

# MATH 135C

## Introduction to Numerical Analysis III

### Course Description

Introduces basic numerical techniques for computing solutions of problems in science and engineering, as well as computational implementation of such techniques using MATLAB and Python. Topics include least square methods and Fourier series, numerical methods for PDEs, and numerical optimization.

### Prerequisites

MATH 135B with a grade of C- or better; or equivalent; or consent of instructor.

### Textbook

*Numerical Mathematics and Computing* (7th edition, 2013) by E. Ward Cheney and David R. Kincaid

### Suggested Lecture Schedule

Week #	Textbook Section(s)	Topic(s)
1	9.1	Introduce method of least squares  Lab – Review of MATLAB/Python programming, using the least squares method to fit a given set of data with a linear function
2	9.2, 9.4	Orthogonal systems and Chebyshev polynomials, Fourier series  Lab – Use polynomials to fit a given data set
3, 4	12.1	Introduce PDEs and the parabolic, hyperbolic, and elliptic problems  Lab – Simulate advection, heat, wave equation in 1D with provided codes
5, 6	12.2	Numerical methods for PDEs including finite difference, finite element  Lab (Week 5) – Implement finite difference to solve Poisson equation in 1D  Lab (Week 6) – Implement finite difference to solve heat equation in 1D
7, 8	12.3	Numerical methods for PDEs including finite volume, applications of PDEs  Lab – Implement finite volume to solve advection equation in 1D

9	13.1	Introduction to numerical optimization, including unconstrained optimization  Lab – Implement Fibonacci search algorithm and golden section search algorithm
10	14.1, 14.2	Gradient descent, linear programming  Lab – Implement gradient descent and simplex method