**SUDHARSAN COLLEGE OF ARTS AND SCIENCE**

**Perumanadu, Pudukottai-622 104.**

## ADVANCED NUMERICAL ANALYSIS

**Class : II M.Sc Mathematics** **Sub Code: P16MA43**

**Time : 3 Hours** **Marks : 75**

## Part – A **(10x2=20)**

***Answer ALL questions.***

1. Define the order of iterative method.
2. Define the multipoint iteration function.
3. Determine the Euclidean & the maximum absolute row sum norms of the matrix.
4. Define residual vector.
5. Describe the Piece wise cubic interpolation.
6. Define Spline function.
7. Find the error of non – uniform nodal points.
8. Define linear interpolation.
9. Define increment function.
10. Define Discretization error (or) Local truncation error.

## Part – B **(5x5=25)**

***Answer ALL questions.***

11. (a) Explain Newton – Raphson method & Find its rate of convergence. **(Or)**

(b) Perform one iteration of the Bairstow method to extract a quadratic factor $x^2 + px + q$ the polynomial $x^4 + x^3 + 2x^2 + x + 1 = 0$.

12. (a) Determine the condition number of the matrix

$$\begin{bmatrix} 1 & 4 & 9 \\ 4 & 9 & 16 \\ 9 & 16 & 25 \end{bmatrix}.$$

**(or)**

(b) Solve the System of equation

$$2x_1 - x_2 + 0x_3 = 7$$
$$-x_1 + 2x_2 - x_3 = 1$$
$$ox_1 - x_2 + 2x_3 = 1$$

Using the Gauss Seidal method & its error format. Take the initial approximation $x^{(0)} = 0$ & Perform 3 iterations.

13. (a) Obtain the Piecewise linear interpolating polynomials for the function f(x) defined by the data. Hence estimate the value of f(3) & f(7).

| x | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
| F(x) | 3 | 7 | 21 | 73 |

**(Or)**

(b) Obtain the Piecewise quardratic interpolating polynomials for the function f(x) defined by the data. Hence the approximate value of f(-2.5) & f(6.5).

| x | -3 | -2 | -1 | 1 | 3 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| F(x) | 369 | 222 | 171 | 165 | 207 | 990 | 1779 |

14. (a) Find the Jacobian matrix for the System of equation

$$f_1(x, y) = x^2 + y^2 - x = 0$$

$f_2(x, y) = x^2 - y^2 - y = 0$ .at the point (1,1).

**(Or)**

(b) Find the approximate value of I = $\int_0^1 \frac{sinx}{x} dx$. Using (i) mid – point rule & (ii) two – point open type rule.

15. (a) Given the initial value problem $u' = t^2 + u^2$, u(0) = 0 determine the first 3 non zero terms the Taylor Series for u(t) & hence obtain the value for u(1). Also determined when the error in u(t) obtained from the first two non zero terms is to be less $10^{-6}$ after rounding.

**(Or)**

(b) Given the initial value problem $u' = -2tu^2$, u(0) = 1 , estimate u(0.4) using (i) modified Euler – cauchey method & (ii) Hence methods h = 0.2 . compare the results with the exact solution u(t) = $\frac{1}{(1+t^2)}$.

## Part – C **(3x10=30)**

***Answer Any THREE questions only.***

16. Find all the roots of the polynomial $x^4 - x^3 + 3x^2 + x - 4 = 0$.
17. Using the following data

| x | -3 | -2 | -1 | 1 | 3 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| F(x) | 369 | 222 | 171 | 165 | 207 | 990 | 1779 |

Obtain the approximate value of f(-2.5) & f(6.5). Using the piecewise cubic interpolation.

18. Solve the System of equation

$$4x_1 + x_2 + x_3 = 2$$
$$x_1 + 5x_2 + 2x_3 = -6$$
$$x_1 + 2x_2 + 3x_3 = -4$$

19. Explain Newton – Cote methods. Trapezoidar rule simpson's rule.
20. Solve the initial value problem $u' = -2tu^2$, u(0) = 1 with h = 0.2 on the interval [0, 0.4] use the 2nd order implicit Rugnge – Kutta method.

********** **ALL THE BEST** **********