

# COMPUTER & COMPUTATIONAL MATH (CCM)

## CCM 504 Dynamical Systems 3 Credit Hours

The aim of this course is to survey the standard types of differential equations. This includes systems of differential equations, and partial differential equations, including for each type, a discussion of the basic theory, examples of applications, and classical techniques of solution with remarks about their numerical aspects. Also included are autonomous and periodic solutions, phase space, stability, perturbation techniques and Method of Liapunov. Additional reading assignments or projects will distinguish this course from its undergraduate version CCM 404. Students cannot receive credit for both CCM 404 and CCM 504. (AY)

**Prerequisite(s):** MATH 216 and (MATH 217 or MATH 227)

**Restriction(s):**

Can enroll if Class is Graduate

## CCM 551 Computer Graphics 3 Credit Hours

Basic geometrical concepts, graphics primitives, two-dimensional transformations, segmented files, windowing and clipping, camera models, and 3-D viewing transformations.

**Restriction(s):**

Can enroll if Class is Graduate

Can enroll if Level is Rackham or Doctorate

Can enroll if Degree is Master of Sci in Engineering, Doctorate in Science, Master of Science

Can enroll if College is Engineering and Computer Science

Can enroll if Major is Software Engineering, Data Science, Computer & Information Science, Computer Engineering

## CCM 558 Introduction to Wavelets 3 Credit Hours

This course will introduce the student to theory and application of wavelets using linear algebra. Topics will include the discrete Fourier transform, linear transformations, orthogonal decomposition, discrete wavelet analysis, the filter bank, Harr Wavelet family, Daubechies's Wavelet family, and applications. Additional reading assignments or projects will distinguish this course from its undergraduate version CCM 458. Students cannot receive credit for both CCM 458 and CCM 558. (OC)

**Prerequisite(s):** (MATH 216 or MATH 217 or MATH 228) and MATH 227

**Restriction(s):**

Can enroll if Class is Graduate

Can enroll if Program is MS-Applied&Computational Math

## CCM 572 Intro to Numerical Analysis 3 Credit Hours

Solution of linear systems by Gaussian elimination, solution of non-linear equations by iterative methods, numerical solution of ordinary differential equations, data fitting with spline functions, numerical integration, optimization. Additional reading assignments or projects will distinguish this course from its undergraduate version CCM 472. Students cannot receive credit for both CCM 472 and CCM 572. (F)

**Prerequisite(s):** MATH 216 and (MATH 217 or MATH 227)

**Restriction(s):**

Can enroll if Class is Graduate

## CCM 573 Matrix Computation 3 Credit Hours

A study of the most effective methods for finding the numerical solution of problems that can be expected in terms of matrices, including simultaneous linear equations, orthogonal projections and least squares, eigenvalues and eigenvectors, positive definite matrices, and difference and differential equations. Additional reading assignments or projects will distinguish this course from its undergraduate version CCM 473. Students cannot receive credit for both CCM 473 and CCM 573. (AY)

**Prerequisite(s):** MATH 217 or MATH 227

**Restriction(s):**

Can enroll if Class is Graduate

\* An asterisk denotes that a course may be taken concurrently.

### Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally