

**Code No: 155CQ****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year I Semester Examinations, January/February - 2023****OPERATIONS RESEARCH****(Mechanical Engineering)****Time: 3 Hours****Max. Marks: 75****Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A****(25 Marks)**

- 1.a) How you can identify the unbounded solution in simplex method. [2]
- b) Define linear programming. [3]
- c) Name the methods to find initial feasible solution for transportation problem. [2]
- d) How you can convert maximization assignment model in to minimization problem? [3]
- e) Write the conditions to find sequence for n jobs 3 machines problem. [2]
- f) Write the procedure to find average cost for replacement when money value is not changing. [3]
- g) Write the characteristics of game theory. [2]
- h) Briefly explain pure strategy, mixed strategy, and optimal strategy. [3]
- i) Define dynamic programming. [2]
- j) Write the formulae to find out length of queue and length of system for (M/M/1): (FCFS/ $\infty$ ) model. [3]

**PART – B****(50 Marks)**

2. Solve the following LPP using simplex method

$$\text{Max } Z = 6x_1 + 4x_2$$

$$\text{Subjected to } 2x_1 + 3x_2 \leq 30$$

$$3x_1 + 2x_2 \leq 24$$

$$x_1 + x_2 \geq 3$$

$$x_1 \geq 0, x_2 \geq 0.$$

[10]

**OR**

3. Use two phase method to solve the following LPP

$$\text{Min } Z = 5x + 6y$$

$$\text{Subjected to } 2x + 5y \geq 1500$$

$$3x + y \geq 1200$$

$$x \geq 0, y \geq 0.$$

[10]

4. Trans bulk company has three warehouses A, B and C of capacities 50, 60 and 40 respectively and four stores P, Q, R and S of capacities 20, 50, 70 and 10 respectively. Cost (in hundreds of rupees) of shipping one unit of commodity from various warehouses to different stores are as follows:

Stores Wharehouse	P	Q	R	S
A	5	15	7	6
B	8	7	9	1
C	15	9	8	8

Workout the transportation schedule by using Vogel's approximation method and find minimum transportation cost. [10]

**OR**

5. Four engineers are available to design four projects. Engineer 2 is not competent to design the project B. Given the following estimates needed by each engineer to design a given project, find how should the engineers be assigned to projects so as to minimize the total design of four projects. [10]

	Projects			
Engineer	A	B	C	D
1	12	10	10	8
2	14	Not suitable	15	11
3	6	10	16	4
4	8	10	9	7

6. Four jobs are to be processed in order on each of the three machines, you are required to set up an operation plan that minimizes the elapsed time and idle time of the system. [10]

Jobs Machines	1	2	3	4
P	12	10	10	11
Q	9	8	7	7
R	10	9	8	8

**OR**

- 7.a) Write a note on replacement of capital items when money value is considered.  
b) The following table gives the running costs per year and resale price of a certain equipment whose purchase price is Rs 5000.

Year	1	2	3	4	5	6	7	8
Running Cost (Rs)	1500	1600	1800	2100	2500	2900	3400	4000
Resale value (Rs)	3500	200	1700	1200	800	500	500	500

At what year is replacement due?

[5+5]

8. Solve the game whose pay of matrix is given below by using graphical method. [10]

		B			
		I	II	III	IV
A	I	1	4	-2	-3
	II	2	1	4	5

**OR**

9. A manufacturing company purchases 9000 parts of the machine for its annual requirements, ordering one month usage at time. Each part costs 20 Rs/- .The ordering cost per order is 15 Rs/- and carrying charges are 15% of the average inventory per year. Find out a more economical purchasing policy for the company. [10]
10. Solve the following LPP by using dynamic programming  
 Maximize  $Z = 3x_1 + 8x_2$   
 Subjected to  $x_1 + 4x_2 \leq 8$   
 $x_2 \leq 2$   
 $x_1, x_2 \geq 0$  [10]

**OR**

11. In a bank single cash counter is operated for drawing money. On average 40 persons arrive in a 4 hour day. Each cashier is to spend 10 minutes on the average on an arrival. If the arrivals are Poisson distributed and service times are according to exponential distribution. Determine
- Average number of customers in the system.
  - Average number of customers waiting in the system.
  - Average time a customer spends in the system.
  - The probability that a customer has to wait before he gets service.
- [10]

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