## Mathematics Courses

### Courses

**MATH 5195. Graduate Seminar.**
Graduate Seminar (1-0) Conferences and discussions of various topics in mathematics and statistics by faculty, graduate students, and outside speakers. Required of all graduate students during each semester of full-time enrollment. May not be counted more than once toward the degree requirement.

- **1 Credit Hour**
- **1 Total Contact Hour**
  - 0 Lab Hour
  - 1 Lecture Hour
  - 0 Other Hour

**MATH 5309. Intro to Applied Analysis.**
Introduction to Applied Analysis This course addresses the solvability of linear and nonlinear problems that arise in applications. Concepts will be introduced to equip students with the mathematical tools essential for an applied mathematician working with deterministic mathematical models.

- **3 Credit Hours**
- **3 Total Contact Hours**
  - 0 Lab Hours
  - 3 Lecture Hours
  - 0 Other Hours

**Prerequisite(s):** (MATH 4341 w/B or better) OR (MATH 5321 w/B or better)

**MATH 5310. Elements of Applied Functional Analysis.**

- **3 Credit Hours**
- **3 Total Contact Hours**
  - 0 Lab Hours
  - 3 Lecture Hours
  - 0 Other Hours

**Prerequisite(s):** (MATH 2313 w/C or better) OR (MATH 2326 w/C or better) AND (MATH 3323 w/C or better)

**MATH 5311. Applied Mathematics.**
Applied Mathematics (3-0) Mathematics 5311 is designed to introduce the student to those areas of mathematics that are useful in engineering and science. Topics are chosen from differential equations, Fourier series, calculus of variations, and theory of algorithms. The course may be repeated once as content changes.

- **3 Credit Hours**
- **3 Total Contact Hours**
  - 0 Lab Hours
  - 3 Lecture Hours
  - 0 Other Hours

**MATH 5314. Partial Differential Equations.**
Partial Differential Equations (3-0) Partial derivatives and differential operators, classification of partial differential equations with emphasis on elliptic, parabolic and hyperbolic, examples from physics, maximum principle and well-posedness, boundary conditions, weak formulations, Lax-Milgram lemma, overview of existence and uniqueness results.

- **3 Credit Hours**
- **3 Total Contact Hours**
  - 0 Lab Hours
  - 3 Lecture Hours
  - 0 Other Hours

**Prerequisite(s):** (MATH 5310 w/C or better)
MATH 5315. Finite Element Methods I.
Galerkin method and its convergence, piecewise-affine and higher-order FEM in one spatial dimension, adaptivity, general concept of nodal elements, unisolvency, local and global finite element interpolants, conformity, continuous elements in two and three dimensions.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 5310 w/B or better ) AND (MATH 5343 w/B or better)

Principles of Analysis (3-0) Investigation of convergence, continuity, differentiability, compactness and connectedness, the Riemann-Stieljes integral, and sequences of functions.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 3341 w/C or better)

MATH 5322. Linear Algebra.
Linear Algebra This course offers a rigorous treatment of linear algebra, including vector spaces, linear transformations and matrix representations, canonical forms, eigenvalues and eigenvectors, invariant subspaces, orthogonal and unitary transformations, and bilinear and quadratic forms. Emphasis will be given on proofs and abstract theory rather than on computation or concrete examples.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 3325 w/B or better)

MATH 5325. Principles of Algebra.
Principles of Algebra (3-0) Groups, including subgroups, quotient spaces, and homomorphisms. Ring theory, including ideals and quotients, homomorphisms, and polynomial rings. An introduction to modules and fields, including field extensions.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 3325 w/C or better)

MATH 5329. Numerical Analysis.
Numerical Analysis (3-0) Introduction to approximation theory, interpolation, numerical differentiation and integration, solutions of linear and non-linear equations, numerical solution of differential equations, optimization. Emphasis is on error analysis and stability. Several practical examples and computer programs will be covered.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 3323 w/C or better)
MATH 5330. Comp Methods of Linear Algebra.
Computational Methods of Linear Algebra (3-0) Numerical methods involved in the computation of solutions of linear systems of equations, eigenvalues, linear least squares solutions, linear programming, error analysis.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 3323 w/C or better)

MATH 5331. Real Variables.
Real Variables (3-0) Lebesgue integration, integration with respect to measure, absolute continuity, fundamental theorem of calculus for the lebesgue integral.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 5321 w/C or better)

MATH 5335. Techniques in Optimization.
Techniques in Optimization (3-0) An introduction to the formulation of optimization problems and their numerical solution with application to problems in science and engineering. Emphasis on deterministic and stochastic techniques such as Newton type methods and simulated annealing.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 1411 w/C or better) OR (MATH 1312 w/C or better) OR (MATH 2313 w/C or better) OR (MATH 2326 w/C or better) OR (MATH 1411A w/C or better AND MATH 1411B w/C or better AND MATH 1411C w/C or better)

MATH 5341. General Topology.
General Topology (3-0) Topics include: Separation, compactness, connectedness, paracompactness, metric spaces and metrization of topological spaces.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 5321 w/C or better)

Numerical Solutions to Partial Differential Equations (3-0) Introduction to finite difference and finite element methods for the solution of elliptic, parabolic and hyperbolic partial differential equations.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 2326 w/C or better) OR (MATH 3326 w/C or better) AND (MATH 3323 w/C or better) AND (MATH 4329 w/C or better)
MATH 5345. Numerical Optimization.
Numerical Optimization (3-0) A study of numerical algorithms for solving systems of nonlinear equations, unconstrained optimization, and nonlinear least squares problems. Derivation of necessary and sufficient conditions for constrained optimization, and an introduction to interior-point methodology.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s): (MATH 2313 w/C or better) OR (MATH 2326 w/C or better) AND (MATH 3323 w/C or better)

MATH 5346. Interior-Point Methods for Linear Optimization.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s): (MATH 2313 w/C or better) OR (MATH 2326 w/C or better) AND (MATH 3323 w/C or better)

MATH 5351. Complex Variables.
Complex Variables (3-0) Complex integration and the calculus of residues. Analytical continuation and expansions of analytic functions. Entire, meromorphic, and periodic functions.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s): (MATH 5321 w/C or better)

MATH 5370. Seminar.
Seminar (3-0) Various topics not included in regular courses will be discussed. May be repeated once for credit as content changes.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

MATH 5380. Mathematical Statistics I.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s): (STAT 3330 w/C or better)

MATH 5381. Mathematical Statistics II.
Mathematical Statistics II (3-0) A continuation of Mathematical Statistics I. Parametric statistical models, sufficiency, exponential families, methods of estimation, comparison of estimators, confidence intervals, hypothesis testing, optimal tests, likelihood ratio tests, large sample theory. Prerequisite: MATH 5380 or STAT 5380 each with a grade of C or higher.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

Prerequisite(s): (MATH 5380 w/C or better) OR (STAT 5380 w/C or better)
MATH 5385. Statistics in Research.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 3323 w/C or better) AND (STAT 4380 w/C or better)

MATH 5388. Multivariate Data Analysis.
Multivariate Data Analysis (3-0) Statistical analysis of a multivariate response. Multivariate multiple linear regression, principal components, factor analysis, canonical correlation, and discriminate analysis. Applications with the use of statistical packages will be considered.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 5385 w/C or better) OR (STAT 5385 w/C or better)

MATH 5391. Time Series Analysis.
Time Series Analysis (3-0) Time domain and frequency domain aspects of discrete time stationary processes, correlation functions, power spectra, filtering, linear systems, arma models for non-stationary series. An introduction to the analysis of multiple time series. Some use of statistical software will be included.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 5380 w/C or better)

Statistical Computing (3-0) A study of stochastic simulation and select numerical methods used in statistical computation.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (STAT 4380 w/C or better)

MATH 5396. Graduate Research.
Graduate Research (0-0-3) A written report on an appropriate subject in mathematics or statistics is required. May not be counted towards the 24 hours of course work in the thesis option, but may be substituted for three hours of thesis credit.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours

MATH 5398. Thesis.
Thesis (0-0-3).
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
MATH 5399. Thesis.
Thesis (0-0-3).
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Prerequisite(s): (MATH 5398 w/P or better)

MATH 6311. Topics in Applied Mathematics.
This course prepares a student for research in applied mathematics on a specific topic. The topics may vary each semester. Each section is dedicated to a different topic. Course may be repeated for credit.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours

MATH 6345. Topics in Optimization.
The topics may vary each semester. Course may be repeated for credit.
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (MATH 5345)