2017
MATHEMATICS
PAPER: MAT 402

NUMERICAL ANALYSIS

FULL MARKS: 80

TIME: 3 HOURS

The figures in the margin indicate full marks for the questions

1. **Answer any two:** $2 \times 10 = 20$

   (i) Solve, by Gauss elimination method, the equations

   $2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16.$

   (ii) Using Escaletor method, find the inverse of

   $$A = \begin{bmatrix} 13 & 14 & 6 & 4 \\ 8 & -1 & 13 & 9 \\ 6 & 7 & 3 & 2 \\ 9 & 5 & 16 & 11 \end{bmatrix}.$$

   (iii) Write in detail about Cholesky's decomposition method.

2. **Answer any two:** $2 \times 10 = 20$

   (i) Write in detail about Jacobi's method. Using Jacobi's method, find all the eigen values and the eigen vectors of the matrix

   $$\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$$

   (ii) Using Given's method , reduce the following matrix to the tri-diagonal form:

   $$A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix}$$

(iii) Using House-holder method, reduce the following matrix to the tri-diagonal form

$$A = \begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix}$$

3. **Answer any two:** $2 \times 10 = 20$

(i) Write in detail about Modified Euler's method. Using modified Euler's method, find an approximate value of y when $x = 0.3$, given that $\frac{dy}{dx} = x + y$ and y=1 when $x = 0$.

(ii) Write in detail about Runge-Kutta method. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$.

(iii) Write in detail about Finite difference method. Determine values of y at the pivotal points of the interval (0,1) if y satisfies the boundary value problem $y^{iv} + 81y = 81x^2$, $y(0) = y(1) = y''(0) = y''(1) = 0$.

4. **Answer any two:** $2 \times 10 = 20$

(i) Write about the polynomial approximation by use of orthogonal polynomials.

(ii) By the method of least squares, find the straight line that best fits the following data:

x:	1	2	3	4	5
y:	14	27	40	55	68

(iii) Prove that

$$\frac{1-t^2}{1-2tx-t^2} = \mathrm{T_0(x)} + 2\sum_{n=1}^{\infty} \mathrm{T_n(x)t^n}$$

(Symbols have their usual meaning)

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