Program : M.A./M.Sc. (Mathematics)

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

Paper Code:MT-08

Numerical Analysis

Section – B

(Short Answers Questions)

1. Find a real root of the equation $x^3 - 9x + 1$ by bisection method.

A (P.No. 3)

2. Find the real root of the equation $x^2 - 2x - 5 = 0$ using secant method.

A (P.No. 7)

3. Find two nearly equal roots of the equation $x^3 - 4.4x^2 + 6.5x - 2.7 = 0$ in the neighbourhood of $x = 1$.

A (P.No.10)

4. Find the square root of 13 using Newton Raphson method.

A (P.No. 26)

5. Perform one iterations of Muller's method to find the root of the equation $x^3 - x - 1 = 0$. Take $x_1 = -1, x_1 = 0.5, x_2 = 1$ as initial approximations.

A (P.No. 32)

6. Show that $x = 1$ is a multiple root of equation $x^3 - 3x^2 - 3x - 1 = 0$ with multiplicity three.

A (P.No.34)

7. Find quotient and remainder on division of polynomial $x^4 - 5x^3 + 6x^2 + 4x - 18$ by a linear factor $(x - 2)$. Also verify the result.

A (P.No. 43)

8. Find a real root of the equation $x^4 + 7x^3 + 24x^2 - 15 = 0$, using Birge-Vieta method, perform two iterations.

A (P.No. 46,47)

9. Solve the given system of the equations using the method of determinants.

$$3x + y + 2z = 3$$
$$2x - 3y - z = -3$$
$$X + 2y - z = 4$$

A (P.No.66, 67)

10. Solve the following linear equations.

$$2x_1 + 8x_2 + 2x_3 = 14$$
$$6x_1 + 6x_2 - x_3 = 13$$
$$2x_1 + x_2 + 2x_3 = 5$$

Using Gauss-Jordon method.

A (P.No. 67, 68)

11. Find the eigenvalues and eigen vectors of the following matrix:

$A = \begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$

A (P.No. 87, 88)

12. Compute largest eigenvalue in magnitude and and corresponding eigenvector of the matrix.

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

A (P.No. 93, 94)

13. Transform the following matrix to tridiagonal form by Given's method.

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

A (P.No. 104)

14. Using the method of least-squares find a straight line that fits the following data:

x	71	68	73	69	67	65	66	67
y	69	72	70	70	68	67	68	64

Also find the value of y at $x = 68.5$.

A (P.No. 121)

15. Fit a curve $y = ax^b$ to the following data:

x	1	2	3	4
y	5	7	9	10

Also estimate the value of y at $x = 2.5$.

A (P.No. 131)

16. Express $2 - x^2 + 3x^4$ as a sum of chebyshev polynomials.

A (P.No. 150)

17. Find the value of y at $t = 0.2$ by using seven terms Taylor's series, where $y(t)$ is the solution of the second order initial value problem:

$\frac{d^2y}{dt^2} = 4 - t + y^2, \ \ y(0) = \ 1, y'(0) = \ -1$

A (P.No. 165)

18. Use Picard's method to compute $y(05)$, where $y(t)$ is the solution to the given IVP.
$\frac{dy}{dt} = 1 + y, \qquad y(0) = \ 1$

A (P.No. 167)

19. Compute $y(0, 2)$, using second order runge-kutta method with two different schemes where $y(t)$ is the solution of the IVP.
$\frac{dy}{dt} = t + y, \qquad y(0) = \ 1$

A (P. No. 172)

20. Explain the Milne's predictor corrector formula.

A (P. No. 185, 186)

21. Use Adans-Moultan Predictor corrector formula to compute $y(0.4)$, given that:
$\frac{dy}{dt} = ty, \qquad y(0) = \ 1, \qquad y(0.1) = 1.01, y(0.2) = 1.022, y(0.3) = 1.023$

A (P.No. 196, 197)

22. Explain Local truncation error and convergence?

A (P.No. 198)

23. Explain Boundary value problems and solutions of Boundary value problem.

A (P.No. 204, 205)

24. Solve the boundary value problem.
$\frac{d^2y}{dx^2} = y, \quad y(0) = 0, \quad y(1) = \ 1.2$
By employing shooting method, take $y'(0) \ = \ 0.85, 0.95$ as initial guesses.

A (P.No. 207)

25. Solve the BVP by Numerous method
$\frac{d^2y}{dx^2} = x + y, \quad y(0) = 0, \quad y(1) = \ 0$ with step size $h = \frac{1}{4}$

A (P.No. 217)

26. Solve the BVP:
$y^{iv} = 2$
$y(0) = y'(0) = y(1) = y'(1) = 0$

A (P.No. 220)

27. Explain Bisection method?

A (P.No. 2, 3)

28. Explain Regular falsi method?

A (P.No. 4, 5)

29. Explain Secant method.

A (P.No. 5, 6)

30. Explain Newton-Raphson method.

A (P.No. 8)

31. Explain Newton-Raphson method for pth root of a number?

A (P.No. 10,11)

32. Find the root of the equation $\sin x - x^3 = 1$ using Newton-Raphson method.

A (P.No 9)

33. Explain iteration method?

A (P.No. 12)

34. Explain Aitken's Δ^2-method to accelerate the convergence.

A (P.No. 14)

35. Explain Newton-Raphson method for system of Non-linear equations?

A (P.No. 15, 16)

36. Explain chebyshev method?

A (P.No. 23, 24)

37. Find the square root of 13 using chebyshev method?

A (P.No. 26)

38. Find the root of the equation $x^3 - x^2 - x - 1 = 0$ using chebyshev method?

A (P.No. 27)

39. Explain Muller's method?

A (P.No. 29, 30)

40. Find a root of the equation: $x^3 + x^2 - x - 1 = 0$ with multiplicity 2, taking initial approximation as $x_0 = 0.9$

A (P.No. 34)

41. Explain Newton-Raphson method for complex roots.

A (P.No. 36)

42. Find the root of the equation $x^4 - x - 10 = 0$ using birge-vieta method. Perform three iterations.

A (P. No. 45)

43. Find all the roots of the equation $x^2 - 6x^2 + 11x - 6 = 0$ using Graeffe's root square method.

A (P.No. 58)

44. Explain partition method?

A (P.No. 75)

45. Solve the given system of equation using conjugate-Gradient method.

A (P.No. 79)

46. Writw basic properties of eigen values and eigen vectors.

A (P.No. 90, 91)

47. Use Jacobi method to compute eigenvalues of given matrix (two iterations only)

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

A (P.No. 96)

48. Explain Rutishauser method?

A (P.No. 110)

49. Using the Rutishauser method, find all the eigenvalues of the matrix.
$A = \begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$

A (P.No. 110)

50. Explain least-squares principle?

A (P.No. 119)

51. Explain linear regression of fitting a straight line?

A (P.No. 120)

52. Fit a straight line to the given data:

x	1	2	3	4	5	6
y	2.6	2.7	2.9	3.025	3.2	3.367

Also find value of y at $x = 5.5$.

A (P.No. 122)

53. Explain fitting a polynomial of degree n?

A (P.No. 125)

54. Fit a second degree polynomial to the data :

x	-4	-3	-2	-1	0	1	2	3	4
y	-5	-1	0	1	3	4	4	3	2

A (P.No. 127)

55. Explain fitting a curve of the form $y = ax^b$.

A (P.No. 130)

56. Explain fitting a curve of the form $y = ae^{bx}$

A (P.No. 132)

57. Fit a exponential curve of the form $y = ae^{bx}$ to the given data:

x	1	2	3	4	5	6
y	1.6	4.5	13.8	40.2	125	300

Also find the value of y at $x = 4.5$.

A (P.No. 133)

58. Explain Taylor series expansion of a function?

A (P.No. 140, 141)

59. Obtain Taylor series expension of the function $f(x) = e^x \; about \; x = 0$. Find the number of terms of the exponential series such that then sum gives the value of e^x corext to siz decimal places at $x = 1$.

A (P.No. 141)

60. Obtain a second degree polynomial approximation to the function:

$$f(x) = \frac{1}{1+x^2}, \quad x \in [1, 12]$$

Using Taylor series expansion about $x = 1$. Find a bound on the truncation error.

A (P.No. 143)

61. Explain orthogonal polynomials and least squares approximations.

A (P.No. 143, 144)

62. Explain chebyshev approximation (uniform-minimax polynomial approximation).

A (P.No. 148, 149)

63. Explain chebyshev polynomials and its properties?

A. (P.No. 146, 147)

64. Express $2T_0(x) + T_1(x) + 2T_2(x)$ as a polynomial in x.

A (P.No. 151)

65. Find the best lower order approximation to the polynomial $2x^2 + 5x^2$

A (P.No. 151)

66. Solve the initial value problem by Taylor's series method.
$\frac{dy}{dt} = (y + 2t),\ \ t = \in [0, 0.2],\qquad y(0) = -1$

A (P.No. 163)

67. Use Picard's method to compute y(t) given that $\frac{dy}{dt} = \frac{e^{-t}}{y},\quad y\,(0) = 2$

A (P.No. 168)

68. Solve the following IVP by Milne's method, given that :
$\frac{dy}{dt} = t + y,\quad t \in [1, 0.4]$
$t_0 = 0,\ \ y_0 = 1$

A (P.No. 186, 187)

69. Evaluate y(1.5) by Adams-Bashfourth method of order four given that
$\frac{dy}{dt} = t^2(1 + y)$
$y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979,\ y(1.4) = 2.575$

A (P.No. 195)

70. Solve the BVP
$\frac{d^2y}{dx^2} = xy$
$y(0) + y'(0) = 1, y(1) = 1\ with\ step\ siiz\ h = \frac{1}{3}$

A (P.No. 218)

71. Write the derivative boundary conditions for $y'' = f(x, y)$.

A (P.No. 214)

72. Write runge-kutta method or order two for stability analysis of single step methods?

A (P.No. 200)

73. Fit a straight line to the given data :

x	-1	0	1	2	3	4	5	6
y	10	9	7	5	4	3	0	-1

Also find the value of y at $x = 3.5$.

A (P.No. 123)

74. Explain least square principle for continuous function?

A (P.No. 134)