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**Question Paper Code: 34022**

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

Fourth Semester

Civil Engineering

01UMA422 - NUMERICAL METHODS

(Common to EEE, EIE and ICE)

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Find an iteration formula to find  $\sqrt{n}$  by Newton's method.
2. Define truncation error.
3. Compare Gauss, Jacobi and Gauss - Seidal methods.
4. Find the dominant Eigen value of  $A = \begin{pmatrix} 1, & 2 \\ 3, & 4 \end{pmatrix}$  by power method.
5. Obtain the Lagrange's interpolating polynomials for the observed data of points (1, 1), (2, 1) and (3, -2).
6. State the conditions required for a natural cubic spline.
7. Using Newton's backward difference formula, write the formula for the first and second order derivatives at the end values at  $x=x_n$ .
8. Using Trapezoidal rule, evaluate  $\int_0^\pi \sin x \, dx$  by dividing the range into 6 equal parts.
9. Write the normal equations for fitting a straight line by the method of least squares.
10. How will you fit a curve of the form  $y=ax^b$ .

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Find the positive root of  $x - \cos x = 0$  by bisection method. (8)  
 (ii) Using Ramanujan's method, find the root of  $x e^x = 1$ . (8)

Or

- (b) (i) Using the secant method find a real root of the equation  $f(x) = x e^x - 1 = 0$ . (8)  
 (ii) Find the real positive root of  $3x - \cos x - 1 = 0$  by Newton Raphson method correct to 6 decimal places. (8)
12. (a) (i) Solve the system of equations by Gauss - Jordan method.

$$\begin{aligned} x + 2y + z &= 3 \\ 2x + 3y + 3z &= 10 \\ 3x - y + 2z &= 13 \end{aligned} \quad (8)$$

- (ii) Find the numerically largest Eigen value of  $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$  and the corresponding Eigen Vector. (8)

Or

- (b) (i) Solve the following system of equations by Gauss Seidel iteration method.  
 $20x + y - 2z = 17, 3x + 20y - z = -18, 2x - 3y + 20z = 25$  (8)  
 (ii) Using Jacobi method, find the eigen values and eigen vectors of  $A = \begin{bmatrix} 1 & 3 \\ 3 & 4 \end{bmatrix}$ . (8)

13. (a) (i) Find the number of students who obtain marks between 40 and 45 using Newton's formula. (8)

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

- (ii) Estimate  $x$  when  $y = 20$  from the following table using Lagrange's method. (8)

x	1	2	3	4
y	1	8	27	64

Or

- (b) (i) Using Newton's divided difference formula, find  $u(3)$  given  $u(1) = -26$ ,  $u(2) = 12$ ,  $u(4) = 256$ ,  $u(6) = 844$ . (8)

- (ii) Using Newton's forward interpolation formula, find the polynomial  $f(x)$  satisfying the following data and hence find  $y(5)$ . (8)

x	4	6	8	10
y	1	3	8	10

14. (a) (i) Find  $\frac{dy}{dx}$  at  $x = 0.5$  and  $x = 0.7$  from the following data: (8)

x	0.4	0.5	0.6	0.7	0.8
y	1.5836	1.7974	2.0442	2.3275	2.6511

- (ii) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by dividing into 6 equal parts using Simpson's one-third rule and three eighth rules. (8)

Or

- (b) (i) Compute first and second derivative of  $f(3)$  for the following data using difference table (8)

x	3.0	3.2	3.4	3.6	3.8	4.0
$f(x)$	-14	-10.032	-5.296	-0.256	-6.672	14

- (ii) Evaluate  $\int_0^1 \int_1^2 \frac{2xy}{(1+x^2)(1+y^2)} dx dy$  using Trapezoidal rule with  $h=k=0.25$ . (8)

15. (a) (i) Find a straight line fit of the form  $y = a + bx$  by the method of group averages for the following data. (8)

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

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

x :	1	2	3	4	5	6
y :	1200	900	600	200	110	50

Or

(b) (i) Find a straight line fit of the form  $y = a + bx$ , by the method of group averages for the following data: (8)

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

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

x	1	2	3	4
Y	1.7	1.8	2.3	3.2