OFFICIAL SYLLABUS
462- ENGINEERING NUMERICAL ANALYSIS
Adopted - Fall 2018 (Committee: Drs. Leem, Liu, Sewell, Song)

Course Description: Polynomial interpolation and approximations, numerical integration, differentiation, direct and iterative methods for linear systems. Introduction to numerical solutions for ODEs and PDEs. Matlab programming is required.

Prerequisites: MATH 250, 305, CS 140 or 141 or consent of instructor.

NOT FOR MATH MAJORS.

Textbook: Fundamentals of Numerical Computation, by Tobin A. Driscoll and Richard J. Braun
ISBN 978-1-611975-07-9

Course Outline:

Chapter 1, Numbers, problems, and algorithms
1.1 Floating point numbers
1.2 Problems and conditioning
1.3 Stability of algorithms

Chapter 2, Square linear systems
2.2 Computing with matrices
2.3 Linear systems
2.4 LU factorization
2.6 Row pivoting
2.7 Vector and matrix norms
2.8 Conditioning of linear systems
2.9 Exploiting matrix structure

Chapter 4, Roots of nonlinear equations
4.1 The rootfinding problem
4.2 Fixed point iteration
4.3 Newton's method in one variable

Chapter 5, Piecewise interpolation and calculus
5.1 The interpolation problem
5.2 Piecewise linear interpolation
5.3 Cubic splines
5.4 Finite differences
5.6 Numerical integration

Chapter 6, Initial-value problems for ODEs
6.1 Basics of IVPs
6.2 Euler's method
6.3 Systems of differential equations
6.4 Runge–Kutta methods

Chapter 9, Global function approximation
9.1 Polynomial interpolation
9.3 Stability of polynomial interpolation
9.6 Spectrally accurate integration

Chapter 10, Boundary-value problems
10.2 Differentiation matrices
10.3 Collocation for linear problems

Chapter 13, Two-dimensional problems
13.1 Tensor-product discretizations
13.3 Laplace and Poisson equations