## MAT-508

## Numerical Analysis

## M. Sc. MATHEMATICS (MSCMAT-12)

Second Year, Examination, 2017

## Time: $\mathbf{3}$ Hours

 Max. Marks : 60Note: This paper is of sixty ( $\mathbf{6 0}$ ) 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 :

$$
\begin{gathered}
y^{\prime \prime}+2 x y^{\prime}+2 y=5 x, \\
0 \leq x \leq 0.5
\end{gathered}
$$

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 $y=a x^{b}$ 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 $x^{3}-2 x-8=0$ 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 $y^{\prime \prime}=x y$, 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 $y^{\prime}(0)=1$.
2. Find the eigen values of the following matrix :

$$
\left[\begin{array}{lll}
2 & 0 & 0 \\
0 & 3 & 4 \\
0 & 4 & 9
\end{array}\right]
$$

3. Evaluate the integral $\mathrm{I}=\int_{0}^{1} \sqrt{1-x^{2}} d x$ 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 :

$$
x y^{\prime \prime}+(x-1) y^{\prime}-y=0,0 \leq x \leq 0.75
$$

Subject to conditions :

$$
y^{\prime}(0)=1, y(0.75)=1.3125
$$

6. Find the function whose first difference is $x^{3}+3 x^{2}+5 x+12$, if 1 be the internal of differencing.
7. Obtain the first five terms in the Taylor's series as solution of the equation :

$$
\frac{d y}{d x}=\frac{1}{2}\left(x^{2}+y^{2}\right), y(0)=1
$$

Also discuss its trunca error in interval [0, 0.1].
8. Solve the equation $\frac{d y}{d x}=x+y^{2}$ 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 $\qquad$ .
2. Milne's method needs part four points of the solution to predict the $y_{n}$ and referred to as $\qquad$ 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. $\mathrm{C}_{\mathrm{K}}^{n}=\mathrm{C}_{n-\mathrm{K}}^{n}$.
5. The term predictor and corrector are related with $\qquad$ 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)
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