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 unconstrainted 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