USN

Sixth Semester B.E. Degree Examination, July/August 2022
Operations Research

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1   a. What is Operations Research? List and explain briefly important phases of operations research. **(06 Marks)**

   b. The ABC electrical appliance company produces two products namely refrigerators and cooking ranges. Production takes place in two separate departments. Refrigerators are produced in department I and cooking ranges are produced in department II. The weekly production cannot exceed 25 refrigerators in department I and 35 cooking ranges in department II, because of limited available facilities in the two departments. The company regularly employs a total of 60 workers in the two departments. A refrigerator requires 2 man – weeks of labour while a cooking range requires 1 man-week of labour. A refrigerator contributes a profit of Rs.600 and a range contributes a profit of Rs.400. Formulate the problem as an L.P problem to determine the number of units of refrigerators and cooking ranges that the company should produce to maximize profit. **(08 Marks)**

   c. Define and illustrate with examples slack, surplus and artificial variables. **(06 Marks)**

2   a. Solve the following LPP by Graphical method :
Maximize $Z = 40x_1 + 100x_2$
Subject to : $12x_1 + 6x_2 \leq 3000$
$4x_1 + 10x_2 \leq 2000$
$2x_1 + 3x_2 \leq 900$
and $x_1 \geq 0, x_2 \geq 0$. **(08 Marks)**

   b. Using Simplex method, solve the following LPP
Maximize $Z = 3x_1 + 2x_2 + 5x_3$
subject to : $x_1 + 2x_2 + x_3 \leq 430$
$3x_1 + 2x_3 \leq 460$
$x_1 + 4x_2 \leq 420$
and $x_1, x_2, x_3 \geq 0$. **(12 Marks)**

3   a. Use penalty method to solve the following LPP
Minimize $Z = 5x_1 + 3x_2$
Subject to $2x_1 + 4x_2 \leq 12$
$2x_1 + 2x_2 = 10$
$5x_1 + 2x_2 \geq 10$
and $x_1, x_2 \geq 0$. **(10 Marks)**

   b. Use two-phase simplex method to solve LPP
maximize $Z = 5x_1 - 4x_2 + 3x_3$
subject to $2x_1 + x_2 - 6x_3 = 20$
$6x_1 + 5x_2 + 10x_3 \leq 76$
$8x_1 - 3x_2 + 6x_3 \leq 50$
and $x_1, x_2, x_3 \geq 0$. **(10 Marks)**

4 a. Obtain the Dual of the following Primal problem
Minimize $Z = 3x_1 - 2x_2 + x_3$
Subject to $2x_1 - 3x_2 + x_3 \leq 5$
$4x_1 - 2x_2 \geq 9$
$-8x_1 + 4x_2 + 3x_3 = 8$
and $x_1, x_2 \geq 0$; x_3 is unrestricted. **(06 Marks)**

b. Use Revised Simplex Method to solve the following LPP :
Maximize $Z = x_1 + 2x_2$
Subject to : $x_1 + x_2 \leq 3$
$x_1 + 2x_2 \leq 5$
$3x_1 + x_2 \leq 6$
and $x_1, x_2 \geq 0$. **(14 Marks)**

PART – B

5 a. What is meant by post optimality analysis? Discuss. **(10 Marks)**

b. Solve the following LPP by Dual Simplex Method :
Minimize $Z = 2x_1 + x_2$
Subject to : $3x_1 + x_2 \geq 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \geq 3$
and $x_1, x_2 \geq 0$. **(10 Marks)**

6 a. A product is produced by four factories F_1, F_2, F_3 and F_4. Their unit production costs are Rs. 2, 3, 1 and 5 respectively. Production capacity of the factories are 50, 70, 30 and 50 units respectively. The product is supplied to four stores S_1, S_2, S_3, and S4 the requirements of which are 25, 35, 105 and 20 respectively. Unit costs of transportation are given below :

	S_1	S_2	S_3	S_4
F_1	2	4	6	11
F_2	10	8	7	5
F_3	13	3	9	12
F_4	4	6	8	3

Find the transportation plan such that the total production and transportation cost is minimum. **(12 Marks)**

b. A department has five employees with five jobs to be performed. The time, in hours, each men will take to perform each job is given in the matrix below. Assign the jobs to employees to minimize cost.

		Employees				
		1	2	3	4	5
	A	10	5	13	15	16
	B	3	9	18	13	6
Jobs	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

(08 Marks)

7 a. Define the following with reference to game theory :
   i)   Pure strategy
   ii) Mixed strategy
   iii) Saddle point
   iv) Two – person zero sum game. (06 Marks)
   b. Reduce the following game by dominance property and solve it.

Player B

	B_1	B_2	B_3	B_4	B_5
A_1	1	3	2	7	4
A_2	3	4	1	5	6
A_3	6	5	7	6	5
A_4	2	0	6	3	1

Player A

(08 Marks)

   c. Solve the following (2 × 3) game graphically.

	B_1	B_2	B_3
A_1	1	3	11
A_2	8	5	2

(06 Marks)

8 Explain briefly the following :
   a. Simulated annealing
   b. Tabu search algorithm
   c. Metaheuristics
   d. Genetic algorithm. (20 Marks)

* * * * *