24U279 (Pages: 3) Name : .....

Reg. No : .....

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2025

(FYUGP)

CC24UBCA2CJ103 - NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

(BCA - Major Course)

(2024 Admission - Regular)

Time: 2.0 Hours Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 3 marks.

1. Define round-off error and its effect in numerical computations. [Level:1] [CO1]

2. Let $f(x) = x^3 - x - 4 = 0$. Use bisection method between $x = 1$ and$x = 2$ to find x_2 . [Level:2] [CO1]

3. Use Trapezoidal Rule with $n = 1$ to approximate $\int_1^2 \frac{1}{1+x} dx$. [Level:2] [CO2]

4. Approximate $\int_0^3 x + 1 dx$ by using Simpsons $3/8$ Rule with $n = 3$. [Level:2] [CO2]

5. A farmer wants to plant wheat and corn on 50 acres of land. Each acre of wheat requires 2 units of fertilizer and 1 unit of water, while each acre of corn requires 3 units of fertilizer and 2 units of water. The farmer has 120 units of fertilizer and 100 units of water available. If wheat yields Rs. 20,000 per acre and corn yields Rs. 25,000 per acre, develop a linear programming model to maximize total revenue. [Level:2] [CO3]

6. Draw the feasible region for $x + y \geq 12$. [Level:2] [CO3]

7. What are the applications of Operations Research? [Level:1] [CO3]

8. Give the form of a general transportation table. [Level:2] [CO4]

9. Verify whether the following Assignment Problem is balanced. If not balance the problem. [Level:2] [CO5]

	Person 1	**Person 2**	**Person 3**	**Person 4**
$Job1$	4	15	18	17
$Job2$	12	1	16	5
$Job3$	17	7	13	9

10. Find an initial basic feasible solution for the following transportation problem using North West Corner method. [Level:2] [CO4]

	M_1	M_2	M_3	**Supply**
W_1	1	2	6	7
W_2	0	4	2	12
W_3	3	1	5	11
Demand	10	10	10	

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer ***all*** questions. Each question carries 6 marks.

11. Apply Newton-Raphson method to solve the equation $f(x) = x^3 + x - 1$ by choosing $x_0 = 1$. [Level:2] [CO1]

12. Using regula-falsi method, find a real root of the equation $x^3 - 5x + 1 = 0$ between $x = 0$ and $x = 1$. [Level:2] [CO1]

13. Using Lagranges interpolation find the cubic polynomial which takes the values $f(0) = 1, f(1) = 2, f(2) = 1, f(3) = 10$. [Level:2] [CO2]

14. Find an approximation to $\int_0^1 x^2 dx$ by using Simpsons $1/3$ Rule with $n = 10$. [Level:2] [CO2]

15. Formulate the dual of the following linear programming problem. [Level:2] [CO3]

Maximize: $z = x - 3y - 2z$
Subject to: $3x - y + 2z \leq 7$
$2x - 4y \geq 12$
$-4x + 3y + 6z \leq 8$
$x, y \geq 0, z \ is \ unrestricted.$

16. Use simplex method to solve the linear programming problem. [Level:3] [CO3]

Maximize: $z = 3x_1 + 5x_2$
Subject to: $4x_1 + x_2 \leq 20$
$2x_1 + 3x_2 \leq 15$
$x_1, x_2 \geq 0$

17. Find an initial basic feasible solution for the following transportation problem using Least Cost method. [Level:2] [CO4]

	M_1	M_2	M_3	M_4	**Supply**
W_1	6	4	1	5	14
W_2	8	9	2	7	16
W_3	4	3	6	2	15
Demand	6	10	4	35	

18. The following is the cost matrix of assigning four clerks to four key punching jobs. [Level:2] [CO5]
Find the optimal assignment.

	C1	**C2**	**C3**	**C4**
J_1	42	35	28	21
J_2	30	25	20	15
J_3	30	25	20	15
J_4	24	20	16	12

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

19. Using Newtons forward difference interpolation formula evaluate f(15) for the following data. [Level:3] [CO2]

x	10	20	30	40	50
f(x)	46	66	81	93	101

20. Find an initial basic feasible solution for the following transportation problem by applying Vogels Approximation Method. Verify whether the solution is optimum if not find the optimum solution. [Level:3] [CO4]

	M_1	M_2	M_3	M_4	**Supply**
W_1	90	90	100	100	200
W_2	50	70	130	85	100
Demand	70	100	100	30	

(1 × 10 = 10 Marks)

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