Roll No. ……..

MAT–508

Numerical Analysis

M. Sc. MATHEMATICS (MSCMAT–12)

Second Year, Examination, 2017

Time : 3 Hours **Max. Marks : 60**

Note : This paper is of **sixty (60)** marks containing **three (03)** sections A, B and C. Learners are required to 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 fifteen (15) marks each. Learners are required to answer *two* (02) questions only.

1. Solve the differential equation :

$$y'' + 2xy' + 2y = 5x,$$

$$0 \leq x \leq 0.5$$

satisfying the boundary conditions,

$$y(0) = 1,\ y(0.5) = 1.5.$$

Compute upto 4 decimals taking $h = 0.1$.

2. Fit a curve of the form $y = ax^b$ to the following data by the method of least squares :

x	y
1	1
2	3
3	5
4	8
5	11

Compute upto four places of decimal and round the values of a and b to two decimal places.

3. Compute the positive root of $x^3 - 2x - 8 = 0$ by Bisection method, correct upto two decimal places.

4. Find the roots of the equation $x^2 - \cos x = 0$ by Newton-Raphson's method correct upto 3 places of decimal.

Section–B

(Short Answer Type Questions)

Note : Section 'B' contains eight (08) short answer type questions of five (05) marks each. Learners are required to answer *four* (04) questions only.

1. Solve the differential equation $y'' = xy$, for $x = 0.5$ in a single step, using Runge-Kutta fourth order method when the initial conditions are given to be $y(0) = 0$ and $y'(0) = 1$.

2. Find the eigen values of the following matrix :

$$\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 4 \\ 0 & 4 & 9 \end{bmatrix}$$

3. Evaluate the integral $I = \int_0^1 \sqrt{1 - x^2}\, dx$ by taking $h = 0.25$. Compute upto 4 decimals and round the answer to 3 decimals.

4. Fit a straight line to the following data :

x	y
0	2
1	5
2	8
3	17
4	38

5. Solve the differential equation :

$$xy'' + (x - 1)y' - y = 0,\ 0 \le x \le 0.75$$

Subject to conditions :

$$y'(0) = 1,\ y(0.75) = 1.3125.$$

6. Find the function whose first difference is $x^3 + 3x^2 + 5x + 12$, if 1 be the internal of differencing.

7. Obtain the first five terms in the Taylor's series as solution of the equation :

$$\frac{dy}{dx} = \frac{1}{2}(x^2 + y^2),\ y(0) = 1$$

Also discuss its trunca error in interval [0, 0.1].

8. Solve the equation $\frac{dy}{dx} = x + y^2$ with $y_0 = 1$, when $x = 0$.

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.

Fill in the blanks.

1. Jordon's method is a modification of .....
2. Milne's method needs part four points of the solution to predict the y_n and referred to as ..... method.
3. Range's method is referred to as ..... when y_{j+1} depend on y_j.
4. Cote's numbers ..... from both ends i.e. $C_K^n = C_{n-K}^n$.
5. The term predictor and corrector are related with ..... method.

Write 'T' for True and 'F' for False statements :

6. Picard's method for solving ordinary first order differential equation is also known as the method of successive approximation. (True/False)
7. The differential equation with the initial conditions is called non-linear. (True/False)
8. Gauss elimination method, the variables from the system of linear equations are eliminated successively. (True/False)
9. In Jordon's method, the elimination takes places not only below but above also, then we get a diagonal matrix. (True/False)
10. Every matrix A can be expressed as the form of LU. (True/False)