

Roll No. :

Total No. of Questions : 16]

[Total No. of Printed Pages : 4

MATHSEM-121

M.A./M.Sc. (Ist Semester) Examination Dec., 2022

MATHEMATICS

Paper - V

(Numerical Methods-I)

Time : 3 Hours]

[Maximum Marks : 50

The question paper contains three Sections.

Section-A

(Marks : 1 × 9 = 9)

Note :- The candidate is required to answer all the *nine* questions carries 1 mark each. The answer should not exceed 50 words.

Section-B

(Marks : 4 × 5 = 20)

Note :- The candidate is required to answer *five* questions by selecting at least *one* question from each Unit. Each question carries 4 marks. Answer should not exceed 200 words.

Section-C

(Marks : 7 × 3 = 21)

Note :- The candidate is required to answer *three* questions by selecting at least *one* question from each Unit. Each question carries 7 marks. The answer should not exceed 500 words.

BRI-21

(1)

MATHSEM-121 P.T.O.

Section–A

1. (i) Define root of an equation.
- (ii) Give an example of polynomial equation of degree four.
- (iii) Write down Descartes's rule of sign for polynomial equations.
- (iv) Describe the graphical method to find initial approximate value of a root of an equation.
- (v) Write down the Newton-Raphson formula to find real root of equation $f(x) = 0$.
- (vi) Write two direct methods to find solution of simultaneous linear equations.
- (vii) Define characteristic equation of a matrix.
- (viii) Define eigen values and eigen vectors of square matrix.
- (ix) If 1, 2, 3 are eigen values of a square matrix A, then find out the eigen values of A^3 .

Section–B

Unit–I

2. Find $\sqrt{12}$ by applying Newton's formula upto three places of decimal.
3. Find the value of the multiple root of the following equation by Newton-Raphson method :

$$f(x) = 27x^5 + 27x^4 + 36x^3 + 28x^2 + 9x + 1 = 0 \text{ (perform two iterations).}$$

4. Using Bisection method find the real root the equation :

$$x^4 + 2x^3 - x - 1 = 0$$

lying in the interval $[0, 1]$, performing three iterations.

Unit–II

5. Find a real root of :

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

by Birge-Vieta method (upto two iterations).

6. Solve the system of equations :

$$2x_1 + 3x_2 + x_3 = 9$$

$$x_1 + 2x_2 + 2x_3 = 6$$

$$3x_1 + x_2 + 2x_3 = 8$$

by using Cramer's rule.

7. Find the real root of equation :

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

correct to three places of decimal by Newton-Raphson method.

Unit-III

8. Solve by Gauss elimination method :

$$x + y + 4z = 12$$

$$8x - 3y + 2z = 20$$

$$4x + 11y - z = 33$$

9. Find the solution of the following system of equation by Jacobi iterative method, performing two iterations :

$$27x_1 + 6x_2 - x_3 = 85$$

$$6x_1 + 15x_2 + 2x_3 = 72$$

$$x_1 + x_2 + 54x_3 = 110$$

10. Find the eigen values and eigen vectors of the matrix :

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$$

Section-C

Unit-I

11. Show that the square root of $N = AB$ is given by :

$$\sqrt{N} = \frac{S}{4} + \frac{N}{S}$$

where $S = A + B$.

12. Using Regula-Falsi method (method of false position) find the real root of the equation in (2, 3) :

$$x^3 - 2x - 5 = 0 \quad (\text{performing three iterations})$$

Unit-II

13. Find the roots of the equation by Graeffe's root squaring method :

$$x^3 - 8x^2 + 17x - 10 = 0$$

squaring three times.

14. Find a quadratic factor of the polynomial by using Bairstow's method :

$$x^4 + 5x^3 + 3x^2 - 5x - 9 = 0$$

starting with $p_0 = 3$, $q_0 = -5$ and repeating the process two times.

Unit-III

15. Apply Gauss-Seidel iteration method to solve the following system of equations :

$$9x_1 - 2x_2 + x_3 = 50$$

$$x_1 + 5x_2 - 3x_3 = 18$$

$$-2x_1 + 2x_2 + 7x_3 = 19 \quad (\text{performing three iterations})$$

16. Find the dominant eigen value and corresponding eigen vector of the matrix :

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

taking initial eigen vector :

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$