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

Question Paper Code: 41402

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

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

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

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

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

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

7. If I_1 & I_2 are the values of the integral I by trapezoidal rule when h=0.25 and h=0.5, then the first approximation of the integral I by Romberg's method is

(a) $\frac{4I_1-I_2}{3}$ (b) $\frac{4I_2-I_1}{3}$ (c) $\frac{4I_2+I_1}{3}$ (d) $\frac{4I_1+I_2}{3}$

8. The number of equal sub intervals required to apply both Simpson's 1/3 rule and Simpson's 3/8 rule to evaluate an integral is

(a) Any number (b) Any multiple of 2

(c) Any multiple of 6 (d) Any multiple of 3

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. If g(x) is continuous in [a, b] then under what condition the iterative method x =g(x) has unique solution in [a, b].

12. Find inverse of A = $\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss – Jordan method.

13. Show that the divided difference operator Δ is linear.

14. Evaluate $\int_{-1}^{1} \frac{dx}{1+x^2}$ using Gaussian two point quadrature formula.

15. Describe the concept curve fitting.

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

(ii) Find a root of the equation $xe^x = 1$ by Ramanujan's 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) Using Jacobi method, find all the eigen values and eigen vectors of the matrix $\begin{pmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{pmatrix}$. (16)

18. (a) (i) From the following table, find the value of $\tan 45^0 15'$ (8)

x^0	45	46	47	48	49	50
$\tan x^0$	1.00000	1.03553	1.07237	1.11061	1.15037	1.19175

(ii) From the following table find $f(x)$ and hence $f(15)$ using Newton's interpolation formula: (8)

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) The population of a certain town is given below. Find the rate of growth of the population in 1941. (8)

Year	1931	1941	1951	1961	1971
Population in thousand	40.62	60.80	79.95	103.56	132.65

(ii) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Romberg's method. Hence find an approximate value of π. (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

(8)

(ii) 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

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