Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U5702

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Fifth Semester

Mechanical Engineering

21UME602 – OPERATIONS RESEARCH FOR MECHANICAL ENGINEERS

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. Graphical method can be applied to solve a LPP when there are only____ variable CO1 U

(a)One (b) More than One (c)Two (d)Three

2. If a constraint with=type, then_____variable should be added CO1 U

(a)Slack (b)Surplus (c) Artificial (d) Decision

3. For solving an assignment problem, which method is used CO1 U

(a)MODI (b) Hungarian (c)German (d)American

4. Degeneracy in an mxn transportation problem occurs when the number of occupied cells is less than__ CO1 U

(a) m-n-1 (b)m+n+1 (c)m+n-1 (d)2m+3n-1

5. In which model, the starting node to ending node and some of the in between nodes may be skipped with minimum distance? CO1 U

(a) Shortest path (b)Maximal flow

(c)Minimal spanning tree (d)Critical path

6. Which activity is denoted by A<B? CO1 U

(a) Dummy (b) Predecessor (c) Successor (d)Critical

7. The time gap between time of placing an order and the time of arrival of goods is called the_____ CO1 U

(a) Delay time (b) Lead time (c) Advance time (d)Shortage time

8. Which of the following is an inventory management technique? CO1 U

(a) HML analysis (b)VED analysis

(c)ABC analysis (d) All the above

9. If a rectangular game has no saddle point, then the strategies of players are CO1 U

(a)Pure strategies (b) Mixed strategies

(c) Unique strategies (d) Specific strategies

10. One of the methods for simplifying mxn game with mixed strategyis CO1 U

(a) Dominance (b) Graphical (c) Saddle (d) Minimax

PART – B (5 x 2= 10Marks)

11. Apply your understanding of LPP constraints to solve a real-world optimization problem, like minimizing costs under resource limitations. CO2 App

12. Explain the methods to find basic feasible solution of a transportation problem. CO1 U

13. Explain predecessor and successor activities. CO1 U

14. Explain buffers to ck or safety stock. CO1 U

15. Explain the saddle point of a game. CO1 U

PART – C (5 x 16= 80Marks)

16. (a) Use Simplex method to solve the following LP problem and find out the optimal solution. CO2 App (16)

Maximize $Z = 3X_1 + 2X_2 + 5X_3$

Subject to $X_1 + 4X_2 \leq 420$

$3X_1 + 2X_3 \leq 460$

$X_1 + 2X_2 + X_3 \leq 430$

$X_1, X_2, X_3 \geq 0$

Or

(b) Solve the following LPP using Simplex method CO2 App (16)

Maximize $Z = 12X_1 + 16X_2$

Subject to $10X_1 + 20X_2 \leq 120$

$8X_1 + 8X_2 \leq 80$

$X_1, X_2 \geq 0$

17. (a) Find the basic feasible solution for the following transportation problem using CO2 App (16)

i) North-West Corner Rule

ii) Vogel's Approximation method.

	To				Supply
From	4	2	7	3	250
	3	7	5	8	450
	9	4	3	1	500
Demand	200	400	300	300	

Or

(b) Solve the following transportation problem using VAM method. CO2 App (16)

		Destination				
Source		1	2	3	4	Supply
	1	3	8	7	4	30
	2	1	7	5	9	40
	3	8	4	3	2	50
	Demand	25	35	40	20	

18. (a) Consider the details of a distance network as shown below. CO2 App (16)

(i) Construct a network

(ii) Determine the Minimal Spanning Tree from node 1 to 7.

1-2	1-3	2-3	2-4	3-4	4-5	4-6	5-7	6-7
20	25	10	12	5	10	5	10	8

Or

(b) Construct a network and find the minimal spanning tree CO2 App (16)

1-2	1-3	1-4	2-3	2-5	3-4	3-5	3-6	3-7	4-7
6	7	10	8	4	6	11	3	5	7
5-6	5-8	6-7	6-8	6-9	6-10	7-9	8-10	9-10	
13	9	5	4	8	3	10	10	9	

19. (a) A factory needs 36000 units annually of a component that cost Rs.2 per unit. Cost of each order placing is Rs. 25 and inventory carrying cost is Rs. 10 per year. Find CO3 App (16)

(i) Economic order quantity

(ii) Number of orders per year

(iii) Time between the orders

(iv) Optimal total inventory cost

Or

(b) A company has a demand of 12000 units/year for an item and it can produce 2000 such items per month. The cost of one setup is Rs. 400 and the holding cost per unit per month is Rs. 0.15. The shortage cost is Rs. 20 per year. Find the optimum lot size and the total cost per year, assuming the cost of one unit as Rs. 4. CO3 App (16)

20. (a) In a railway marshalling yard, goods train arrives at a rate of 30 trains per day. Assuming that inter arrival time follows an exponential distribution and the service time distribution is also exponential, with an average of 36 minutes. Calculate the following:
(i) The mean queue size (line length)
(ii) The probability that queue size exceeds 10
(iii) If the input of the train increases to an average 33 per day, what will be the changes in (i) and (ii)? CO3 App (16)

Or

(b) In a self-service store with one cashier, 8 customers arrive on an average of every 5 mins. And the cashier can serve 10 in 5 mins. If both arrival and service time are exponentially distributed, then determine
(a) Average number of customers waiting in the queue for average
(b) Expected waiting time in the queue
(c) What is the probability of having more than 6 customers In the system. CO3 App (16)