Syllabus

Course

CSC 422 Numerical Methods

Credits: 3-0-0-3

Text Books

- Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 5th Edition

References

- W. Cheney and Kincaid, Numerical Mathematics and Computing, 4th Edition.

Prerequisite:

CSC-321 Design and Analysis of Algorithms

Course Description

This course will emphasize the development of numerical algorithms to provide solutions to common problems in science and engineering. Topics covered include number systems and errors, solution of nonlinear equations, interpolation, systems of linear equations, approximation, differentiation and integration and solution of ordinary differential equations.

Objectives:

- Understand how to evaluate the approximation error
- Solve linear system of equations and locate the roots
- Evaluate the derivative or the integral
- Understand relationships among methods, algorithms and computer errors.

Course Outline

Week	*Lecture Topics*
1	Introduction to numerical methods: Absolute and relative errors, Rounding and chopping, Computer errors in representing numbers, Review of Taylor series
2	Roots of Equations: Graphical Methods, Bisection method, Newton method.
3	Secant method, Systems of nonlinear equations
4	Systems of Linear Equations: Naïve Gaussian elimination, Gaussian elimination with scaled partial pivoting and Tri-diagonal systems,
5	Gauss-Jordan method
6	Method of Least Squares: Linear Regression, Polynomial Regression, Multiple Linear Regression
7	Interpolation: Newton's Divided Difference method, Lagrange interpolation,
8	Inverse Interpolation
9	Numerical Integration: Trapezoid rule,
10	Simpson's Rules, Romberg algorithm
11	Numerical Differentiation: Numerical Differentiation, Estimating derivatives and Richardson Extrapolation
12	Ordinary Differential Equations: Euler's method, Improvements of Euler's method,
13	Runge-Kutta methods, Methods for systems of equations, Adaptive RK Methods,
14	Multistep Methods, Boundary value problems
15	Partial Differential Equations: Elliptic Equations, Parabolic Equations
16	Final Exam

Grading

Assessment/Evaluation:

1. Class work. (15)
2. Quizzes (5) (05)
3. Midterm-1 Exam. (20)
4. Midterm-2 Exam. (20)
5. Final Exam. (40)

Total (100%)

Method of Teaching:

- Lectures - 15 weeks (3 hrs per week).
- Individual exercises.
- In-class discussion
- Selection of Readings