SUBJECT: MATH-356**: Numerical Methods**

CREDIT HOURS: **2-0**

CONTACT HOURS: 2 Hours per Week

TEXT BOOKS: *Numerical Analysis (Latest ed) By Burden & Faires*

REFERENCE BOOKS: *Curtis F.Gerald Patrick O.Wheatley:* ***Applied Numerical Analysis****, Addison-Wesley*

Numerical Methods Using Matlab *(Latest Edition) By John H. Mathews and Kurtis D. Fink , Pearson Education.*

E. Kreyszing. ***Advanced Engineering Mathematics*** *9th ed*

PREREQUISITE: None

MODE OF TEACHING: Lectures.

COURSE DESCRIPTION: Numerical analysis is the branch of mathematics and computer science that deals with solving a given mathematical problem involving methods based on rigorous mathematical analysis and leads to an approximate (non-exact) solution. Such problems originate generally from real-world applications of algebra, geometry, and calculus, and these problems occur throughout the natural sciences, social sciences, engineering, medicine, and business. In this course, we introduce the field of computational techniques for solving problems concerning Calculus, Linear algebra and Differential Equations.

COURSE OBJECTIVES:

a) Use of numerical techniques for solving nonlinear equations.
b) Implementation of various methods for interpolating the data.
c) Calculate integrals numerically.
d) Understanding the numerical techniques in linear algebra.
e) Solving ODEs and PDEs using numerical techniques.

TOPICS COVERED:

1. Introduction to Numerical Methods a) Introduction to course – course outline, education needs b) Types of errors c) Relative and absolute errors	1
2. Iterative Methods for the Solutions of Non-Linear Equations a) Bisection Method b) Newton-Raphson Method c) Secant Method	2-3
3. Interpolation a) Introduction to interpolation b) Lagrange interpolation Method c) Newton's divided difference interpolation method d) Newton's forward and backward interpolation method	4-6
4. Numerical Differentiation and Numerical Integration a) Introduction to differentiation and integration b) First and second order numerical differentiation c) Trapezoidal rule of integration d) Simpson's rule of integration	7-9
5. Numerical Methods in Linear Algebra a) LU factorization Dolittle and Crout's methods b) Iterative methods to solve the system of linear equations. c) Jacobi's and Gauss Seidel methods d) Iterative method to find eigenvalue and eigenvector (power method)	10-13

6. Numerical Solutions of 1st and 2nd order Ordinary Differential Equations a) Introduction b) Euler's Method, Modified Euler's Method c) 2nd and 4th Order Runge Kutta Methods d) Solution of higher order Initial value problems	14-16

COURSE TARGETS:

S.No	Outcomes	Level of Learning	PLO
1	Use of numerical techniques for solving nonlinear equations	C3	2
2	Implementation of various methods for interpolating the data	C3	2
3	Calculate integrals numerically	C3	1
4	Understanding the numerical techniques in linear algebra	C3	1
5	Solving ODEs and PDEs using numerical techniques	C3	2