APPLIED MATH & COMPUTATIONAL SCIENCE (AMCS)

AMCS 510 Complex Analysis
Complex numbers, DeMoivre’s theorem, complex valued functions of a complex variable, the derivative, analytic functions, the Cauchy-Riemann equations, complex integration, Cauchy’s integral theorem, residues, computation of definite integrals by residues, and elementary conformal mapping.
Taught by: Staff.
One-term course offered either term
Also Offered As: MATH 410
Prerequisite: MATH 240
Activity: Lecture
1.0 Course Unit

AMCS 514 Advanced Linear Algebra
Topics will include: Vector spaces, Basis and dimension, quotients; Linear maps and matrices; Determinants, Dual spaces and maps; Invariant subspaces, Canonical forms; Scalar products: Euclidean, unitary and symplectic spaces; Orthogonal and Unitary operators; Tensor products and polylinear maps; Symmetric and skew-symmetric tensors and exterior algebra.
Also Offered As: MATH 314, MATH 514
Prerequisite: MATH 240
Activity: Lecture
1.0 Course Unit

AMCS 520 Ordinary Differential Equations
After a rapid review of the basic techniques for solving equations, the course will discuss one or more of the following topics: stability of linear and nonlinear systems, boundary value problems and orthogonal functions, numerical techniques, Laplace transform methods.
One-term course offered either term
Also Offered As: MATH 420
Prerequisite: MATH 240
Activity: Lecture
1.0 Course Unit

AMCS 525 Partial Dif Equations
Method of separation of variables will be applied to solve the wave, heat, and Laplace equations. In addition, one or more of the following topics will be covered: qualitative properties of solutions of various equations (characteristics, maximum principles, uniqueness theorems), Laplace and Fourier transform methods, and approximation techniques.
Course usually offered in fall term
Also Offered As: MATH 425
Prerequisite: MATH 240
Activity: Lecture
1.0 Course Unit

AMCS 567 Mathematical Computation Methods for Modeling Biological Systems
This course will cover topics in systems biology at the molecular/cellular scale. The emphasis will be on quantitative aspects of molecular biology, with possible subjects including probabilistic aspects of DNA replication, transcription, translation, as well as gene regulatory networks and signaling. The class will involve analyzing and simulating models of biological behavior using MATLAB. Prerequisite: Graduate standing or permission of the instructor.
One-term course offered either term
Also Offered As: BE 567, GCB 567
Activity: Lecture
1.0 Course Unit

AMCS 568 Mathematical Modeling in Physiology and Cell Biology
Mathematical modeling is increasingly becoming a standard technique in physiology and cell biology. In this class, we will cover some classical models in physiology and cell biology. Half of the course will be devoted to electrophysiology (Hodgkin-Huxley model, action potential propagation and related topics), which has arguably been the most successful area of application of mathematical techniques to biology. We will then consider models of molecular motors and muscle mechanics, of pattern formation and cell polarization.
Taught by: Mori
Course not offered every year
Also Offered As: BIOL 568
Prerequisite: MATH 240 AND MATH 312
Activity: Lecture
1.0 Course Unit

AMCS 584 The Mathematics of Medical Imaging and Measurement
The last several decades have seen major revolutions in both medical and non-medical imaging technologies. Underlying all of these advances are sophisticated mathematical tools to model the measurement process and reconstruct images. This course begins with an introduction of the mathematical models and then proceeds to discuss the integral transforms that underlie these models: the Fourier transform, the Radon transform and the Laplace transform. We discuss how each of these transforms is inverted, both in theory and in practice. Along the way we study interpolation, sampling, approximation theory, filtering and noise analysis. This course assumes a thorough knowledge of linear algebra and a knowledge of analysis at the undergraduate level (Math 314 and Math 360 and Math 361, or Math 508 and Math 509).
Taught by: Staff.
Course not offered every year
Also Offered As: BE 584, MATH 584
Prerequisite: MATH 114 AND MATH 360 OR MATH 508 AND MATH 361 OR MATH 509
Activity: Lecture
1.0 Course Unit

AMCS 599 Independent Study
Activity: Independent Study
1.0 Course Unit
AMCS 602 Algebraic Techniques for Applied Mathematics and Computational Science, I.
We turn to linear algebra and the structural properties of linear systems of equations relevant to their numerical solution. In this context we introduce eigenvalues and the spectral theory of matrices. Methods appropriate to the numerical solution of very large systems are discussed. We discuss modern techniques using randomized algorithms for fast matrix-vector multiplication, and fast direct solvers. Topics covered include the classical Fast Multipole Method, the interpolative decomposition, structured matrix algebra, randomized methods for low-rank approximation, and fast direct solvers for sparse matrices. These techniques are of central importance in applications of linear algebra to the numerical solution of PDE, and in Machine Learning. The theoretical content of this course is illustrated and supplemented throughout the year with substantial computational examples and assignments.
Course not offered every year
Activity: Lecture
1.0 Course Unit

AMCS 603 Algebraic Techniques for Applied Mathematics and Computational Science, II.
We begin with an introduction to group theory. The emphasis is on groups as symmetries and transformations of space. After an introduction to abstract groups, we turn our attention to compact Lie groups, in particular SO(3), and their representations. We explore the connections between orthogonal polynomials, classical transcendental functions and group representations. This unit is completed with a discussion of finite groups and their applications in coding theory.
Course not offered every year
Activity: Lecture
1.0 Course Unit

AMCS 608 Analysis
One-term course offered either term
Also Offered As: MATH 608
Prerequisite: MATH 508 AND MATH 509
Activity: Lecture
1.0 Course Unit

AMCS 609 Analysis
One-term course offered either term
Also Offered As: MATH 609
Prerequisite: MATH 608
Activity: Lecture
1.0 Course Unit

AMCS 610 Functional Analysis
Also Offered As: MATH 610
Prerequisite: MATH 608 OR MATH 609
Activity: Lecture
1.0 Course Unit

AMCS 810 Reading Seminar
Reading Seminar
One-term course offered either term
Activity: Seminar
1.0 Course Unit

AMCS 999 Independent Study & Research
Study under the direction of a faculty member.
Activity: Independent Study
1.0 Course Unit