MAT–508

Numerical Analysis

M. Sc. MATHEMATICS (MSCMAT–12)

First Year, Examination, 2017

Time : 3 Hours   **Max. Marks : 80**

Note : This paper is of **eighty (80)** 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 nineteen (19) marks each. Learners are required to answer *two* (02) questions only.

1. Find the root of the equation :

    $$x^3 - 2x - 5 = 0$$

    using Regula-Falsi method.

2. Find the root of the equation :

    $$x^4 - x - 10 = 0$$

    using Birge-Vieta method. Perfrom *three* iterations.

3. Using Cholesky method, solve the system of equations :

    $$4x - y = 1,$$
    $$-x + 4y - z = 0 \text{ and}$$
    $$-y + 4z = 0.$$

B-82   **P. T. O.**

4. Solve the following initial value problem :
$$y'' + 2y' + y = 0$$

where $y' = \dfrac{dy}{dt}$ and $0 \leq t \leq 0.1$, $y\,(0) = 0$, $y'(0) = 1$.

Section–B

(Short Answer Type Questions)

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

1. Find the root of the equation :
$$\log x - \cos x = 0$$

by using Bisection method.

2. Find the root of the equation :
$$x^3 + x^2 - x - 1 = 0$$

with multiplicity 2, taking initial approximation as $x_0 = -0.9$.

3. Compute the largest eigenvalue in magnitude and corresponding eigenvector of matrix :
$$\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$$

4. Fit a straight line to the given data :

X	Y
1	2.6
2	2.7
3	2.9
4	3.025
5	3.2
6	3.367

5. Determine the best minimax approximation to the function, $f(x) = x^2$ on [0, 1] with a straight line.

6. Use Picard's method to compute $y(t)$ given that :

$$\frac{dy}{dt} = \frac{e^{-t}}{y}$$

7. Compute $y(0.2)$ by Taylor's series, where $y(t)$ is the solution of the IVP $\frac{dy}{dt} = t + y, \ y(0) = 1$.

8. Solve the BVP :

$$\frac{d^2y}{dx^2} = \frac{3}{2} y^2$$

$y(0) = 4$, $y(1) = 1$, with step size $h > 1/3$, using second order method.

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 questions.

1. Newton-Raphson method is known as Normal method.

2. Convergence of the Chebyshev method is 3.

3. If $(1 + i)$ is the root of some equation then the another root of the equation will be $(1 - i)$.

4. Synthetic division can be applied on transcendental equation.

5. Using least-squares principle, we can approximate a polynomial of n degree, fit to discrete data.

P. T. O.

Fill in the blanks in the following questions.

6. To fit a parabola, unknown parameters can be obtained by solving normal-equations consisting of .... equations.

7. Chebyshev polynomials are .... polynomials.

8. Secant method is also known as ....

9. A method is said to be .... if the total effect of all errors is bounded and is independent of the number of mesh points.

10. A two point BVP is the .... case to understand by the numerical solution methods.