Numerical Method

BEG370CO

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	1	2/2	3	80	-	-	20	50	150

Course Objective:

To solve the engineering problems by using the theory of numerical computational procedures.

1 Introduction **(4 hrs)**

1.1. Numerical computing process
1.2. New trends in Numerical Computing
1.3. Application in Numerical Computing
1.4. Taxonomy of errors in numerical method.
1.5. Absolute Relative & percentage errors .

2. Solution of non – Linear equation **(7 hrs)**

2.1. Iterative methods and stopping criteria
2.2. Bisection method & its Convergence
2.3. Horner's method
2.4. Newton- Raphson method and its convergence
2.5. Secant method and its convergence
2.6. Evaluation of polynomials using Horner's Rule

3. Curve Fitting **(8 hrs)**

3.1.Interpolation
- 3.1.1. Linear interpolation
- 3.1.2. Lagrange interpolation
- 3.1.3. Newton interpolation
- 3.1.4. Newton Divided Different interpolation
- 3.1.5. Spine interpolation: cubic spines
- 3.1.6. Control Interpolation (Gauss Forward/ Backward Formulae)

3.2. Regression
- 3.2.1 Least squares Regression
  - 3.2.2 Fitting Transcendental Equations.
  - 3.2.3 Fitting a polynomial function

4. Numerical Differentiation & integration **(7 hrs)**

4.1. Differentiating continuous function
- 4.1.1. Forward Difference Quotient
- 4.1.2. Backward Difference Quotient
- 4.1.3. Central Difference quotient

4.2. Newton cotes methods of integration
- 4.2.1. Trapezoidal rule and composite trapezoidal rule
- 4.2.2. Simpson's 1/3 rule & its composite
- 4.2.3. Simpson's 3/8 rule.
- 4.2.4. Bode 's Rule

4.3. Romberg integration
4.4. Gaussian integration

5. Linear Algebraic Equations (10 hrs)

- 5.1. Elimination Approach
  - 5.1.1. Basic Gauss Elimination
  - 5.1.2. Gauss Elimination with partial pivoting
  - 5.1.3. Gauss Jordon method
  - 5.1.4. LU decomposition methods
    - 5.1.4.1. Do Little Algorithm
    - 5.1.4.2. Crout Algorithm
  - 5.1.5. Matrix Inversion Method
  - 5.1.6. Cholesky Method
- 5.2 Iterative method
  - 5.2.1 Iconic method
  - 5.2.2 Gauss- Seidal method
  - 5.2.3 Eigen values and Eigen vectors using power method & inverse power method

6 Solution of Ordinary Differential Equations (6 hrs)

- 6.1 Euler's method.
- 6.2 Heun's method (predictor – Corrector method)
- 6.3 Fourth order Runge-kutta method
- 6.4 Systems of differential equations using Heun's method
- 6.5 Higher order differential equations using Heun's method

7 Solutions of Partial Differential Equations (3 hrs)

- 7.1 Elliptic equations
  - 7.1.1 Poisson's equations
  - 7.1.2 Laplace's equations
- 7.2 Parabolic Equations
- 7.3 Hyperbolic Equations

Laboratories:

- (i) Review of properties of programming language
- (ii) Bisection method
- (iii) Newton-raphson method
- (iv) Secant method & Horner's rule
- (v) Lagrange interpolation
- (vi) Linear Regression
- (vii) Basic gauss elimination method
- (viii) Gauss seidal method
- (ix) Matrix inversion method
- (x) Trapezoidal rule
- (xi) Simpson's 1/3 rule
- (xii) Simpson's 3/8 rule
- (xiii) Solution of differential equation using Euler's method
- (xiv) Solution of differential equation using Runge-Kutta method

References:

- E. Balagurusamy " Numencal Methods ' Tatal Mc Graw Hill
- S.Yakwitz and F. szidarouszky '' An Introduction to Numerical Computations "2nd Edition Macmillan Publishing co ', New York .
- W. Cdhency and D kixaid " Numerical Mathematics 4 computing "2nd Editior, Brooks /Cole publishing
- C.F Gerald and P.o. Wheatley " Applied Numerical Analysis "4th Editim Addipon wesley publishing co. New york .
- W. It presss, B p. Flannery et . al "Numerical Recises Inc", 1st Edition, Cambridge press 1988