in algebra, trigonometry, complex numbers as the need for these topics arises. Mathematics 1150 is a prerequisite for 1160. Students finishing the course sequence 1150-1160 may continue with 1220 or any other course having Calculus 1201 as a prerequisite. The combination of 1150 and 1160 may count as one course toward the B.S. degree requirement.

Prerequisite(s): MATH 1150.

MATH 1210 Calculus I (4)
Functions and their graphs, limits and continuity, derivatives and applications of derivatives, and introduction to the integral.

Corequisite(s): MATH 1211.
MATH 1211 Calculus I Recitation (0)
This is a co-requisite recitation course for MATH 1210.

MATH 1220 Calculus II (4)
Integration; exponential, logarithmic, and trigonometric functions; techniques of integration; mean value theorem; Taylor’s Theorem and Taylor series; and infinite series. Prerequisite(s): MATH 1160 or 1210.

Prerequisite(s): MATH 1160 or 1210.

MATH 1230 Stats For Scientists (4)
The objective of this course is to provide a practical overview of the statistical methods and models most likely to be encountered by scientists in practical research applications. Students will learn statistical concepts by generating and analyzing stochastic datasets using the Minitab software package. Specific topics that will be covered in this course include discrete and continuous distributions, sampling methods, and descriptive statistics, the Central Limit Theorem and its applications, estimation methods, confidence intervals, hypothesis testing, linear regression, and Analysis of Variance. Students may receive credit for only one of MATH 1110, 1140 or 1230. Only MATH 1230 counts towards the B.S. degree. Prerequisite(s): (MATH 1210) or (MATH 1150 and 1160) or (MATH 1310).

Prerequisite(s): (MATH 1210) or (MATH 1150 and 1160) or (MATH 1310).
Corequisite(s): MATH 1231.

MATH 1231 Stats for Scientists Recitation (0)
This is a co-requisite recitation course for MATH 1230.

MATH 1310 Consolidated Calculus (4)
A combined course in Calculus I and II for students with a background in Calculus I.

MATH 1940 Transfer Coursework (0-20)
Transfer Coursework at the 1000 level. Department approval may be required.

Maximum Hours: 99

MATH 2010 Math Modeling of World (3)
This course exposes students to the process of mathematical modeling as a way to describe, explain, understand, or predict situations arising in everyday life. Examples of such situations might include: the design of handicap ramps, estimating the number of sand bags needed to raise a levee a few feet, understanding and predicting the number of daylight hours at different places in the world, analyzing the consequences of child support payment adjustment formulas used by the states, etc. The modeling process emphasizes making assumptions, translating the empirical situation into mathematical language, drawing conclusions from the mathematical solution, interpreting and validating those conclusions in the context of the original situation and revising assumptions if necessary. Prerequisite: Calculus I or equivalent.

Prerequisite(s): MATH 1150, 1210, 1220, 1310 or 2210.

MATH 2170 Intro To Discrete Math (3)
An introduction to the concepts and techniques of discrete mathematics including set theory, mathematical induction, graphs, trees, ordered sets, Boolean algebras, and the basic laws of combinatorics.

MATH 2210 Calculus III (4)
A basic course in differential and integral calculus of several variables. Vectors in the plane and space. Vector functions, derivatives, arc length, curvature. Functions of several variables: continuity, partial derivatives, chain rule, gradient, optimization, Lagrange multipliers. Double and triple integrals: change of variables, polar coordinates, cylindrical and spherical coordinates, surface area. Vector fields: gradient, curl, divergence, line and surface integrals, Green’s, Stokes’, and Divergence theorems. Prerequisite(s): MATH 1220 or 1310.

Prerequisite(s): MATH 1220 or 1310.

MATH 2240 Intro To Applied Math (4)
An introduction to the techniques of applied mathematics. The emphasis will be on the mathematical modeling by differential equations of a variety of applications in the natural sciences. Numerical and graphical techniques for finding both quantitative and qualitative information about solutions will be discussed and implemented on the computer. No programming experience is assumed. Note: Students may not receive credit for both 2240 and 4240. Prerequisite(s): MATH 1220 or 1310.

Prerequisite(s): MATH 1220 or 1310.

MATH 2890 Service Learning (0-1)
Service learning component to MATH courses. See Schedule of Classes each semester for offerings. 20 or 40 hours of public service with a CPS approved community partner. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99
MATH 2940  Transfer Coursework (0-20)  
Transfer Coursework at the 2000 level. Department approval may be required.

Maximum Hours: 99

MATH 3050  Real Analysis I  (3)  
Introduction to analysis. Real numbers, limits, continuity, uniform continuity, sequences and series, compactness, convergence, Riemann integration. An in-depth treatment of the concepts underlying calculus. Prerequisite(s): MATH 2210.

Prerequisite(s): MATH 2210.

MATH 3070  Intro To Probability  (3)  

Prerequisite(s): MATH 2210 and 3070.

MATH 3080  Intro to Statistical Inference  (3)  
Basics of statistical inference. Sampling distributions, parameter estimation, hypothesis testing, optimal estimates and tests. Maximum likelihood estimates and likelihood ratio tests. Data summary methods and categorical data analysis. Analysis of variance and introduction to linear regression. Prerequisite(s): MATH 2210.

Prerequisite(s): MATH 2210 and 3070.

MATH 3090  Linear Algebra  (4)  
An introduction to linear algebra emphasizing matrices and their applications. Gaussian elimination, determinants, vector spaces and linear transformations, orthogonality and projections, eigenvector problems, diagonalizability, Spectral Theorem, quadratic forms, applications. MATLAB is used as a computational tool. Prerequisite(s): MATH 2210.

Prerequisite(s): MATH 2210.

MATH 3110  Abstract Algebra I  (3)  
An introduction to abstract algebra. Elementary number theory and congruences. Basic group theory: groups, subgroups, normality, quotient groups, permutation groups. Ring theory: polynomial rings, unique factorization domains, elementary ideal theory. Introduction to field theory. Prerequisite(s): MATH 2210.

Prerequisite(s): MATH 2210.

MATH 3140  Experimental Mathematics  (3)  
The exploration of Mathematical tools in Symbolic Languages. Examples are taken from calculus, differential equations, and linear algebra. Prerequisite(s): MATH 1210, 1220 and 2210.

Prerequisite(s): MATH 1210, 1220 and 2210.

MATH 3200  Combinatorics  (3)  
Basics of combinatorics with emphasis on problem solving. Provability, pigeonhole principle, mathematical induction. Counting techniques, generating functions, recurrence relations, Polya’s counting formula, a theorem of Ramsey. Prerequisite(s): (MATH 1210) and (MATH 1220) and (MATH 2210) or (MATH 3090) or (MATH 1310).

Prerequisite(s): (MATH 1210) and (MATH 1220) and (MATH 2210) or (MATH 3090) or (MATH 1310).

MATH 3250  Theory of Computation  (3)  
Introduction to the theory of computation: Formal languages, finite automata and regular languages, deterministic and nondeterministic computation, context free grammars, languages, pushdown automata, turning machines, undecidable problems, recursion theorem, computational complexity and NP-completeness. Prerequisite(s): MATH 2170.

Prerequisite(s): MATH 2170.

MATH 3260  Algorithms and Complexity  (3)  
Students who have taken neither MATH 2170 nor MATH 3200 require the permission of the instructor. A study of important algorithms (including searching and sorting, graph/network algorithms, and algorithms in number theory) and algorithm design techniques (including greedy, recursive, and probabilistic algorithms). Covers the analysis of algorithms (including worst-case and average-case analysis) and discussions of complexity classes for decision and enumeration problems (including P, NP, #P, PSPACE). Prerequisite(s): CMPS 2200.

Prerequisite(s): CMPS 2200.
**MATH 3280  Information Theory  (3)**

This introduction to information theory will address fundamental concepts, such as information, entropy, relative entropy, and mutual information. In addition to giving precise definitions of these concepts, the course will include a probabilistic approach based on equipartitions. Many of the applications of information will be discussed, including Shannon’s basic theorems on channel capacity and related coding theorems. In addition to channels and channel capacity, the course will discuss applications of information theory to mathematics, statistics, and computer science.

Prerequisite(s): MATH 3050, 3090 or 6090.

**MATH 3310  Scientific Computing I  (3)**


Prerequisite(s): (MATH 2210) and (MATH 2240) or (MATH 4240).

**MATH 3650  Number Theory  (3)**

The subject of number theory is one of the oldest in mathematics. The course will cover some basic material and describe interesting applications. One of the recurrent themes is the realization that mathematics that was developed usually for its own sake, has found applications in many unexpected problems. Some of the topics covered in the class are Pythagorean triples, prime numbers, divisibility and the highest common divisor, linear diophantine equations, congruences, round-robin tournaments and perpetual calendars, multiple functions, perfect numbers, primitive roots, pseudo-random numbers, decimal fractions and continued fractions, quadratic reciprocity.

**MATH 3660  Special Topics  (1-3)**

Special Topics. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

**MATH 3890  Service Learning  (0-1)**

Students complete a service activity in the community in conjunction with the content of a three-credit corequisite course. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

**MATH 3940  Transfer Coursework  (0-20)**

Transfer Coursework at the 3000 level. Department approval may be required.

Maximum Hours: 99

**MATH 3980  Senior Seminar  (1)**

Under faculty guidance, students will select a topic in current mathematical research, write an expository article on that topic, and give an oral presentation. This seminar is required of all mathematics majors who are not doing an Honors Project within the department.

**MATH 3990  Senior Seminar  (3)**

Under faculty guidance, students will select a topic in current mathematical research, write an expository article on that topic, and give an oral presentation. This seminar is required of all mathematics majors who are not doing an Honors Project within the department.

**MATH 4060  Real Analysis II  (3)**

An in-depth treatment of multivariable calculus. Extends the material covered in Mathematics 2210. Chain rule, inverse and implicit function theorems, Riemann integration in Euclidean n-space, Gauss-Green-Stokes theorems, applications. Prerequisite(s): MATH 3050 and 3090.

Prerequisite(s): MATH 3050 and 3090.

**MATH 4120  Abstract Algebra II  (3)**

Abstract vector spaces, quotient spaces, linear transformations, dual spaces, determinants. Solvable groups. Field extensions, Galois theory, solvability of equations by radicals. Prerequisite(s): MATH 3090 and 3110.

Prerequisite(s): MATH 3090 and 3110.

**MATH 4210  Differential Geometry  (3)**

Theory of plane and space curves including arc length, curvature, torsion, Frenet equations, surfaces in three-dimensional space. First and second fundamental forms, Gaussian and mean curvature, differentiable mappings of surfaces, curves on a surface, special surfaces. Prerequisite(s): MATH 3050 and 3090.

Prerequisite(s): MATH 3050 and 3090.
MATH 4240  Ordinary Differential Equa  (3)
Review of linear algebra, first-order equations (models, existence, uniqueness, Euler method, phase line, stability of equilibria), higher-order linear equations, Laplace transforms and applications, power series of solutions, linear first-order systems (autonomous systems, phase plane), application of matrix normal forms, linearization and stability of nonlinear systems, bifurcation, Hopf bifurcation, limit cycles, Poincare-Bendixson theorem, partial differential equations (symmetric boundary-value problems on an interval, eigenvalue problems, eigenfunction expansion, initial-value problems in 1D). Note: Students may not receive credit for both 2240 and 4240.

MATH 4250  Math Found Comp Security  (3)
This course studies the mathematics underlying computer security, including both public key and symmetric key cryptography, crypto-protocols and information flow. The course includes a study of the RSA encryption scheme, stream and clock ciphers, digital signatures and authentication. It also considers semantic security and analysis of secure information flow. Prerequisite(s): (MATH 2170 or CMPS 2170) and MATH 3110.

Prerequisite(s): (MATH 2170 or CMPS 2170) and MATH 3110.

MATH 4300  Complex Analysis  (3)
The complex number system, complex integration and differentiation, conformal mapping, Cauchy's theorem, calculus of residues.

MATH 4410  Topology  (3)
An introduction to topology. Elementary point set topology, topological spaces, compactness, connectedness, continuity, homeomorphisms, product and quotient spaces. Classification of surfaces and other geometric applications. Prerequisite(s): MATH 3050.

Prerequisite(s): MATH 3050.

MATH 4411  Intro to Alg Topology  (3)
An introduction to algebraic topology with perspectives on applications to sensor networks, target detection and learning theory. Elementary algebraic topology: fundamental group, simplicial complexes, homology, long exact sequences, excision, Lefschetz fixed point theorem, persistent homology. Applications to coverage in sensor networks, deSilva-Ghrist criterion, target enumeration.

MATH 4470  Analyt Method Appl Math  (3)
Derivations of transport, heat/reaction-diffusion, wave, Poisson's equations; well-posedness; characteristics methods for first order PDE's; D'Alembert formula and conservation of energy for wave equations; propagation of waves; Fourier transforms; heat kernel, smoothing effect; maximum principles; Fourier series and Sturm-Liouville eigen-expansions; method of separation of variables, frequencies of wave equations, stable and unstable modes, long time behavior of heat equations; delta-function, fundamental solution of Laplace equation, Newton potential, Green's function and Poisson formula; Dirichlet Principle.

MATH 4560  Internship  (1-3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 4660  Special Topics  (1-3)
Special Topics. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 4880  Writing Intensive  (1)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 4900  Advanced Topics In Math  (3)
This course covers a variety of advanced topics in mathematics and exposes students to recent developments not available in other parts of the mathematics curriculum. Topics covered will vary from semester to semester. Recent topics offered include Knot Theory and 3-Manifolds, Algebraic Combinatorics, Cardiac Modeling, Number Theory.

MATH 4910  Independent Study  (1-3)
No more than four hours of 4910-4920 may be counted toward satisfying the major requirements. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 4920  Independent Study  (1-3)
No more than four hours of 4910-4920 may be counted toward satisfying the major requirements. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99
MATH 4940 Transfer Coursework (0-20)
Transfer coursework at the 4000 level. Departmental approval required.

Maximum Hours: 99

MATH 4990 Honors Thesis (3)
Honors thesis research, first semester. Register in department.

MATH 5000 Honors Thesis (4)
Honors thesis research, second semester. Register in department.

MATH 5380 Study Abroad (1-20)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 5390 Study Abroad (1-20)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 6020 Mathematical Statistics (3)
Thorough review of key distributions for probability and statistics, including the multivariate calculus needed to develop them. Full derivation of sampling distribution. Classical principles of inference including best tests and estimations. Methods of finding tests and estimators. Introduction to Bayesian estimators.

MATH 6030 Stochastic Processes (3)
Markov processes, Poisson processes, queueing models, introduction to Brownian Motion. Prerequisite(s): MATH 3070.

Prerequisite(s): MATH 3070.

MATH 6040 Linear Models (3)
Overview of multivariate analysis, theory of least squares linear regression, regression diagnostics, introduction to generalized linear models with emphasis on logistic regression. The student will complete several extended data analysis assignments using SAS, S-Plus, or R.

MATH 6050 Real Analysis I (3)
Introduction to analysis. Real numbers, limits, continuity, uniform continuity, sequences and series, compactness, convergence, Riemann integration. An in-depth treatment of the concepts underlying calculus. Prerequisite(s): MATH 2210.

Prerequisite(s): MATH 2210.

MATH 6060 Real Analysis II (3)
An in-depth treatment of multivariable calculus. Extends the material covered in Mathematics 2210. Chain rule, inverse and implicit function theorems, Riemann integration in Euclidean n-space, Gauss-Green-Stokes theorems, applications.

MATH 6070 Intro To Probability (3)
An introduction to probability theory. Counting methods, conditional probability and independence. Discrete and continuous distributions, expected value, joint distributions and limit theorems. Prepares student for future work in probability and statistic.

MATH 6080 Intro to Statistical Inference (3)

MATH 6090 Linear Algebra (3)
An introduction to linear algebra emphasizing matrices and their applications. Gaussian elimination, determinants, vector spaces and linear transformations, orthogonality and projections, eigenvector problems, diagonalizability, Spectral Theorem, quadrati

MATH 6100 Linear Algebra (3)
An introduction to linear algebra. Elementary number theory and congruences. Basic group theory: groups, subgroups, normality, quotient groups, permutation groups. Ring theory: polynomial rings, unique factorization domains, elementary ideal theory. Int

MATH 6110 Abstract Algebra I (3)
MATH 6200 Combinatorics (3)

MATH 6210 Differential Geometry (3)
Theory of plane and space curves including arc length, curvature, torsion, Frenet equations, surfaces in three-dimensional space. First and second fundamental forms, Gaussian and mean curvature, differentiable mappings of surfaces, curves on a surface, sp

MATH 6240 Ordinary Differential Equations (3)
Review of linear algebra, first-order equations (models, existence, uniqueness, Euler method, phase line, stability of equilibria), higher-order linear equations, Laplace transforms and applications, power series of solutions, linear first-order, systems (autonomous systems, phase plane), application of matrix normal forms, linearization and stability of nonlinear systems, bifurcation, Hopf bifurcation, limit cycles, Poincare-Bendixson theorem, partial differential equations (symmetric boundary-value problems on an interval, eigenvalue problems, eigenfunction expansion, initial-value problems in 1D). Students may not receive credit for both 2240 and 4240.

MATH 6250 Math Found Comp Security (3)
This course studies the mathematics underlying computer security, including both public key and symmetric key cryptography, crypto-protocols and information flow. The course includes a study of the RSA encryption scheme, stream and clock ciphers, digital signatures and authentication. It also considers semantic security and analysis of secure information flow.

MATH 6260 Advanced Algorithms (3)

MATH 6280 Information Theory (3)
This introduction to information theory will address fundamental concepts, such as information, entropy, relative entropy, and mutual information. In addition to giving precise definitions of these concepts, the course will include a probabilistic approach.

MATH 6300 Complex Analysis I (3)
The complex number system, complex integration and differentiation, conformal mapping, Cauchy’s theorem, calculus of residues.

MATH 6310 Scientific Computing I (3)

MATH 6350 Optimization (3)
Constrained and unconstrained non-linear optimization; Linear programming, combinatorial optimization as time allows. Emphasis is on realistic problems whose solution requires computers, using Maple or Mathematica.

MATH 6370 Time Series Analysis (3)
This course provides an introduction to time series analysis at the graduate level. The course is about modeling based on three main families of techniques: (i) the classical decomposition into trend, seasonal and noise components; (ii) ARIMA processes and the Box and Jenkins methodology; (iii) Fourier analysis. If time permits, other possible topics include state space modeling and fractional processes. The course is focused on the theory, but some key examples and applications are also covered and implemented in the software package R. Prerequisite(s): MATH 6070 and 6080 and (MATH 6040 or 7260).

Prerequisite(s): MATH 6070 and 6080 and (MATH 6040 or 7260).

MATH 6410 Topology I (3)

MATH 6470 Analy Methods Appl Math (3)

MATH 6510 Topology I (3)

MATH 6520 Topology II (3)
MATH 6550 Differential Geometry I (3)

MATH 6560 Differential Geometry II (3)

MATH 6570 Stochastic Diff Equatns (3)

MATH 6610 Algebra I (3)

MATH 6620 Algebra II (3)

MATH 6660 Special Topics (1-3)
Special Topics. Can be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 6670 Analysis I (3)

MATH 6680 Analysis II (3)

MATH 6810 Applied Math I (3)

MATH 6820 Applied Math II (3)
MATH 6940  Transfer Coursework (0-20)
Transfer coursework at the 6000 level. Departmental approval required.

Maximum Hours: 99

MATH 7001  Math Teaching Training (1)
An interactive seminar to prepare students to teach mathematics at the college level. Topics covered will include discussion of practical issues such as how to keep a class engaged, how to prepare and grade assessments, how to prepare for class meetings, as well as discussion of theoretical issues such as what a teacher should be trying to achieve in the classroom, current understanding of how students learn best, and evaluating the effectiveness of assessments of student performance.

MATH 7010  Topology I (3)

MATH 7020  Topology II (3)

MATH 7030  Stochastic Processes (3)
Markov processes, Poisson processes, queueing models, introduction to Brownian Motion.

MATH 7110  Algebra I (3)

MATH 7120  Algebra II (3)

MATH 7150  Probability Theory I (3)

MATH 7210  Analysis I (3)
Lebesgue measure on R. Measurable functions (including Lusin’s and Egoroff’s theorems). The Lebesgue integral. Monotone and dominated convergence theorems. Radon-Nikodym Theorem. Differentiation: bounded variation, absolute continuity, and the fundamental

MATH 7220  Analysis II (3)
Lebesgue measure on R. Measurable functions (including Lusin’s and Egoroff’s theorems). The Lebesgue integral. Monotone and dominated convergence theorems. Radon-Nikodym Theorem. Differentiation: bounded variation, absolute continuity, and the fundamental

MATH 7240  Mathematical Statistics (3)
Consists of Math 6020 and additional meetings and readings to cover advanced limit theorems and foundations of mathematical statistics.

MATH 7260  Linear Models (3)

MATH 7291  Algebraic Geometry I (3)
This is the first semester of a second year course for graduate students with research interest in Algebraic Geometry and related areas. The course will give students a necessary background preparation for research in Algebraic Geometry or to read and understand papers in this area. Topics in this course include: affine and projective varieties, morphisms of varieties, nonsingular varieties, and category theory.
MATH 7292  Algebraic Geometry II (3)
This is the second semester of a second year course for graduate students with research interest in Algebraic Geometry and related areas. The course will give students a necessary background preparation for research in Algebraic Geometry or to read and understand papers in this area. Topics in this course include: sheaves and schemes, line bundles and divisors, projective morphisms, and applications in toric geometry, homogeneous spaces, and algebraic group embeddings.

MATH 7310  Applied Mathematics I (3)
This is a first year graduate course in Applied Mathematics. A solid working knowledge of linear algebra and advanced calculus is the necessary background for this class. The topics covered include a mix of analytical and numerical methods that are used to understand models described by differential equations. We will emphasize applications from science and engineering, as they are the driving force behind each of the topics addressed.

MATH 7320  Applied Math II (3)
This is a first year graduate course in Applied Mathematics. A solid working knowledge of linear algebra and advanced calculus is the necessary background for this class. The topics covered include a mix of analytical and numerical methods that are used to understand models described by differential equations. We will emphasize applications from science and engineering, as they are the driving force behind each of the topics addressed.

MATH 7340  Numerical Methods In Pde (3)
MATH 7350  Scientific Computing I (3)

MATH 7360  Data Analysis (3)
This course covers the statistical analysis of datasets using R software package. The R environment, which is an Open Source system based on the S Language, is one of the most versatile and powerful tools available for statistical data analysis, and is widely used in both academic and industrial research. Key topics include graphical methods, generalized linear models, clustering, classification, time series analysis and spatial statistics. No prior knowledge of R is required.

MATH 7370  Time Series Analysis (3)
This course provides an introduction to time series analysis at the graduate level. The course is about modeling based on three main families of techniques: (i) the classical decomposition into trend, seasonal and noise components; (ii) ARIMA processes and the Box and Jenkins methodology; (iii) Fourier analysis. If time permits, other possible topics include state space modeling and fractional processes. The course is focused on the theory, but some key examples and applications are also covered and implemented in the software package R.

MATH 7440  Linear Models (3)
MATH 7510  Differential Geometry I (3)

MATH 7520  Differential Geometry II (3)

MATH 7530  Partial Diff Equations I (3)

MATH 7540  Partial Diff Equations II (3)
MATH 7550 Probability Theory II (3)

MATH 7560 Stochastic Process II (3)

MATH 7570 Scientific Computatn II (3)
Floating point arithmetic (limitations and pitfalls). Numerical linear algebra, solving linear system by direct and iterative methods, eigenvalue problems, singular value decompositions, numerical integrations, interpolations. Unconstrained optimization.

MATH 7580 Scientific Computing III (3)
Numerical ODE, both initial and boundary value problems. Numerical PDE. Introduction to fluid dynamics and other areas of application. Prerequisite(s): MATH 7570.

Prerequisite(s): MATH 7570.

MATH 7590 Functional Analysis I (3)

MATH 7600 Functional Analysis II (3)

MATH 7610 Topology III (3)

MATH 7630 Algebra III (3)

MATH 7710 Topics In Algebra (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7711 Topics In Algebra (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7712 Topics in Algebra (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7713 Topics in Algebra (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7714 Topics in Algebra (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7715 Topics in Algebra (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7720 Topics In Analysis (3)

MATH 7730 Topics In Applied Math (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7731 Topics in Applied Math (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99
MATH 7732  Topics in Applied Math (3)
MATH 7740  Topics In Computation (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7750  Topics/Differential Equa (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7760  Topics In Geometry (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7770  Topics/Probability&Stats (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7780  Topics/Theoret. Comp Sci (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7790  Topics In Topology (3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7940  Transfer Credit-Grad (1-12)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7980  Reading and Research (1-9)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 7990  Advanced Math (1-9)
MATH 9980  Masters Research (3)
Research toward completion of a masters degree. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

MATH 9990  Dissertation Research (3)
Research toward completion of a doctoral degree. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99