Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA – SEMESTER III - EXAMINATION –SUMMER-2022

Subject Code: 639406 Date:08/06/2022

Subject Name: Operation Research

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make Suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What is Operation Research? What are the main features of OR? Enlist major applications of operation research. **07**

(b) What is Linear Programming? Explain various components of Linear Programming (LP) model and state assumptions in Linear Programming model. **07**

Q.2 **(a)** Explain in detail the structure of a Queuing System. **07**

(b) A mobile manufacturer company produces two kinds of mobile; a keypad version simple feature phone mobile 'Qphone' and a touchscreen android version mobile 'Tphone'. To produce each mobile of type Tphone takes double time as compared to produce one mobile of type Qphone. The manufacturer has time/manpower to make a maximum of 6000 mobiles of each type per day, and the supply of electronic circuit material is enough to produce 4500 mobiles per day and each type requires same amount of electronic circuit material. The touchscreen android version, i.e. type Tphone requires a touch screen panel of which there are only 1800 available in a day. The company makes a profit of Rs. 1000 and Rs. 6000 per mobile, respectively, on mobile Qphone and Tphone. Formulate this problem as Linear Programming problem such that it will maximize the total profit on mobiles produced in a day. **07**

OR

(b) Enlist and explain all the steps of simplex method to solve the Linear Programming problem. **07**

Q.3 **(a)** How to describe a queuing model using a standard format? Explain Kendall's notation in detail. What do you mean by (M/M/1) : (∞ /FCFS)? **07**

(b) A truck owner finds, from his past records, that the maintenance costs per year of a truck whose purchase price is Rs 8,000 are as given in the table below. **07**

Years	1	2	3	4	5	6	7	8
Maintenance cost (Rs)	1000	1300	1700	2000	2900	3800	4800	6000
Resale price (Rs)	4000	2000	1200	600	500	400	400	400

Determine what time would it be profitable to replace the truck.

OR

Q.3 **(a)** What is the meaning of Inventory management and control? Explain the different inventory cost components. **07**

(b) Explain the difference between PERT and CPM. **07**

Q.4 **(a)** Define job sequencing. Explain Johnson's procedure (steps) for processing n jobs through two machines **07**

(b) Describe the PERT/CPM network components and rules for network construction. **07**

OR

Q.4 **(a)** In the IT consultancy company five android applications are to be developed by five developers. Man-hours cost is shown in the table below. Solve the assignment problem (show all steps) which minimizes the total man-hours to develop 5 applications by developers. **07**

	App1	App2	App3	App4	App5
Dev1	8	4	2	6	1
Dev2	0	9	5	5	4
Dev3	3	8	9	2	6
Dev4	4	3	1	0	3
Dev5	9	5	8	9	5

(b) Which are the patterns of customer arrivals in a Queuing system? For a queuing system, define (i) Traffic intensity (server utilization factor) (ii) Customer arrival rate (iii) Reneging (iv) Jockeying **07**

Q.5 **(a)** A dairy firm has three plants located in a state. The daily milk production at each plant is as follows: Plant 1: 6 million litres, Plant 2: 1 million litres, and Plant 3: 10 million litres. Each day, the firm must fulfill the needs of its four distribution centres. The minimum requirement of each centre is as shown in the table. Cost (in hundreds of rupees) of shipping one million litre from each plant to each distribution centre is given in the following table: **07**

		Distribution centers				
		D1	D2	D3	D4	Supply
Plants	P1	2	3	11	7	6
	P2	1	0	6	1	1
	P3	5	8	15	9	10
	Demand	7	5	3	2	

Find the initial basic feasible solution and total transportation cost for the given problem using

(1) North west corner method
(2) Least cost method

(b) Explain in brief what is assignment problem? Enlist the steps of Hungarian method to solve an assignment problem. **07**

OR

Q.5 **(a)** A dairy firm has three plants located in a state. The daily milk production at each plant is as follows: Plant 1: 6 million litres, Plant 2: 1 million litres, and Plant 3: 10 million litres. Each day, the firm must fulfill the needs of its four distribution centres. The minimum requirement of each centre is as shown in the table. Cost (in hundreds of rupees) of shipping one million litre from each plant to each distribution centre is given in the following table: **07**

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	P2	1	0	6	1	1
	P3	5	8	15	9	10
	Demand	7	5	3	2	

Find the initial basic feasible solution and total transportation cost for the given problem using Vogel's approximation method.

(b) The cost of a machine is Rs. 6200 and its scrap value is Rs. 400. The maintenance costs found as shown in the table. When should the machine be replaced? **07**

Year	1	2	3	4	5	6	7	8
Maintenance cost	100	200	500	700	1000	1300	1700	2100

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