Reg. No. : | | | | | | | | | | |

Question Paper Code: 44022

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Civil Engineering

14UMA422 - NUMERICAL METHODS

(Common to EEE, EIE and ICE Branches)

(Regulation 2014)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. In the case of bisection method, the convergence is
   (a) linear (b) biquadratic (c) very rapid (d) h^2

2. In calculating the reciprocal of a given number N, the iterative formula is,
   (a) $x_{n+1} = x_n (2N - x_n)$ (b) $x_{n+1} = x_n (2 - Nx_n)$
   (c) $x_{n+1} = x_n (x_n - 2N)$ (d) $x_{n+1} = (2 - Nx_n)$

3. The solution of $x + y = 2$; $2x + 3y = 5$ by Gauss- Elimination method is,
   (a) (2, 0) (b) (0, 2) (c) (1, 1) (d) (2, 1)

4. The Eigen values and Eigen vectors of the matrix $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$ using Gauss – Jacobi method is,
   (a) (1, 3) and $(1, 1)^T$ $(1, -1)^T$ (b) (1, 1) and $(1, 3)^T$ $(1, -1)^T$
   (c) (3, 1) and $(-1, -1)^T$ $(-1, 1)^T$ (d) (3, 3) and $(1, 1)^T$ $(1, -1)^T$

5. The second divided differences with arguments a, b, c if $f(x) = \frac{1}{x}$ is
   (a) abc (b) $a^2b^2c^2$ (c) $\frac{1}{a^2b^2c^2}$ (d) $\frac{1}{abc}$

6. By Lagrange's interpolation formula, the parabola of the form $y = ax^2 + bx + c$ passing through the points (0, 0), (1, 1) and (2, 2) is

   (a) $y = x^2 - 9$ (b) $y = 9x^2 - 8x$ (c) $y = 8x^2 - 9x$ (d) $y = 8x^2 - 9$

7. Condition for maxima point for the function is

   (a) $y' = 0, y'' < 0$ (b) $y' = 0, y'' > 0$ (c) $y' < 0, y'' = 0$ (d) $y' > 0, y'' < 0$

8. Simpson's 3/8th rule is used only when the number of sub-intervals is

   (a) odd (b) multiple of 3
   (c) for all natural numbers (d) even

9. The number of equations needed to solve two unknowns in a system of equations is

   (a) 2 (b) 3 (c) 5 (d) 6

10. The method of group averages is based on the principle that the sum of the residuals at all points is

    (a) non zero (b) zero (c) one (d) greater than zero

PART - B (5 x 2 = 10 Marks)

11. If a real root of the equation $f(x) = 0$ lies in (a, b). state the formula that gives the root approximately as per Regula Falsi method.

12. Write down the condition for convergence of Gauss Seidel method.

13. Define Lagrange's inverse interpolation formula.

14. Evaluate $\int_{-3}^{3} x^4 dx$, by Trapezoidal rule.

15. Fit a straight line of the form $y = a + bx$, by the method of group averages for the following data.

x	0	5	10	15	20	25
y	12	15	17	22	24	30

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Find the real root of the equation $x^3 - 2x - 5 = 0$ using false position method correct to three decimal places. (8)

    (ii) Obtain the root of the equation $x^3 - 5x - 7 = 0$, that lies between 2 and 3, using the method of false position. (8)

Or

(b) (i) Find an iterative formula to find the reciprocal of a given number N and hence find the value of $\frac{1}{19}$. (8)

(ii) Solve the equation $x^3 + x^2 - 1 = 0$ for the positive root (correct to 4 decimal places) by iteration method. (8)

17. (a) (i) Solve the system of equations
$5x_1 - x_2 = 9$; $-x_1 + 5x_2 - x_3 = 4$; $-x_2 + 5x_3 = -6$ by Gauss-elimination method. (8)

(ii) Solve the system of equations

$10x_1 + 2x_2 + x_3 = 9$; $x_1 + 10x_2 - x_3 = -22$; $-2x_1 + 3x_2 + 10x_3 = 22$ by Gauss-Seidel's method. (8)

Or

(b) Find by power method, the largest eigen value and the eigen vector of the matrix $\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ (16)

18. (a) From the following table find $f(x)$ and hence $f(15)$ using Newton's interpolation formula: (16)

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

Or

(b) (i) The population of a town is as follows:

Year x	1941	1951	1961	1971	1981	1991
Population in Lakhs y	20	24	29	36	46	51

Estimate the population increase during the period 1946 to 1976. (8)

(ii) Using cubic spline, find $y(0.5)$ and $y'(1)$ given $M_0 = M_2 = 0$ and the table. (8)

x	0	1	2
y	-5	-4	3

19. (a) (i) Given the following data, find $y'(6)$. (8)

x	0	2	3	4	7	9
y	4	26	58	112	466	922

(ii) Evaluate by using Gaussian three point formula, $\int_{0.2}^{1.5} e^{-t^2}\,dt$ (8)

Or

(b) (i) Evaluate $\int_{-3}^{3} x^4 dx$ using (i) Trapezoidal rule and (ii) Simpson's 1/3 rule by dividing 6 equal subintervals. Verify your results by actual integration. (8)

(ii) Evaluate $\int_{1}^{1.4}\int_{2}^{2.4} \frac{dxdy}{xy}$ using Simpson's rule, taking h = k = 0.1. Verify your result by actual integration. (8)

20. (a) (i) Find a straight line fit of the form $y = ax + b$, by the method of group averages for the following data:

x	0	5	10	15	20	25
y	12	15	17	22	24	30

(16)

Or

(b) (i) From the table given below, find the best values of 'a' and 'b' in the law $y = ae^{bx}$ by the method of least squares. (8)

x	0	5	8	12	20
y	3	1.5	1	0.55	0.18

(ii) By using the method of moments, obtain a straight line fit to the data: (8)

x	1	2	3	4
y	1.7	1.8	2.3	3.2