

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: R4709

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Mechanical Engineering

R21UME409 OPERATIONS RESEARCH FOR MECHANICAL ENGINEERS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. If a constraint with $\leq$ type, then ___ variable should be added 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. TSP stands for _____ CO1-U
(a) Transportation Problem (b) Travelling Salesman Problem
(c) Travelling Schedule Problem (d) Task Scheduling Problem
5. In which model, all the nodes must be connected with minimum distance? CO1- U
(a) Shortest path (b) Maximal flow (c) Minimal spanning tree (d) Critical path
6. CPM stands for_the die shape? CO1- U
(a) Crucial path method (b) Central path Method
(c) Critical path method (d) Circular path Method
7. The inventory may be categorized as CO1- U
(a) Raw materials inventory (b) In-process inventory
(c) Finished goods inventory (d) All the above

8. EOQ stands for_ CO1-U
- (a) Economic optimize quantity
 (b) Economic optimize quality
 (c) Economic order Quantity
 (d) Economic order quality
9. Which one of the following is a part of every game theory model? CO1- U
- (a) Strategies (b) Probabilities
 (c) Players (d) Payoffs
10. Which of the following denotes the queue discipline? CO1- U
- (a) FIFO (b) LIFO (c) SIRO (d) All the above

PART – B (5 x 2= 10 Marks)

11. Explain the term surplus variable. CO 1-U
12. Describe the process of converting a maximization transportation problem into a minimization problem CO 1-U
13. Apply the formula for calculating expected duration and variance to estimate the time required to complete a project task. CO 1-U
14. Explain lead time. CO 1-U
15. Explain the saddle point of a game.. CO 1-U

PART – C (5 x 16= 80 Marks)

16. (a) Use Graphical method to solve the following LP problem CO2 -App (16)
 to Maximize $Z=6X_1+5X_2$ Subject to
 $X_1+ 5X_2 \leq 5$
 $3X_1 + 2X_2 \leq 12$
 $X_1, X_2 \geq 0$
- Or
- (b) Solve the following LP problem using Simplex method. CO2 -App (16)
 Maximize $Z=6X_1+8X_2$
 Subject to $5X_1+ 10X_2 \leq 60$
 $4X_1+ 4X_2 \leq 40$

17. (a) Find the basic feasible solution for the following transportation problem using
 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 assignment problem.

		Machines				
		I	II	III	IV	V
Jobs	1	11	17	8	16	20
	2	9	7	12	6	15
	3	13	16	15	12	16
	4	21	24	17	28	26
	5	14	10	12	11	15

18. (a) Consider the details of a distance network as shown below.
 (i) Construct a network
 (ii) Determine the Shortest Path from node 1 to 7.

1-2	1-3	2-4	3-4	2-5	4-5	3-6	4-6	4-7	5-7	6-7
15	20	10	15	25	20	20	15	30	10	20

Or

- (b) Consider the details of a distance network (months) as shown below.
 (i) Construct a project network
 (ii) Determine the critical path with its duration
 (iii) Also determine the earliest start, earliest finish, latest start, and latest finish time

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

19. (a) The annual demand for an item is 3200 units. The unit cost is Rs. 6 and inventory carrying charges 25% per annum. If the cost of one procurement is Rs. 150. Determine (16)
CO3 -App
- (i) Economic order quantity
 - (ii) Number of orders per year
 - (iii) Time between the orders
 - (iv) Optimal total yearly cost

Or

- (b) The cost of a bike is Rs. 3000. The salvage value (resale value) and the running cost are given as under. Find the most economical replacement age of the bike. (16)
CO3 -App

Year	1	2	3	4	5	6	7
Running Cost	600	700	800	900	1000	1200	1500
Resale Value	2000	1333	1000	750	500	300	300

20. (a) A television repairman finds that the time spent on his jobs has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution approximately with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in. (16)
CO3 -App

Or

- (b) Solve the following game and determine (16)
CO3 -App
- (i) Saddle Point
 - (ii) Dominance
 - (iii) Strategy
 - (iv) Value of the game

		Player B		
		I	II	III
Player A	I	2	8	3
	II	7	3	8
	III	7	2	7