Roll No.

MAT-508

Numerical Analysis

M. Sc. MATHEMATICS (MSCMAT-12)

Second Year, Examination, 2018

Time : 3 Hours

Max. Marks: 80

Note: This paper is of eighty (80) marks containing three (03) Sections A, B and C. Attempt the questions contained in these Sections according to the detailed instructions given therein.

Section-A

(Long Answer Type Questions)

- **Note :** Section 'A' contains four (04) long answer type questions of nineteen (19) marks each. Learners are required to answer *two* (02) questions only.
- 1. Using the Runge-Kutta method of order 4, obtain y(0.2) for the differential equation :

$$\frac{dy}{dx} = y - x$$

y(0) = 2, step size h = 0.1.

2. Solve the following equations by Crout's method :

$$x_1 + x_2 + x_3 = 1$$

$$3x_1 + x_2 - 3x_3 = 5$$

$$x_1 - 2x_2 - 5x_3 = 10$$

(A-68) **P. T. O.**

4. Find the Eigen values and Eigen vectors of $\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$.

Section-B

(Short Answer Type Questions)

- **Note :** Section 'B' contains eight (08) short answer type questions of eight (8) marks each. Learners are required to answer *four* (04) questions only.
- 1. Fit a polynomial of the second degree to the data points (*x*, *y*) given by (0, 1), (1, 6) and (2, 17).
- 2. Factorize the matrix :

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

into the LU form.

3. Use Taylor's series method to obtain a power series solution of the Initial Value Problem (IVP) :

$$\frac{dy}{dx} = 2y + 3e^x, \ y(0) = 0$$

4. Find a real root of :

$$f(x) = x^3 - 3x^2 + 4x - 5 = 0$$

By Birge-Vieta method.

5. Using finite difference method, solve the boundary value problem :

$$\frac{d^2 y}{dx^2} = y$$

with $y(0) = 0$, $y(2) = 3.627$ and $y = \frac{1}{2}$.

- 6. Using Chebyshev polynomials obtain the least squares approximations for $f(x) = x^4$ on [-1, 1].
- 7. Solve $x^3 9x + 1 = 0$ for root lying between 2 and 4 by using Regula-Falsi method.
- 8. Find the inverse of the matrix by Choleski's method :

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 6 \end{bmatrix}$$

Section-C

(Objective Type Questions)

Note : Section 'C' contains ten (10) objective type questions of one (01) mark each. All the questions of this section are compulsory.

Write True/False in the following statements :

- 1. The matrix A and A^{T} have same eigen values with different eigen vectors.
- 2. The order of a linear difference equation is always one.
- 3. Gauss-Jordan method is a modification of Gauss elimination method.
- 4. Picard method for solving first order differential equations is also known as the method of successive approximation.

- [4]
- 5. Newton-Raphson's method is suitable in the cases when f'(x) is large.

Fill in the blanks in the following questions.

- 6. If f(x) is exactly divisible by (x a), then *a* is the root of $f(x) = \dots$
- 7. The terms predictor and corrector are related with method.
- 8. Rate of convergence of Newton-Raphson method is