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

Question Paper Code: 44022

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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 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. Condition for convergence in iteration method is
   (a) $|\emptyset'(x)| < 1$ (b) $|\emptyset'(x)| > 1$ (c) $|\emptyset'(x)| \leq 1$ (d) $|\emptyset'(x)| \geq 1$

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 values of y are 0,1 corresponding to the values of x = 0,1. The polynomial we can obtained through Newton's Forward Interpolation Formula using the given data is
   (a)$y = x^2$ (b)$y = x$ (c) $y = x^3 + 4$ (d)$y = x^2 + 1$

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. By Gauss two point formula , the value of $I = \int_{-1}^{1} \frac{dx}{1+x^2}$ is,

(a) 5/2 (b) 3/2 (c) 1/2 (d) 2/5

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

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

10. For the best fitting curve to the set of given points, the sum of squares of the residuals should be

(a) 0 (b) maximum

(c) minimum (d) neither maximum nor minimum

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. State the condition for convergence to use Gauss-seidel method.

13. Define Lagrange's inverse interpolation formula.

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 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) Solve $x^3 = 2x + 5$ for positive root by the method of iteration. (8)

(ii) Find the positive root of $x^3 - x = 1$ using bisection method. (8)

17. (a) (i) Solve by Gauss Elimination method,
$3x + 4y + 5z = 18, 2x - y + 8z = 13, 5x - 2y + 7z = 20.$ (8)

(ii) Solve the following system of equations by Gauss Seidel method
$4x - 10y + 3z = -3, x + 6y + 10z = -3\ , 10x - 5y - 2z = 3.$ (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) Find the interpolating polynomial for *y* from the following data using Newton's forward formula . (8)

x	*4*	*6*	*8*	*10*
y	*1*	*3*	*8*	*16*

(ii) Obtain the cubic spline approximation for the function *y = f(x)* from the following data, given that $y_0'' = y_3'' = 0 \ -1 \leq x \leq 0.$ (8)

x	*-1*	*0*	*1*	*2*
y	*-1*	*1*	*3*	*35*

19. (a) Evaluate $\int_0^1 \int_0^1 \frac{dx\,dy}{x+y+1}$ by using Trapezoidal rule taking $h = 0.5$ and $k = 0.25.$ (16)

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 $\int_1^{1.4} \int_2^{2.4} \frac{\mathrm{dxdy}}{\mathrm{xy}}$ 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) By the method of least squares, fit a curve of the form $y = ab^x$ to the data given below:

(16)

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