



Ahsanullah University of Science and Technology
Department of Computer Science and Engineering

Course Outline

Course No : CSE 2201
Course Title : Numerical Methods
Credit Hour : 3.0
Semester (Session) : Spring 2019
Student Year & Student Semester : 2nd Year, 2nd Semester
Course Teacher(s) : Raqeebir Rab, Assistant Professor

Course Objective/Course Outcome (CO):

- CO₁: To perform an error analysis for a given numerical method.
- CO₂: To solve an algebraic or transcendental equation using an appropriate numerical method.
- CO₃: To prove results for numerical root finding methods.
- CO₄: To solve a linear system of equations using an appropriate numerical method.
- CO₅: To establish a mathematical relationship between experimental values.
- CO₆: To approximate a function using an appropriate numerical method.
- CO₇: To solve a differential equation using an appropriate numerical method.
- CO₈: To evaluate a derivative at a value using an appropriate numerical method.
- CO₉: To calculate a definite integral using an appropriate numerical method.
- CO₁₀: Implementation of numerical methods in a modern computer language.

Text/Reference books:

- E. Balagurusamy, Numerical methods, 4th Reprint, Tata McGraw-Hill, Inc
- G. Shanker Rao, Numerical Analysis, 2nd edition, New Age International (P) Limited

Lecture Plan:

Week	Topics/Contents	Course Outcome
01	➤ What is numerical methods, It's areas, Exact & Approximate numbers, Significant Digits, Accuracy & Precision, Sources of errors - Inherent errors, Roundoff errors, Truncation errors; Absolute & Relative errors, Error propagation.	CO ₁
02	➤ Concepts of non-linear equations and iterative methods (bracketing and open end Methods), Evaluation of polynomials, Horner's rule. ➤ Bisection method, False position method, Newton-Raphson method.	CO ₃ CO ₂ , CO ₁₀

03	<ul style="list-style-type: none"> ➤ Secant method, Fixed-point method. ➤ Basic Concepts of Deflation and Synthetic division, finding multiple roots using Bisection method and Newton's methods. 	CO ₂ , CO ₁₀ CO ₂ , CO ₁₀
04	<ul style="list-style-type: none"> ➤ Definition of linear equations, Gauss Elimination method, Gauss-Jordan method, Review of Matrix, Cramer's rule. ➤ Class Test – 01. 	CO ₄ , CO ₁₀
05	<ul style="list-style-type: none"> ➤ Matrix inversion method, Gauss-Jordan matrix inversion method, Do little's LU Decomposition method. ➤ Iterative methods - Jacobi's method, Gauss-Seidel method. 	CO ₄ , CO ₁₀ CO ₄ , CO ₁₀
06	<ul style="list-style-type: none"> ➤ Definition of curve fitting regression, importance of curve fitting, Least Square method: Fitting a straight line, Non-linear curve fitting: Fitting an exponential function, Fitting polynomial function. 	CO ₅ , CO ₁₀
07	<ul style="list-style-type: none"> ➤ Definition of interpolation, Finite Differences – Forward difference, Backward difference, Central differences; Shift operator, Averaging operator; Divided difference; Error propagation in a difference table. ➤ Newton's Binomial Expansion formula. ➤ Class Test – 02. 	CO ₆ CO ₆
08	<ul style="list-style-type: none"> ➤ Newton's Forward and Backward interpolation formulas. ➤ Central difference interpolation formulas – Gauss Forward and Gauss Backward formula. 	CO ₆ CO ₆
09	<ul style="list-style-type: none"> ➤ Central difference interpolation formulas – Stirling's formula, Bessel's formula. ➤ Interpolation with unequal intervals – Lagrange's interpolation formula, inverse interpolation formula, Newton's General Divided Difference formula. 	CO ₆ CO ₆ , CO ₁₀
10	<ul style="list-style-type: none"> ➤ Definition of numerical differentiation, Derivatives using Newton's Forward and Backward difference and Central difference interpolation formulas. ➤ Finding first and second derivatives of a tabulated function. ➤ Class Test – 03. 	CO ₇ , CO ₈ CO ₇ , CO ₈
11	<ul style="list-style-type: none"> ➤ Definition of numerical integration, General Quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule. ➤ Romberg Integration. 	CO ₉ CO ₉
12	<ul style="list-style-type: none"> ➤ Review of Ordinary Differential equations, Taylor's series method, Euler's method, Picard's method. 	CO ₇
13	<ul style="list-style-type: none"> ➤ Ordinary Differential equations: Heun's method, R-K method. ➤ Class Test – 04. 	CO ₇
14	<ul style="list-style-type: none"> ➤ Milne's method ➤ Review Class. 	CO ₇

Note: *This Lecture Plan is subject to change. Course teacher will slow down or speed up each chapter to meet the needs of students.*

Marks Distribution:

Attendance and Class Performance	10
Class Test	20
Final Exam	70
Total	100

FOUR class tests will be taken (as it is a 3 credit course) and best THREE will be considered for "Class Test" marks.