

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Sixth Semester B.Tech Degree Regular and Supplementary Examination July 2021

**Course Code: ME372****Course Name: OPERATIONS RESEARCH**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any three full questions, each carries 10 marks.*

Marks

- 1 a) Illustrate the use of Slack and Surplus variables with examples. (3)
- b) By simplex method, solve the LPP: (7)

$$\text{Maximize } Z = 6x_1 + 11x_2$$

$$\text{Subjected to: } 2x_1 + x_2 \leq 104, \quad x_1 + 2x_2 \leq 76, \quad x_1, x_2 \geq 0$$

- 2 a) Write the dual of the following LPP: (4)

$$\text{Maximize } Z = 3x_1 - x_2 + 4x_3$$

Subjected to:

$$2x_1 + x_2 + 2x_3 \leq 19, \quad 3x_1 - x_2 - 3x_3 \leq 6, \quad 2x_1 - x_2 - x_3 \geq 3, \quad x_1, x_2, x_3 \geq 0$$

- b) Solve the LPP graphically, (6)

$$\text{Maximize } Z = 45x_1 + 80x_2$$

$$\text{Subjected to: } x_1 + 4x_2 \leq 80, \quad 2x_1 + 3x_2 \leq 90, \quad x_1, x_2 \geq 0$$

- 3 a) What is meant by degeneracy? What is the condition to avoid it in transportation problem? (3)
- b) Get the initial feasible solution of the given transportation problem, using North – West corner rule and also get the optimal solution using MODI Method (cost of transportation are given in the respective cells): (7)

Plants	Warehouses			Capacity
	D1	D2	D3	
O1	11	9	6	40
O2	12	14	11	50
O3	10	8	10	40
Demand	55	45	30	130

- 4 a) Give the general representation of the assignment problem, with the objective function and constraints. (3)
- b) Four jobs A, B, C and D are to be assigned to four workers 1, 2, 3 and 4. The respective profit contributed by each worker, if the respective job's assigned is (7)

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given in the cells. Find out the optimum assignment that will maximize the profit.

Jobs / Workers	J1	J2	J3	J4
1	21	15	19	16
2	19	16	20	20
3	10	20	18	17
4	18	17	19	20

#### PART B

*Answer any three full questions, each carries 10 marks.*

- 5 a) What is meant by sequencing? List the assumptions of sequencing. (3)
- b) There are six jobs, which are to be processed on two machines A and B in the order A – B. The time for the respective operations are given in the table: (7)

Machines	Jobs					
	1	2	3	4	5	6
A	5	3	2	10	12	6
B	3	2	5	11	10	7

Find the optimal sequence, total elapsed time and delays if any?

- 6 Duration of the activities of a project are given in the table: (10)

Activity :	1-2	1-4	1-7	2-3	3-6	4-5	4-8	5-6	6-9	7-8	8-9
Duration :	3	2	1	3	2	4	6	5	4	4	5

- i) Draw the network.
- ii) Determine the total float.
- iii) Mark the critical activities and determine the project completion time.
- 7 a) Give the general representation of M-M-1 Queue model. (2)
- b) At a one man barber shop, customers arrive according to the Poisson distribution with a mean arrival rate of 4 per hour and his hair cutting time was exponentially distributed with an average hair – cut taking 12 minutes. There is no restriction in queue length. Calculate a) Expected time in minutes that a customer has to spend in the queue. b) Fluctuations of the queue length. c) Probability that there is at least 5 customers in the system. (8)
- 8 a) Describe various costs associated with inventory. (3)
- b) Define Economic Order Quantity? State the assumptions of the deterministic inventory model with instantaneous supply and no shortage and, derive the formula for EOQ for the above model. (7)

#### PART C

*Answer any four full questions, each carries 10 marks.*

- 9 a) Illustrate the situations of decision making under risk and decision making under uncertainty with examples. (3)

- b) The estimated demand of a machine seller has the following demand pattern. (7)
- Each machine cost Rs 6200 and sells Rs 9500. Any machine that left unsold at the end of the season must be disposed of for Rs 5600 each. How many machines should be in stock so as to maximise expected profit. The pay-offs under different combinations

Demand	0	1	2	3	4	5	6
Probability	0.14	0.27	0.27	0.18	0.09	0.04	0.01

- 10 a) Describe the importance of decision making in business problems. (3)
- b) Illustrate a decision tree with the aid of an example. Describe the procedure of evaluation using decision tree. (7)
- 11 a) State the assumptions of game theory. How games are classified? (3)
- b) Define the terms saddle point and value of game in game theory. (3)
- c) Solve the game whose pay off matrix is given by (4)

Player A/B	B1	B2	B3
A1	7	6	3
A2	-2	2	-3
A3	5	9	7

- 12 Solve the game by graphical method: (10)

	Player B				
	3	1	6	-1	5
Player A	-2	4	-1	2	1

- 13 A shopkeeper keeps stock of an item. Previous experience shows that the daily demand pattern for the item with the associated probabilities is given below. (10)

Daily Demand (Nos)	0	10	20	30	40	50
Probability	0.08	0.12	0.15	0.30	0.20	0.15

Simulate the demand for next 10 days using the following sequence of random numbers. Random Numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49. Find the average demand of item per day.

- 14 a) What are the advantages and disadvantages of simulation models? (5)
- b) Explain various languages used in system simulation? (5)

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