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Question Paper Code: 31402

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

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. State the condition for convergence of iterative method.
2. Establish an iteration formula to find the reciprocal of a positive number N by Newton-Raphson method?
3. Solve the following system of equations by Gauss elimination method $2x + y = 3$, $7x - 3y = 4$.
4. Compare Gauss-Jacobi and Gauss Seidel methods.
5. Obtain the divided difference table for the following data.

x	-1	0	2	3
y	-8	3	1	12

6. Using Lagrange's interpolation, find the polynomial through (0, 0), (1, 1) and (2, 2).

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 $x^3 - x = 1$ correct to three decimal places by bisection method. (8)
- (ii) Find an approximate root of $x \log_{10} x - 1.2 = 0$ by Regula-Falsi method. (8)

Or

- (b) (i) Using the secant method find a real root of the equation $f(x) = xe^x - 1 = 0$. (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 $x+3y+3z=16$, $x+4y+3z=18$, $x+3y+4z=19$ by Gauss Jordan method. (8)

- (ii) Find the dominant eigen values of $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$. (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) Using Lagrange's interpolation formula fit a polynomial to the data:

x	0	1	3	4
y	-12	0	6	12

And hence find y at $x = 2$. (8)

- (ii) From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age 46 and 63. (8)

Age	45	50	55	60	65
Premium	114.84	96.16	83.32	74.48	68.48

Or

- (b) Find the cubic spline for the data: (16)

x	0	1	2	3
$f(x)$	1	2	9	28

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) Use Gaussian three-point formula and evaluate $I = \int_1^5 \frac{dz}{z}$. (8)

- (ii) Evaluate $\int_1^2 \int_3^4 \frac{1}{(x+y)^2} dx dy$ using $h = k = 0.2$ by Trapezoidal rule. (8)

15. (a) (i) Fit a parabola, by the method of least squares, to the following data; also estimate y at $x = 6$. (8)

x	1	2	3	4	5
y	5	12	26	60	97

- (ii) It is known that the curve $y = ab^x$ fits the data given below. Find the best values of a and b . (8)

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

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, obtain a second degree curve which fit best to the following data: (8)

x	1	2	3	4
y	0.30	0.64	1.32	5.40
