Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
Odd Semester Examination: Oct Nov.2024
Faculty: Science and Technology

Program:BScGen04 **SET : A**
Program (Specific): BSc(Mathematics) **Course Type: core**
Class: TYBSc(Mathematics) **Max.Marks: 35**
Name of the Course: Operations Research **Course Code:MT 355(A)**
Time: 2Hrs **Max Marks: 35**
Paper: V **Semester: V**

Instructions to the candidate:

1) ***There are 3 sections in the question paper. Write each section on separate page.***
2) ***All Sections are compulsory.***
3) ***Figures to the right indicate full marks.***
4) ***Draw a well labelled diagram wherever necessary.***

SECTION: A

Q1. Attempt any FIVE of the following. **(5*2=10 marks)**

a) Identify the direction of decrease in Z when minimize Z = $4x_1 - 2x_2$.

b) Define slack and surplus variables.

c) Define linear programming problem.

d) Write the dual of Max Z = $3x_1 + 25x_2$

Sub to, $2x_1 + 4x_2 \geq 40$

$3x_1 + 2x_2 \geq 50, x_1 , x_2 \geq 0.$

e) Determine the feasible space for the following constraint.

$-x_1 + x_2 \geq 0$, $x_1, x_2 \geq 0$

f) Write the canonical form of

Max Z= 3x+5y

Sub to, x-3y =4

-x+ y ≥1, x, y ≥ 0

g) Define degeneracy in a Transportation Problem. How is it resolved?

SECTION: B

Q2. Attempt any THREE of the following. **(3*5=15 marks)**

a) Solve the LPP by simplex method.

$$Max\ Z = 5x + 3y$$

$$\text{Sub to,} \quad 3x + 5y \leq 15$$

$$6x + 2y \leq 24 \qquad x \geq 0, y \geq 0.$$

b) Find the optimal solution of the following LPP by algebraic method:

$$\text{Max } Z = 3x_1 + 5x_2 - 2x_3$$

$$\text{Sub to,} \quad x_1 + 2x_2 + 2x_3 \leq 10$$

$$2x_1 + 4x_2 + 3x_3 \leq 15, \qquad x_1\ ,\ x_2\ ,\ x_3 \geq 0.$$

c) The table given below has been taken from the solution procedure of transportation problem.

	X	Y	Z	Supply
A	31 (4)	24 (8)	(8)	56
B	41 (16)	(24)	41 (16)	82
C	(8)	77 (16)	(24)	77
Demand	72	102	41	

Find optimal solution, check whether it is optimal or not.

d)) Write the dual of the following primal problem.

$$Max\ Z = 25x - 12y$$

$$\text{Sub to,} \quad 2x + 3y \geq 2$$

$$-2x + 6y = 8$$

$$12x + 13y \leq 30$$

$$x \geq 0, y\ is\ unrestricted\ in\ sign.$$

e) Determine Initial basic feasible solution of the following transportation problem by north west corner method and optimize it.

	W1	W2	W3	W4	Capacity
O1	6	8	8	5	30
O2	5	11	9	7	40
O3	8	9	7	13	50
Demand	35	28	32	25	

SECTION: C

Q3. Attempt any ONE of the following. **(1*10=10 marks)**

a) Use the Simplex Method to solve the following LPP

$$\text{Max } Z = 3x_1 + 25x_2 + 4x_3$$
$$\text{Sub to, } \quad 2x_1 + 3x_2 \leq 8$$
$$2x_1 + 5x_3 \leq 10$$
$$3x_1 + 2x_2 + 4x_3 \leq 15 \qquad x_1,\ x_2,\ x_3 \geq 0.$$

b) Reddy Mikks produces both interior and exterior paints from two raw materials M_1 *and* M_2. The following table provides the basic data of the problem.

R	Exterior Paint	Interior Paint	Max. daily availability
Raw material M_1	6	4	24
Raw material M_2	1	2	6
Profit per tons	5	4	-

A market survey indicates that the daily demand for interior paint cannot exceed that of exterior paint by more than 1 ton. Also, maximum daily demand of interior paint is 2 tons. Formulate the LPP and solve graphically. Also determine the range of optimality $\frac{c_1}{c_2}$.