Reg. No…….. Name……. **25ACT310**

BCA DEGREE END SEMESTER EXAMINATION – OCTOBER 2025

UGP (HONS.) SEMESTER - 3: MULTI DISCIPLINARY ELECTIVE

COURSE: 24UBCAMDE201: NUMERICAL METHODS AND LINEAR PROGRAMMING PROBLEM

(For Regular 2024 Admission)

Time: 1.5 Max. Marks: 50

PART A

Maximum mark from this part is 10. Each question carries 2 marks.

1. Find an interval in which positive root of the equation $f(x) = \cos(x) - xe^x$ lies. (U, CO1)
2. Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Let $Z = 4x + 6y$ be the objective function. Find the point at which Z value is minimum. (E, CO2)
3. Draw the feasible region for the LPP: Maximize $Z = 3x + 4y$ and subject to constraints $x + y \leq 4, x \geq 0, y \geq 0$. (A,CO2)
4. State any one difference between Big-M method and Simplex method. (R, CO3)
5. Define the term basic feasible solution in the simplex tableau and write the condition for optimality for Simplex method. (A, CO3)
6. Define a transportation problem and write its standard form. (R, CO3)
7. State any difference between North-west corner method and Vogel's approximation method. (E, CO4)

PART B

Maximum mark from this part is 20. *Each question carries 5 mar*ks

8. The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface:

$x =$ height	100	150	200	250	300	350	400
$y =$ distance	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the value of y when $x = 218$ ft by using Newton's forward interpolation formula. (A, CO1)

9. A factory makes two products, A and B. Each unit of A requires 2 hours of labour and 3 kg of raw material. Each unit of B requires 1 hour of labour and 2 kg of raw material. The factory has 100 hours of labour and 120 kg of raw material available. Profit from each unit of A is \$40, and from B is \$30. Formulate an LPP to maximize profit. (A, CO2)

10. Solve the following LPP by graphical method: Maximize $Z = 400x + 300y$, Subject to $x + y \leq 10, 2x + y \leq 12, x, y \geq 0$. (A, CO2)

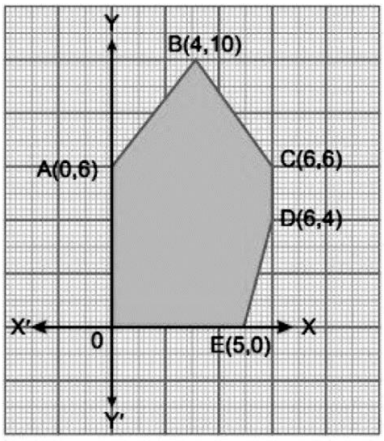
11. The corner points of a feasible region determined by the system of linear constraints are as shown below.

(i) Is this feasible region is bounded?

(ii) Write the number of corner points in the feasible region.

(iii) (a) If $Z = ax + by$ has maximum value at C (6, 6) and B (4, 10). Find the relationship between a & b.

(iii) (b) If $Z = 2x - 5y$ then find the minimum value of this objective function.



(U, CO2)

12. Differentiate slack, surplus and artificial variables. Rewrite the following constraints using these variables: $x + 4y \leq 12, 3x - 7y = 4, 5x + 6y \geq 8$. (A, CO3)

13. Use North-West Corner method to find the initial feasible solution to the transportation problem: A company has three production facilities S1, S2 and S3 with production capacity of 7, 9 and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses D1, D2, D3 and D4 with requirement of 5, 6, 7 and 14 units (in 100s) per week, respectively. The transportation costs (in rupees) per unit between factories to warehouses are given in the table below:

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

(E, CO3)

PART C

Maximum mark from this part is 20. Each question carries 10 marks

14. Find a root of the equation $x^3 - 4x - 9 = 0$, using Bisection method correct to three decimal places. Carry out the computation up to 7th stage. (A, CO1)

15. Find an optimal solution by using Simplex method: $Max\ Z = 3x_1 + 5x_2$ subject to the constraints $x_1 + 2x_2 \leq 6, 3x_1 + 2x_2 \leq 12, x_1, x_2 \geq 0$. (A, CO4)

16. A company has factories at F1, F2, and F3 that supply products to warehouses at W1, W2 and W3. The weekly capacities of the factories are 200, 160 and 90 units, respectively. The weekly warehouse requirements are 180, 120 and 150 units, respectively. The unit shipping costs (in rupees) are as follows:

	W_1	W_2	W_3	Supply
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Demand	180	120	150	450

Determine the optimal distribution for this company in order to minimize its total shipping cost.

(C, CO4)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Marks
CO1	Apply numerical methods to approximate solutions to mathematical problems.	A	1,8,14	16
CO2	Understanding Linear Programming and Operations Research	A	2,3,9,10,11	17
CO3	Applying Optimization Techniques	A	4,5,12,15	19
CO4	Formulate and solve transportation problems	C	6,7,13,16	19

Cognitive Level (CL): Cr - CREATE; E - EVALU