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

Question Paper Code: 55074

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fifth Semester

Mechanical Engineering

15UME504 - OPERATIONS RESEARCH

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Operations Research (OR) , which is a very powerful tool for

   (a) Research (b) Decision-Making
   (c) Operations (d) None of these

2. Operations Research has the characteristics the it is done by a team of

   (a) Scientists (b) Mathematicians
   (c) Academics (d) All the above

3. In _____ models, everything is defined and the results are certain

   (a) Deterministic Models (b) Probabilistic Models
   (c) both (a) and (b) (d) None of these

4. To balance the ≤ constraints in LLP _____ are Introduced in simplex method.

   (a) Economists (b) Slack Variables
   (c) Administrators (d) Statisticians and Technicians

5. Which method is used to Optimize the basic feasible solution in transportation problem?

   (a) Scientific Models (b) Algorithms
   (c) MODI method (or) u – v method (d) Mathematical Models

6. _____ method is used to solve assignment problems.

   (a) Quailing Theory (b) Waiting Line
   (c) both (a) and (b) (d) Hungarian method

7. _____rule is used for numbering the events in a network diagram.

(a) Fulkerson rule (b) Solution
(c) variable (d) None of these

8. The time gap between placing of an order and its actual arrival is known as

(a) Lead Time (b) Game Theory
(c) Network Analysis (d) Decision Theory

9. _____ notation is used for representing queuing models.

(a) Sequencing (b) Kendall's notation
(c) Allocation Models (d) Decision Theory

10. Server utilization factor (or Busy Period) is also called as

(a) Deterministic Models (b) Probabilistic Models
(c) Traffic Intensity (d) Both (a) and (b)

PART - B (5 x 2 = 10 Marks)

11. What are the phases of OR?

12. Write the methods available to find out starting solution in transportation algorithm.

13. Give the applications of network models.

14. Write the assumptions in EOQ formula.

15. What is Simulation?

PART - C (5 x 16 = 80 Marks)

16. (a) A company manufactures two types of products P1 and P2. Each product uses Lathe and Milling machine. The processing time per unit of P1 on the Lathe is 10 hours and on the milling machine is 8 hours. The processing time per unit of P2 on the Lathe is 20 hours and on the milling machine is 8hours. The maximum number of hours available per week on the Lathe and milling machine are 120 hours and 80 hours respectively. The profit per unit of selling P1 and P2 are Rs.18 and Rs.24 respectively. Formulate a linear programming model to determine the production volume of each of the products such that the total profit is maximized. (Use graphical method). (16)

Machine	Machine hours per unit		Limit on machine hours
	Product P1	Product P2	
Lathe	10	20	120
Milling Machine	8	8	80
Profit/Unit	Rs. 18	Rs. 24	

Or

(b) Solve the following LPP by Simplex Method

Maximize $Z = X_1 - 3X_2 + 3X_3$

Subject to $3X_1 - X_2 + 2X_3 \leq 7$

$2X_1 + 4X_2 \geq -12$

$-4X_1 + 3X_2 + 8X_3 \leq 10$

X_1, X_2 and $X_3 \geq 0$ (16)

17. (a) Find out the Initial basic feasible solution by VAM method. (16)

	Stores				
	1	2	3	4	Production Capacity
Factory-A	04	06	08	13	50
Factory-B	13	11	10	08	70
Factory-C	14	04	10	13	30
Factory-D	09	11	13	08	50
Demand	25	35	105	20	

Or

(b) A company has one surplus truck in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5 and 6. The distance between the cities in kilometers is shown in matrix below. Find the assignment of trucks from cities surplus to cities in deficit so that the total distance covered by vehicles is minimum. (16)

Cities	1	2	3	4	5	6
City **A**	12	10	15	22	18	8
City **B**	10	18	25	15	16	12
City **C**	11	10	3	8	5	9
City **D**	6	14	10	13	13	12
City **E**	8	12	11	7	13	10

18. (a) Consider the details of the distance network as shown below. Construct the distance network and find the minimum spanning tree using Kruskal algorithm. (16)

S.No.	Arc	Distance (Km)	S.No.	Arc	Distance (Km)	S.No.	Arc	Distance (Km)	S.No.	Arc	Distance (Km)
1	1-2	12	6	3-4	12	11	5-6	26	16	6-10	6
2	1-3	14	7	3-5	22	12	5-8	18	17	7-9	20
3	1-4	20	8	3-6	6	13	6-7	10	18	8-10	20
4	2-3	16	9	3-7	10	14	6-8	8	19	9-10	18
5	2-5	8	10	4-7	14	15	6-9	16			

Or

(b) A project involving 11 activities. Construct a network. Find the expected duration of each activity. Also find the Critical Path and the expected project completion time. t_o = Optimistic time, t_m = Most likely time, t_p = Pessimistic time. (16)

S.No.	Activity	Predecessor(s)	Duration (weeks)		
			t_o	t_m	t_p
1	A	-	6	7	8
2	B	-	1	2	9
3	C	-	1	4	7
4	D	A	1	2	3
5	E	A, B	1	2	9
6	F	C	1	5	9
7	G	C	2	2	8
8	H	E, F	4	4	4
9	I	E, F	4	4	10
10	J	D, H	2	5	14
11	K	I, G	2	2	8

19. (a) Annual demand for an item is 5400 units. Ordering cost is Rs.600 per order. Inventory carrying cost is 30% of the purchase price/unit/year. The price breaks are shown as. Find the optimal order size. (16)

Quantity	Price per Unit (Rs.)
$0 < Q < 2400$	12
$2400 \leq Q < 3000$	10
$3000 \leq Q$	8

Or

(b) The annual demand for a component is 7200 units. The carrying cost is Rs.500/unit/year, the ordering cost is Rs.1500 per order and shortage cost is Rs.2000/unit/year. Find the optimal values of economic order quantity, maximum inventory, maximum shortage quantity, cycle time (t), inventory period (t_1) and shortage period (t_2). (16)

20. (a) A self service stores employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time. Find (i) Average number of customers in the system (ii) Average number of customers in the queue. (or) Average queue length (iii) Average time a customer spends in the system. Average time a customer waits before being served. (16)

Or

(b) What is a saddle point in game theory? and Explain with pure strategies game with saddle point. (16)