Fall Semester 2018
Numerical Methods for Computer Science

TextBook
Numerical Methods for Engineers, 7th Edition,
Steven C Chapra and Raymond P Canale,
Current edition is ISBN: 978 0073397924
McGraw-Hill Publishers, 2015.

Prerequisites: Calc II, and Programming Competency

COMP SCI 3200 Introduction To Numerical Methods **(LEC 3.0)**
Finite difference interpolation, numerical differentiation and integration, linear systems of equations, solution of nonlinear equations, numerical solution of ordinary differential equations, computational techniques and the programming of a large number of problems on digital computers. Prerequisites: Programming competency and a "C" or better grade in either Math 1215 or Math 1221

Topics and Chapters in the book
Math Modeling: Error Consideration, Taylor Series, Polynomials
Methods for finding roots of equations: Bisection, False-Position, Fixed-Point, Newton, Secant
Matrix applications to Linear systems: Systems of linear Equations, Gaussian Elimination, Pivoting, LU-Decomposition, Cholesky, Jacobi and Gauss-Seidel
Interpolation techniques: Interpolation Techniques: Least Squares Regression (Linear   & Multiple), Logistic Regression, Interpolating Polynomials, Newton, Lagrange, and Splines
Integration Techniques: Trapezoid, Simpson, Richardson, Romberg
Differentiation, Differential Equations, Euler's, Huen's, Runge-Kutta, Multi-Step

Course Objective and Outline
Learning computational efficiency techniques

Math Modeling Parachutist example 1.1   Matlab 2.5, matlab GUI,
Error Consideration
Taylor Series, Polynomials, and truncation

Methods for finding roots of equations

Bisection & False-Position
Fixed-Point iteration, Newton's Method,   Secant Method, Modified Secant, Dynamic Modified Secant.

Matrix applications to Linear systems

Gaussian Elimination w/ Pivoting Techniques
LUP-Decomposition
Gauss-Seidel and Jacobi Iteration

Interpolation Techniques

Least Squares Regression (Linear & Multiple)
Interpolating Polynomials: Newton, Lagrange
Interpolating Polynomials: Splines

Numerical Integration,

Numerical Integration Techniques: Trapezoid, Simpson(1/3,3/8),
Richardson, Romberg Techniques

Numerical Differentiation,
Numerical Differentiation,
FDF,BDF,CDF methods for
first and second order derivatives
Numerical Solution of Differential equations.

Methods for Solving Differential Equations

| Taylor's, Euler's, Huen's -Modified Euler, Midpoint, Modified MidPoint, , Runge-Kutta RK3, RK4 |
| Multi-Step Methods to Solve D.E.'s |

Stability of Numerical solutions

Prerequisites

MATH 1215 Calculus For Engineers II **(LAB 1.0 and LEC 3.0)**
Continuation of Math 1214. Transcendental functions, techniques of integration, sequences, series including power series, polar coordinates, polar and parametric equations. Applications in physical science and engineering. Credit will be given for only one of Math 1215 or Math 1221. Prerequisites: Math 1160 and either Math 1208 or Math 1214 both with a grade of "C" or better; or by placement exam.

MATH 1221 Calculus With Analytic Geometry II **(LEC 5.0)**
A continuation of Math 8; differentiation and integration of elementary transcendental functions, integration techniques, improper integrals, conic sections, polar coordinates, introduction to sequences and series. Credit will only be given for one of Math 1221 or Math 1215. Prerequisites: Math 1160 and either Math 1208 or Math 1214 both with a grade of "C" or better; or by placement exam.