

(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2023 ONLY)

23UMS512

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS :NOVEMBER-2025

B.Sc.-MATHEMATICS

MAXIMUM MARKS: 75

SEMESTER: V

TIME : 3 HOURS

**PART – III
OPERATIONS RESEARCH**

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS.

(K1)

1. A constrain in an LPP is expressed as_____.
a) an equation with = sign b) inequality with \geq sign
c) inequality with \leq sign d) any of the above
- 2.For maximization linear programming problem, the simplex method is terminated when all the net-evaluations are_____.
a) negative b) non-negative c) Zerod) non-positive
3. If dual has an unbounded solution, primal has_____.
a) an unbounded solution b) an infeasible solution
c) a feasible solution d) none of the above
4. The solution to a transportation problem with m -sources and n -destinations is feasible, if the number of allocations are_____.
a) $m + n - 1$ b) $m + n + 1$ c) $m + nd$ d) $m \times n$
5. The method used for solving an assignment problem is called_____.
a) MODI method b) Reduced matrix method
c) Hungarian method d) None of the above

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES.

(K2)

6. Define slack variables.
7. Define degenerate solution.
8. State fundamental theorem of Duality
9. Define Transportation problem.
10. What is a replacement problem?

SECTION – B

(5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

- 11.a) A company has three operational departments (weaving, processing and packing) with capacity to produce three different types of clothes namely suitings, shirtings and woollens yielding a profit of Rs. 2, Rs. 4 and Rs. 3 per metre respectively. One metre of suiting requires 3 minutes in weaving, 2 minutes in processing and 1 minute in packing. Similarly one metre of shirting requires 4 minutes in weaving, 1 minute in processing and 3 minutes in packing. One metre of woollen requires 3 minutes in each department. In a week, total run time of each department is 60, 40 and 80 hours for weaving, processing and packing respectively. Formulate the linear programming problem to find the product mix to maximize the profit.

(OR)

(CONTD.....2)

b) Use graphical method to solve the following LPP: Minimize $z = 20x_1 + 40x_2$
Subject to the constraints:

$$\begin{aligned} 36x_1 + 6x_2 &\geq 108 \\ 3x_1 + 12x_2 &\geq 36 \\ 20x_1 + 10x_2 &\geq 100 \\ \text{and } x_1, x_2 &\geq 0. \end{aligned}$$

12.a) Show that the following system of linear equations has a degenerate solution:

$$\begin{aligned} 2x_1 + x_2 - x_3 &= 2 \\ 3x_1 + 2x_2 + x_3 &= 3 \end{aligned}$$

(OR)

b) Explain Big- M method.

13.a) Formulate the dual of the following LPP: Maximize $z = 5x_1 + 3x_2$
Subject to the constraints:

$$\begin{aligned} 3x_1 + 5x_2 &\leq 15 \\ 5x_1 + 2x_2 &\leq 10 \\ x_1 \geq 0 \text{ and } x_2 &\geq 0 \end{aligned}$$

(OR)

b) Discuss dual simplex method.

14.a) Obtain an initial basic feasible solution to the following T.P. using the north-west corner rule:

					Available
	5	3	6	2	19
	4	7	9	1	37
	3	4	7	5	34
Requirement	16	18	31	25	

(OR)

b) Obtain an initial basic feasible solution to the following T.P. using the matrix minima method:

					Capacity
	1	2	3	4	6
	4	3	2	0	8
	0	2	2	1	10
Demand	4	6	8	6	

15.a) Explain Hungarian assignment method.

(OR)

b) Solve the following assignment problem:

		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
1	10	25	15	20	
2	15	30	5	15	
3	35	20	12	24	
4	17	25	24	20	

SECTION – C

(5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

16. a) Rewrite in Standard form of the following LPP: Minimize $z = 2x_1 + x_2 + 4x_3$ (K4)

Subject to the constraints:

$$\begin{aligned} -2x_1 + 4x_2 &\leq 4 \\ x_1 + 2x_2 + x_3 &\geq 5 \\ 2x_1 + 3x_2 &\leq 2 \end{aligned}$$

 $x_1, x_2 \geq 0$ and x_3 unrestricted in sign.

(OR)

b) Use the graphical method to solve the following LPP. Maximize $z = 2x_1 + 3x_2$

Subject to the constraints:

$$\begin{aligned} x_1 + x_2 &\leq 30 \\ x_1 - x_2 &\geq 0 \\ x_2 &\geq 3 \\ 0 \leq x_1 &\leq 20 \text{ and } 0 \leq x_2 \leq 12 \end{aligned}$$

(K4)

17. a) Use simplex method to solve the following LPP: Maximize $z = 4x_1 + 10x_2$ (K4)

Subject to the constraints:

$$\begin{aligned} 2x_1 + x_2 &\leq 50 \\ 2x_1 + 5x_2 &\leq 100 \\ 2x_1 + 3x_2 &\leq 90 \\ x_1 \geq 0 \text{ and } x_2 &\geq 0 \end{aligned}$$

(OR)

b) Use penalty (or Big M) method to solve Maximize $z = 6x_1 + 4x_2$ (K4)

Subject to the constraints:

$$\begin{aligned} 2x_1 + 3x_2 &\leq 30 \\ 3x_1 + 2x_2 &\leq 24 \\ x_1 + x_2 &\geq 3 \\ x_1 \geq 0 \text{ and } x_2 &\geq 0 \end{aligned}$$

18. a) Use duality to solve the following LPP: Maximize $z = 2x_1 + x_2$

Subject to the constraints: (K4)

$$\begin{aligned} x_1 + 2x_2 &\leq 10 \\ x_1 + x_2 &\leq 6 \\ x_1 - x_2 &\leq 2 \\ x_1 - 2x_2 &\leq 1 \\ x_1, x_2 &\geq 0 \end{aligned}$$

(OR)

b) Use dual simplex method to solve the following LPP: Minimize $z = 3x_1 + x_2$ (K4)

Subject to the constraints:

$$\begin{aligned} x_1 + x_2 &\geq 1 \\ 2x_1 + 3x_2 &\geq 2 \\ x_1, x_2 &\geq 0 \end{aligned}$$

19. a) Use Vogel's Approximation method to obtain an initial basic feasible solution of the T.P. (K5)

				Supply	
	11	13	17	14	250
	16	18	14	10	300
	21	24	13	10	400
Demand	200	225	275	250	

(CONTD.....4)

(OR)

19 b) Solve the following transportation problem:

(K5)

		Supply			
	3	7	6	4	5
	2	4	3	2	2
	4	3	8	5	3
Demand	3	3	2	2	

20.a) Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows:

		1	2	3	4	5
<i>A</i>	8	4	2	6	1	
<i>B</i>	0	9	5	5	4	
<i>C</i>	3	8	9	2	6	
<i>D</i>	4	3	1	0	3	
<i>E</i>	9	5	8	9	5	

Determine the optimum assignment schedule.

(K5)

(OR)

b) A firm considering replacement of a machine, whose cost price is Rs. 12200 and the scrap value Rs. 200. The running (maintenance and operating) costs in rupees are found from experience to be as follows:

Year	1	2	3	4	5	6	7	8
Running Cost	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced?

(K5)
