Course Title: **Numerical Methods (3 Cr.)**
Course Code: **CACS252**
Year/Semester: **II/IV**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1, Practical: 2 Hrs.)**

**Course Description**

This course covers solution of nonlinear equations, interpolation and approximation, numerical differentiation and integration and solution of linear algebraic equation, ordinary differential equations and partial differential equations. It provides knowledge for numerical analysis.

**Course Objectives**

The general objectives of this subject are to make students familiar with the theory of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations, numerical differentiation and integration.

**Course Contents**

**Unit 1 Solution of Nonlinear Equations** **10 Hrs.**

Introduction, Types of Equation, Errors in Computing, The Bisection Method; The Method of False Position, Newton- Raphson Method, Solution of System of Nonlinear Equation, Fixed Point Iteration and Convergence

**Unit 2 Interpolation and Approximation** **8 Hrs.**

Introduction, Errors in Polynomial Interpolation, Lagrange's Polynomials, Newton's Interpolation using Difference and Divided Differences, Cubic Spline Interpolation, Least Squares Method for Linear and Non-linear Data.

**Unit 3 Numerical Differentiation and Integration** **5 Hrs.**

Introduction to Numerical Differentiation, Newton's Differentiation Formulas, Numerical Integration (Trapezoidal Rule, Simpson's 1/3 rule, 3/8 rule); Romberg Integration; Numerical Double Integration.

**Unit 4 Solution of Linear Algebraic Equations** **10 Hrs.**

Review of the existence of solutions and properties of matrices, Consistency of a Linear System of Equations, Gaussian Elimination Method, Gauss-Jordan Method, Inverse of matrix using Gauss Elimination Method, Method of factorization, Iterative Methods(Jacobi & Gauss-Seidel Iteration),Power Method.

**Unit 5 Solution of Ordinary Differential Equations** **7 Hrs.**

Introduction to Differential Equations, Initial Value Problem, Taylor Series Method, Picard's Method, Euler's Method and Its Accuracy, Heun's method,