CALIFORNIA STATE UNIVERSITY, SACRAMENTO
Department of Mathematics and Statistics

# SYLLABUS

Math 150: Introduction to Numerical Analysis

Prerequisites: Math 32 or 45. Some programming experience is desirable

Finite differences and applications, interpolations, inverse interpolations; numerical differentiation and integration; inversion of matrices; numerical methods of solution of linear equations; algebraic and transcendental equations; numerical methods of solving ordinary and partial differential equations. Some computer programming is desirable.

OUTLINE:

I. Introduction — 1 Week

a. What is Numerical Analysis?
b. Some definitions
c. Mathematical background

II. The Solution of Nonlinear Equations in One Variable — 3 Weeks

a. Synthetic division
b. Bisection method
c. Fixed-point iteration
d. The Newton-Raphson method
e. The secant method

III. The Interpolation Polynomial — 2 Weeks

a. The Lagrange form of the interpolating polynomial
b. The error of the interpolating polynomial
c. Newton's forward-difference formula

IV. Numerical Integration — 2 Weeks

a. The trapezoidal rule
b. The error of the trapezoidal rule
c. Simpson's rule
d. The error of Simpson's rule
e. Romberg integration
f. Gaussian quadrature

V. Approximation Theory and Curve Fitting 3 Weeks

a. Approximation of functions by Taylor Series
b. Chebyshev polynomials
c. Economization of power series
d. Least-squares curve fitting of discrete data

VI. Systems of Linear Equations 2 Weeks

a. Gaussian elimination
b. Gauss-Seidel iteration

VII. Differential Equations 2 Weeks

a. Euler's method
b. Taylor series method
c. Runge-Kutta methods