

## **(ME 527) ADVANCED NUMERICAL METHODS FOR ENGINEERING ( ELECTIVE - II )**

### **Objective of the Course :**

*To familiarize the students with various numerical methods for solving mechanical engineering problems*

### **UNIT - I**

Transcendental and polynomial equations: Bisection method, Iteration method, Regula falsi Method, Newton Raphson Method,, Solution of linear algebraic equations and eigen value problems: Direct methods, Error Analysis, Iteration methods, Eigen Values and Eigen Vectors

### **UNIT- II**

Interpolation and Approximation,- Lagrange and Newton Interpolations, Finite Difference operators, Interpolating polynomials using finite differences, Hermite interpolation, Approximation, Least Square Approximation, Uniform Approximation, Rational Approximation

**UNIT –III** Numerical Differentiation: Methods based on Interpolation, Methods based on finite difference operators, Numerical integration Newton-Cotes integration formulas, Composite *integration methods* –Trapezoidal rules, Simpson's rules, Gaussian quadrature. Romberg Integration.

### **UNIT - IV**

Numerical Solution of Ordinary Differential Equations: Picards Method, Taylor Series Method, Euler's Method, Modified Euler's method, Runge's method, Runge-kutta method, Predictor-Corrector Methods-Milne's Method, Adam-Bashforth method, Simultaneous First order differential Equations, Second order differential equations, Boundary value Problems-Finite Difference Method

### **UNIT - V**

Numerical Solution of Partial Difference Equations-Solution of Laplace equation, Solution of Poisson Equations, Schmidt's method, crank-Nicolson method, Du-Fort and Frankel method , Solution of two dimensional Heat equation,-Hyperbolic equation, Solution of wave equation,

### **TEXT BOOKS:**

- 1..M.K. Jain, S.R.K. Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering Computation", 3<sup>rd</sup>, Edition, New age International Publication, 2007.
2. Dr B.S.Grewal, Numerical Methods in Engineering and Science, Khanna Publishers

### **REFERENCE BOOKS:**

- 1.Steven.C. Chapra, Raymond, P. Canale, "Numerical Methods for Engineering", 6th Edition, Tata Mc Graw Hill, 2010.
- 2.J. Douglas Faires, Richard, L. Burden, "Numerical Methods", 3rd Edition, Thomson / Brooks / Cole, 2003.