AMSC - APPLIED MATHEMATICS & SCIENTIFIC COMPUTATION

AMSC420 Mathematical Modeling (3 Credits)
The course will develop skills in data-driven mathematical modeling through individual and group projects. Emphasis will be placed on both analytical and computational methods, and on effective oral and written presentation of results.
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461); and 1 course with a minimum grade of C- from (MATH241, MATH340); and 1 course with a minimum grade of C- from (MATH246, MATH341); and minimum grade of C- in STAT400. And 1 course with a minimum grade of C- from (CMSC106, CMSC131); or students who have taken courses with comparable content may contact the department. Also offered as: MATH420.
Credit Only Granted for: AMSC420 or MATH420.

AMSC452 Introduction to Dynamics and Chaos (3 Credits)
An introduction to mathematical dynamics and chaos. Orbits, bifurcations, Cantor sets and horseshoes, symbolic dynamics, fractal dimension, notions of stability, flows and chaos. Includes motivation and historical perspectives, as well as examples of fundamental maps studied in dynamics and applications of dynamics.
Prerequisite: MATH246 and MATH240. Also offered as: MATH452.
Credit Only Granted for: AMSC452 or MATH452.

AMSC460 Computational Methods (3 Credits)
Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241); and 1 course with a minimum grade of C- from (CMSC106, CMSC131). Also offered as: CMSC460.
Credit Only Granted for: AMSC460, CMSC460, AMSC466, or CMSC466.

AMSC466 Introduction to Numerical Analysis I (3 Credits)
Floating point computations, direct methods for linear systems, interpolation, solution of nonlinear equations.
Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH461, MATH341); and 1 course with a minimum grade of C- from (MATH340, MATH241); and 1 course with a minimum grade of C- from (MATH246, MATH341). Also offered as: CMSC466.
Credit Only Granted for: AMSC460, CMSC460, AMSC466, or CMSC466.

AMSC498 Selected Topics in Applied Mathematics (1-3 Credits)
Topics in applied mathematics of special interest to advanced undergraduate students.
Repeatable to: 6 credits if content differs.

AMSC660 Scientific Computing I (3 Credits)
Monte Carlo simulation, numerical linear algebra, nonlinear systems and continuation method, optimization, ordinary differential equations. Fundamental techniques in scientific computation with an introduction to the theory and software of each topic.
Prerequisite: Must have knowledge of C or Fortran. And AMSC460 or CMSC460; or (CMSC466 or AMSC466); or (must have knowledge of basic numerical analysis (linear equations, nonlinear integration, interpolation); and permission of instructor). Also offered as: CMSC660.
Credit Only Granted for: AMSC660 or CMSC660.

AMSC661 Scientific Computing II (3 Credits)
Fourier and wavelet transform methods, numerical methods for elliptic partial differential equations, numerical linear algebra for sparse matrices. Finite element methods, numerical methods for time dependent partial differential equations. Techniques for scientific computation with an introduction to the theory and software for each topic. Course is part of a two course sequence (660 and 661), but can be taken independently.
Prerequisite: Must have knowledge of C or Fortran. And AMSC460 or CMSC460; or (CMSC466 or AMSC466); or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: CMSC661.
Credit Only Granted for: AMSC661 or CMSC661.

AMSC662 Computer Organization and Programming for Scientific Computing (3 Credits)
This course presents fundamental issues of computer hardware, software, parallel computing, and scientific data management for programming for scientific computation.
Prerequisite: Must have knowledge of C or Fortran. And AMSC460 or CMSC460; or (CMSC466 or AMSC466); or (must have knowledge of basic numerical analysis (linear equations, nonlinear equations, integration, interpolation); and permission of instructor). Also offered as: CMSC662.
Credit Only Granted for: AMSC662 or CMSC662.

AMSC663 Advanced Scientific Computing I (3 Credits)
In the sequence AMSC663, AMSC664 students work on a year-long individual project to develop software for a scientific task in a high performance computing environment. Lectures will be given on available computational environments, code development, implementation of parallel algorithms.
Prerequisite: CMSC660 or AMSC660; and (CMSC661 or AMSC661). Restriction: Permission of instructor. Also offered as: CMSC663.
Credit Only Granted for: AMSC663 or CMSC663.

AMSC664 Advanced Scientific Computing II (3 Credits)
In the sequence AMSC663, AMSC 664 students work on a year-long individual project to develop software for a scientific task in a high performance computing environment. Lectures will be given on code development and validation, parallel algorithms for partial differential equations, nonlinear systems, optimization.
Prerequisite: AMSC663.
Restriction: Permission of instructor. Also offered as: CMSC664.
Credit Only Granted for: AMSC664 or CMSC664.

AMSC666 Numerical Analysis I (3 Credits)
Approximation theory, numerical solution of initial-value problems, iterative methods for linear systems, optimization.
Prerequisite: CMSC466 or AMSC466; and MATH410. Also offered as: CMSC666.
Credit Only Granted for: AMSC666 or CMSC666.
AMSC667 Numerical Analysis II (3 Credits)
**Prerequisite:** AMSC666 or CMSC666. Also offered as: CMSC667.
**Credit Only Granted for:** AMSC667 or CMSC667.

AMSC670 Ordinary Differential Equations I (3 Credits)
Existence and uniqueness, linear systems usually with Floquet theory for periodic systems, linearization and stability, planar systems usually with Poincare-Bendixson theorem.
**Prerequisite:** MATH405. And MATH410; or students who have taken courses with comparable content may contact the department. Also offered as: MATH670.
**Credit Only Granted for:** AMSC670 or MATH670.

AMSC671 Ordinary Differential Equations II (3 Credits)
The content of this course varies with the interests of the instructor and the class. Stability theory, control, time delay systems, Hamiltonian systems, bifurcation theory, and boundary value problems.
**Prerequisite:** MATH630. And MATH670 or AMSC670; or students who have taken courses with comparable content may contact the department. Also offered as: MATH671.
**Credit Only Granted for:** AMSC671 or MATH671.

AMSC673 Partial Differential Equations I (3 Credits)
**Prerequisite:** MATH411; or students who have taken courses with comparable content may contact the department. Also offered as: MATH673.
**Credit Only Granted for:** AMSC673 or MATH673.

AMSC674 Partial Differential Equations II (3 Credits)
**Prerequisite:** MATH673 or AMSC673; or permission of instructor. Also offered as: MATH674.
**Credit Only Granted for:** AMSC674 or MATH674.

AMSC689 Research Interactions in Applied Mathematics and Scientific Computation (1-3 Credits)
The students participate in a vertically integrated (undergraduate, graduate and/or postdoctoral, faculty) research group. Format varies, but includes regular meetings, readings and presentations of material. See graduate program’s online syllabus or contact the graduate program director for more information.
**Restriction:** Permission of instructor.
**Repeatable to:** 6 credits if content differs.

AMSC698 Advanced Topics in Applied Mathematics (1-4 Credits)
AMSC699 Applied Mathematics Seminar (1-3 Credits)
Seminar to acquaint students with a variety of applications of mathematics and to develop skills in presentation techniques.
**Repeatable to:** 99 credits if content differs.
AMSC762 Data Analysis Project (1 Credit)
This course cannot be used to meet any of the Applied Statistics Area's seminar requirements. Offered yearly, required of and limited to MS non-thesis and doctoral students in Applied Statistics Area, for whom the resulting projects serve as a Qualifying Exam component. After 5-6 lectures or presentations on components of successful data analyses and write-ups, 3-4 sessions will discuss previous student project submissions. The culminating project, to be completed in a two week period between semesters, is an analysis and written report of one of three project choices made available each year to represent a spectrum of realistic applied statistical problems.
Restriction: Permission of CMNS-Applied Mathematics department; and permission of instructor.

AMSC763 Advanced Linear Numerical Analysis (3 Credits)
Advanced topics in numerical linear algebra, such as dense eigenvalue problems, sparse elimination, iterative methods, and other topics.
Prerequisite: AMSC666 or CMSC666; or permission of instructor. Also offered as: CMSC760.
Credit Only Granted for: AMSC600 or CMSC760; AMSC763 or CMSC763.
Formerly: AMSC600.

AMSC764 Advanced Numerical Optimization (3 Credits)
Modern numerical methods for solving unconstrained and constrained nonlinear optimization problems in finite dimensions. Design of computational algorithms and the analysis of their properties.
Prerequisite: MATH410; or permission of instructor. Also offered as: CMSC764.
Credit Only Granted for: AMSC607, AMSC764 or CMSC764.
Formerly: AMSC607.

AMSC799 Master's Thesis Research (1-6 Credits)

AMSC808 Advanced Topics in Applied Mathematics (1-3 Credits)
Advanced topics of current interest.
Restriction: Permission of instructor.
Repeatable to: 18 credits.

AMSC819 Applied Mathematics Seminar (1-3 Credits)
Advanced topics of current interest.
Restriction: Permission of instructor.
Repeatable to: 18 credits.

AMSC898 Pre-Candidacy Research (1-8 Credits)

AMSC899 Doctoral Dissertation Research (1-8 Credits)