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

Question Paper Code: 44022

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. Suppose a root of $f(x) = 0$ lies between 'a' and 'b'. Then by the method of false position, its first approximation x_1 is

   (a) $\frac{af(b)-bf(a)}{f(a)-f(b)}$ (b) $\frac{af(a)-bf(b)}{f(a)-f(b)}$

   (c) $\frac{af(b)-bf(a)}{f(b)-f(a)}$ (d) $\frac{af(a)-bf(b)}{f(b)-f(a)}$

2. The order of convergence of method of false position is

   (a) 1.618 (b) 1.816 (c) 1.168 (d) 1.186

3. In Gauss Seidel method, diagonally dominant condition of coefficient matrix is

   (a) necessary and sufficient (b) necessary but not sufficient

   (c) sufficient but not necessary (d) neither necessary nor sufficient

4. Power method is not applicable to the matrix whose Eigen vectors are

   (a) Linearly independent (b) Linearly dependent

   (c) Distinct (d) Not all non-zero

5. If $(x) = \frac{1}{x^2}$, then the divided difference $f(a, b)$ is

   (a) $\frac{\mathrm{a+b}}{\mathrm{a}^2 b^2}$ (b) $\frac{\mathrm{a-b}}{\mathrm{a}^2 b^2}$ (c) $-\frac{\mathrm{a-b}}{\mathrm{a}^2 b^2}$ (d) $-\frac{\mathrm{a+b}}{\mathrm{a}^2 b^2}$

6. I If $= \frac{x-x_0}{h}$, then the error in Newton's forward interpolation formula is

   (a) $\frac{u(u-1)\ldots(u-n)}{(n)!}\mathrm{h}^{n+1}f^{n+1}(c)$ (b) $\frac{u(u-1)\ldots(u-n)}{(n-1)!}\mathrm{h}^{n+1}f^{n+1}(c)$

   (c) $\frac{u(u-1)\ldots(u-n)}{(n+1)!}\mathrm{h}^{n+1}f^{n+1}(c)$ (d) $\frac{u(u-1)\ldots(u-n)}{(n+1)!}\mathrm{h}^{n}f^{n}(c)$

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 method of group averages is based on the assumption that the sum of the residuals is

   (a) 0 (b) 1 (c) 2 (d) 3

10. If $y = 2x + 5$ is the best fit for 8 pairs of values $(x, y)$by the method of least squares and $\sum Y = 120$,the $\sum X =$

    (a) 35 (b) 40 (c) 45 (d) 30

PART - B (5 x 2 = 10 Marks)

11. Find an iterative formula for finding $\sqrt{N}$ where N is a real number, using Newton-Raphson formula.
12. Compare Gaussian elimination & Gauss-Jordan methods in solving system $[A]\{X\} = \{B\}$.
13. Using Lagrange's interpolation, find the polynomial through $(0, 0)$ $(1, 1)$ and $(2, 2)$.
14. State the formula for three Point Gaussian-quadrature.
15. By method of least squares find the normal equations to fit straight line.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Find an approximate root of $x \log_{10} x - 1.2 = 0$ by False position method. (8)

    (ii) Find the positive root of $x = \cos x$ usings Newton's method. (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 by Gauss-Seidal method:

$27x + 6y - z = 85, x + y + 54z = 110, 6x + 15y + 2z = 72.$ (8)

(ii) Using Gauss-Jordan method, find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$. (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) (i) Apply Lagrange's interpolation formula to find *f(9)* using the following data: (8)

x	*5*	*7*	*11*	*13*	*17*
y	*150*	*392*	*1452*	*2366*	*5202*

(ii) Find *f(4)* from the following data by using Newton's divided difference formula: (8)

x	*0*	*1*	*2*	*5*
y	*2*	*3*	*12*	*147*

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) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.5$ from the data. (8)

x	*1.5*	*2.0*	*2.5*	*3.0*	*3.5*	*4.0*
y	*3.375*	*7*	*13.625*	*24*	*38.875*	*59*

(ii) Find the approximate value of $I = \int_0^1 \frac{dx}{1+x}$ using trapezoidal rule with h = $\frac{1}{2}$, $\frac{1}{4}$ and then Romberg's method. (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) By the method of least squares find the best fitting straight line to the data given below. (8)

x	*5*	*10*	*15*	*20*	*25*
y	*15*	*19*	*23*	*26*	*30*

(ii) Fit a curve of the form $y = ab^x$ to the data. (8)

x	*1*	*2*	*3*	*4*	*5*	*6*
y	*151*	*100*	*61*	*50*	*20*	*8*

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