Section–C   2×16=32

(Long Answer Type Questions)

Note :– Answer any *two* questions. You have to delimit your each answer maximum up to **500** words. Each question carries 16 marks.

10. Find complex root of the equation $z^2 + 1 = 0$ by Newton-Raphson method. Use $z_0 = \frac{1}{2}(1+i)$ as an initial approximation.

11. Using Cholesky (square root) method solve the following system of equations :

$$4x - y = 1$$
$$-x + 4y - z = 0$$
$$-y + 4z = 0$$

12. Compute $y(1.4)$, using fourth order Runge-Kutta method, given that :

$$\frac{dy}{dt} = \frac{t}{y}, y(1) = 2$$

13. Solve the following boundary value problem :

$$\frac{d^2 y}{dt^2} = y, y(0) = 0, y(1) = 1.1752$$

by shooting method together with Runge-Kutta method.

MAMT-08/MSCMT–08

June – Examination 2024

M.A./M.Sc. (Final) Examination

MATHEMATICS
(Numerical Analysis)

Paper : MAMT-08/MSCMT-08

Time : 3 Hours]   *[Maximum Marks : 80*

Note :– The question paper is divided into three Sections A, B and C. Write answers as per the given instructions. Use of non-programmable scientific calculator is allowed in this paper.

Section–A   8×2=16

(Very Short Answer Type Questions)

Note :– Answer all questions. As per the nature of the question delimit your answer in maximum up to **30** words. Each question carries 2 marks.

1. (i) Write the condition for Newton-Raphson method to be convergent.

    (ii) Define Direct method to solve the system of linear equations.

(iii) Define Spectrum and spectral radius of a matrix.

(iv) Express $2x^2 + 3x + 1$ as sum of Chebyshev polynomials.

(v) What do you mean by Curve fitting ?

(vi) Write normal equations for fitting a parabola $y = ax + bx^2$.

(vii) What do you mean by stability of a method ?

(viii) Write formula for Runge-Kutta method of order two.

Section–B   4×8=32

(Short Answer Type Questions)

Note :– Answer any *four* questions. Each answer should not exceed **200** words. Each question carries 8 marks.

2. Find square root of 10 using Newton-Raphson method.

3. Solve the following system of the equation using partition method :

$$3x + 2y + z = 11.6$$
$$2x + 3y + 2z = 15.9$$
$$x + 2y + 2z = 12.2$$

4. Use Jacobi method to compute eigenvalues of the following matrix (two iterations only) :

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

5. Population of a city in different years are given in the following table :

x	1970	1980	1990	2000	2010
y (in thousands)	1450	1600	1850	2150	2500

Fit a parabola to the given data, using least squares principle. Also estimate the population of the city in 2005.

6. Obtain the Chebyshev polynomial approximation of second degree (best minimax approximation) to $f(x) = x^3$ on the interval [0, 1].

7. Evaluate $y(1.5)$ by Adams-Bashfourth method of order four, given that :

$$\frac{dy}{dt} = t^2(1+y)$$

$y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$ $y(1.4) = 2.575$

8. Solve the following boundary value problem :

$$\frac{d^2 y}{dx^2} = y$$
$$y(0) = 0,\ y(1) = 1.2$$

by employing shooting method, take $y'(0) = 0.85$, 0.95 as initial guesses.

9. Solve the following boundary value problem by Numerov method :

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

$y(0) = 0$, $y(1) = 0$ with step size $h = \dfrac{1}{4}$.