Course Code: **19ME0325** **R19**

SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY:: PUTTUR

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QUESTION BANK (DESCRIPTIVE)

Subject with Code: OPERATIONSRESARCH (19ME0325) Course & Branch : B.Tech - MECH

Regulation: R19 **UNIT —I** Year & Semester: IV-B Tech & I

INTRODUCTION TO OR AND LINEAR PROGRAMMING

1. Solve the following LPP Minimize $Z= X_1 - 3X_2+3X_3$ **L3 CO1 12M**
   Subjected to $3X_1-X_2+2X_3 \leq 7$, $2X_1+4X_2\geq -12$, $- 4X_1+3X_2+8X_3\leq 10$
   and $X_1,X_2,X_3\geq 0$
2. Solve the following by using Big-M method. **L3 CO1 12M**
   Maximize $Z=2X_1+3X_2+4X_3$, Subjectedto$3X_1+X_2+4X_3\leq 600$,
   $2X_1+4X_2+2X_3\geq 480$, $2X_1+3X_2+3X_3= 540$ and $X_1,X_2,X_3\geq 0$.
3. Solve the following LPP using Simplex method. **L3 CO1 12M**
   Maximize $Z=3X_1+5X_2+4X_3$, Subjected to: $2X_1+3X_2 \leq 8$, $2X_2+5X_3 \leq 10$,
   $3X_1+2X_2+4X_3\leq 15$ and $X_1,X_2,X_3 \geq 0$
4. Solve the following problem by using Big-M- method **L3 CO1 12M**
   Maximize $z=X_1+2X_2+3X_3-X_4$, subjected to :$X_1+2X_2+3X_3\leq 15$,
   $2X_1+X_2+5X_3\geq 20$,$X_1+2X_2+X_3+X_4=10$ and $X_1,X_2,X_3,X_4 \geq 0$
5. Solve the following Degeneracy in simplex method **L3 CO1 12M**
   Maximize $3X_1 + 9X_2$, Subjected to $X_1 +4X_2 \leq 8$, $X_1 + 2X_2 \leq 4$, $X_1, X_2 \geq 0$
6. Find the Geometrical solution maximize $Z= 6X_1+10X_2$, **L3 CO1 12M**
   Subject to the constraints $X_1+X_2 < 70$, $X_1 <40$, $X_2 >20$, $2X_1+ 3X_2 < 300$.
   $X_1, X_2 , X_3 \geq 0$
7. Solve following by using Big-M Method Maximize $Z = 6X_1 +4 X_2$, **L3 CO1 12M**
   Subjected to $2X_1 + 3X_2 < 30$, $3X_1 + 2X_2 < 24$, $X_1 + X_2 > 3$, $X_1, X_2 > 0$
8. (a) Discuss the applications of Operations Research **L2 CO1 6M**
   (b) Explain the procedure to solve the LPP **L2 CO1 6M**
9. (a) Define operations research. How OR is useful for decision makers **L1 CO1 4M**
   (b) Discuss the importance model in the solution of OR problem **L2 CO1 4M**
   (c).What are the limitations of linear programming technique **L1 CO1 4M**
10. (a)What are the characteristics of operation Research **L1 CO1 6M**
    (b) Discuss the types of operation Research models **L2 CO1 6M**

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TRANSPORTAION PROBLEM AND ASSIGNMENT PROBLEM

1. Solve the following transportation problem to maximize profit **L3 CO2 12M**

1

	A	B	C	D	SUPPLY
P	40	25	22	23	100
Q	44	35	30	30	30
R	38	38	28	30	70
DEMAND	40	20	60	30	

2. Determine the basic Feasible solution to the following Transportation problem using NWC, VCM and VAM? **L5 CO2 12M**

	A	B	C	D	E	**SUPPLY**
P	2	11	10	3	7	4
Q	1	4	7	2	1	8
R	3	9	4	8	12	9
DEMAND	3	3	4	5	6	

3. Solve the following transportation problem Determine the Shipping scheme by the Northwest corner Rule. **L3 L5 CO2 12M**

	A	B	C	D	**AVAILABLE**
P	4	6	8	13	50
Q	13	11	10	8	70
R	14	4	10	13	30
S	9	11	13	8	50
REQUIRED	**25**	**35**	**105**	**20**	

4. A as salesman has visits of Five cities A,B,C,D and E the distance between the five cities is as Follows. If the salesman starts from city A and has to come back to his starting point, which route is should be select So that the total distance travelled in minimum.. **L4 CO2 12M**

	A	**B**	**C**	**D**	**E**
A	-	7	6	8	4
B	7	-	8	5	6
C	6	8	-	9	7
D	8	5	9	-	8
E	4	6	7	8	-

5. The processing time in hours for the jobs when allocated to the different machines is indicated below. Assign the machines for the jobs so that the total processing time in minimum **L3 CO2 12M**

MACHINES

JOBS	**1**	**2**	**3**	**4**	**5**
1	9	22	58	11	19
2	43	78	72	50	63
3	41	28	91	37	45
4	74	42	29	49	39
5	36	11	57	22	25

6. A Department has 5 employees and five jobs are to be performed. The time each man will take to perform each job is given in the following table below. How the job should be Allocated one per employee, so as to minimize the total man-hours. **LI CO2 12M**

MACHINES / JOBS	A	B	C	D	E
1	9	3	10	13	4
2	8	17	13	20	5
3	5	14	8	11	6
4	11	13	9	12	3
5	12	8	14	16	7

7. Consider the problem of assigning five operators to five machines. The assignment costs are given in following Table **L1 L3 CO2 12M**

	M 1	M 2	M 3	M 4	M 5
A	7	7	-	4	8
B	9	6	4	5	6
C	11	5	7	-	5
D	9	4	8	9	4
E	8	7	9	11	11

Operator A cannot be assigned to machine M3 and operator C cannot be assigned to machine M4. Find the optimum assignment schedule

8. Find the minimum transportation cost for the following data. **L1 L6 CO2 12M**

		A	B	C	D	E	F	Available
Factory	**1**	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
	Requirement	4	4	6	2	4	2	

9. There are three parties who supply the following quantities of coal and three consumers who require the coal as follows Find the minimum transportation cost. **L1 L6 CO2 12M**

Party 1:	14 tons	consumer A :	6 tons
Party 2:	12 tons	consumer B :	10 tons
Party 3:	5 tons	consumer C :	15 tons

The cost Matrix is as shown below

	A	B	C
1	6	8	4
2	4	9	3
3	1	2	6

10. (a).What is Transportation Problem? **L1 CO2 4M**
(b) What do you mean by balanced transportation problem? **L1 CO2 4M**
(c). What is travelling salesman problem? **L1 CO2 4M**

UNIT-III
GAME THEORY AND QUEING THEORY

1. (a). Find the saddle point following GAME? **L1 CO3 6M**

Player A	Payer B				
	I	II	III	IV	V
I	9	3	1	8	0
II	6	5	4	6	7
III	2	4	4	3	8
IV	5	6	2	2	1

(b). Find the optimal strategy of following GAME? **L1 CO3 6M**

Player A	Payer B		
	I	II	III
I	-3	-2	6
II	2	0	2
III	5	-2	-4

2. (a). Find the saddle point following GAME? **L1 CO3 6M**

Player A	Payer B		
	B1	B2	B3
A1	-3	-1	6
A2	2	0	2
A3	5	-2	-4

(b). Explain Pure strategy and Mixed strategy. **L2 CO3 6M**

3. Solve the following GAME, using the Dominance Principle. **L3 CO3 12M**

FirmA	Firm B				
	4	6	5	10	6
	7	8	5	9	10
	8	9	11	10	9
	6	4	10	6	4

4. Use the relation of Dominance to solve the game matrix. **L3 CO3 12M**

FirmA	Firm B					
	Bl	B2	B3	B4	B5	B6
Al	4	2	0	2	1	1
A2	4	3	1	3	2	2
A3	4	3	7	-5	1	2
A4	4	3	4	-1	2	2
A5	4	3	3	-2	2	2

5. Consider a self-service store with one cashier. Assume Poisson arrivals and exponential service times. Suppose that 9 customers arrive on the average every 5 minutes and the cashier can serve 10 in 5 minutes, Find
   a) Average number of customers queuing for service
   b) Probability of having more than 10 customers in the system. c) Probability that a customer has to queue for more than 2 minutes

L1 L3 CO3 12M

6. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day, assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate a).Expected queue size b).Probability that the queue size exceeds 10. If the input of trains increases to an average of 33 per day what will be the change in (a) and (b).

L3 L5 CO3 12M

7. A Company distributes its products by trucks loaded and its only loading station, both company's trucks and conductor truck's are used for this purpose. It was found that an average of every 5 minutes. One truck is arrived and the average loading time is 3 minutes. 50% of the trucks belong to the contractor Find out 1.Probability that truck has to wait 2. waiting time of truck that waits 3. Expected time for contractor truck per day assuming 24 – hr shift.

L1 CO3 12M

8. (a) State briefly the applications of queuing models. **L1 CO3 6M**
   (b) Briefly explain i) queue ii) infinite queue iii) queue models **L1 CO3 6M**

9. (a) What is game theory? What are the various types of games? **L1 CO3 6M**
   (b) What is Queuing Theory and what are the elements of Queuing system? **LI CO3 6M**

10. (a) Discuss i) Server ii) Arrival rate iii) Service rate **L6 CO3 6M**
    (b)What are the limitations for Applications of queuing Theory? **L1 CO3 6M**

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UNIT -IV

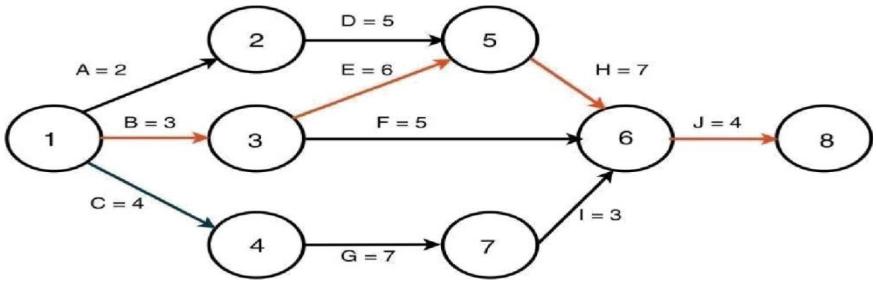
PERT & CPM

1 A project has the following schedule. Construct PERT network & compute the total float for each activity. Find critical path and its duration .Also calculate Total Float, Free Float.

L1 L4 CO4 12M

Activity	**1-2**	**1-3**	**2-4**	**3-4**	**3-5**	**4-9**	**5-6**
Time in weeks	4	1	1	1	6	5	4
Activity	5-7	6-8	7-8	8-9	8-10	9-10	
Time in weeks	8	1	2	1	8	7	

2. Find the critical path and calculate the Total float, Free float. **LI L6 CO4 12M**



3. A project has the following schedule. Construct PERT network and compute the total float for each activity. Find critical path with its duration. **L1 L3 CO4 12M**

Activity	Time in month	Activity	Time in month	Activity	Time in month
1-2	2	3-6	8	6-9	5
1-3	2	3-7	5	7-8	4
1-4	1	4-6	3	8-9	3
2-5	4	5-8	1		

4. (a) List similarities and differences between PERT and CPM **L1 CO4 4M**
(b). State the rules for drawing network diagram. **L1 CO4 4M**
(c)What is line of balance and Define total elapsed time **L1 CO4 4M**

5. A project has the following schedule. Construct PERT network and compute the total float for each activity Find critical path and its duration . **L1 L5 CO4 12M**

Activity	Time in month	Activity	Time in month	Activity	Time in month
1-2	2	3-6	1	6-9	3
1-4	2	4-5	5	7-8	3
1-7	1	4-8	8	8-9	3
2-3	4	5-6	4		

6. Construct PERT network and compute the total float for each activity Find critical path and its duration. **L1 L3 CO4 12M**

Activity	Time	Activity	Time
1-2	2	4-6	3
1-3	2	5-8	1
1-4	I	6-8	5
2-5	4	7-8	4
3-6	8	8-9	3
3-7	5		

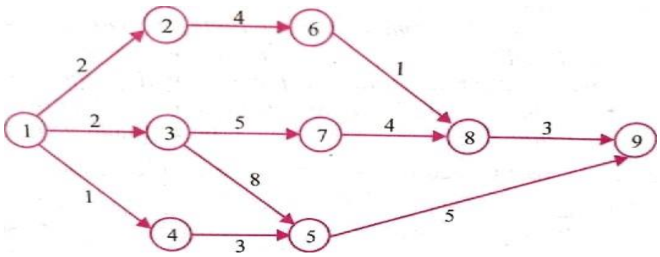
7. A project schedule has the following characteristics **L1 L6 CO4 12M**

Activity	Time	Activity	Time
1-2	2	4-8	8
1-4	2	5-6	4
1-7	I	6-9	3
2-3	4	7-8	3
3-6	l	8-9	5
4-5	5		

Construct i) PERT network

ii) Find critical path and Time duration of the project

8. Find the critical path and calculate the slack time for each event for the following PERT diagram. **L1 L6 CO4 12M**



9. (a) Explain the Forward Pass computations for Earliest Event Time in detail **L2 CO4 6M**
(b) Discuss the Backward pass computations for Latest Allowable Time in detail **L6 CO4 6M**

10. (a) Explain the following a) critical event b) critical activity c) Total float D) Free float **L2 CO4 6M**
(b) What is meant by critical path and explain the main features of critical path? **L1 L6 CO4 6M**

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UNIT-V

INTRODUCTION TO MAINTENACE & SEQUENCING

1. The cost of a machine is Rs6100 and its scrap value is Rs.100.The maintenance costs found From experience are as follows. When should the machine be replaced? **L5 CO5 12M**

Year (n)	1	2	3	4	5	6	7	8
Running M/C Cost in Rs	100	250	400	600	900	1200	1600	2000

2. A truck owner from his past records that the maintenance costs per year of a truck whose Purchase price is Rs.8000 are as given below. When should the machine be replaced? **L5 CO5 12M**

Year (n)	1	2	3	4	5	6	7	8
Running cost (MC)in Rs.	1000	1300	1700	2000	2900	3800	4800	6000
Resale Price(Rs)	4000	2000	1200	600	500	400	400	400

3. Assume that present value of one rupee to be spent in a years' time is Re.0.90 and C=Rs 6000, Capital cost of equipment .Running costs are given in the table below. When should the machine be replaced? **L5 CO5 12M**

Year (n)	1	2	3	4	5	6	7
Running cost (MC)in Rs.	1000	1200	1600	2000	2600	3200	4000

4. A manufacturer finds from his past records that casts per year associated with a machine With a purchase price of Rs 50,000/- are as given below. Determine the optimum policy? **L5 CO5 12M**

Year (n)	1	2	3	4	5	6	7	8
Running cost (MC)in Rs.	15000	16000	18000	21000	25000	29000	34000	40000
Scrap value	35000	25000	17000	12000	10000	5000	4000	4000

5. Determine the sequence for the jobs and the total elapsed time ? **L5 CO5 12M**

	A	B	C	D	E	F	G	H	I
Machine1	4	7	6	11	8	10	9	7	6
Machine2	8	10	9	6	5	11	5	10	13

6. Find the sequence that minimizes the total elapsed time required to complete the following Tasks on the machines in the order 1 – 2 – 3. Find also the minimum total elapsed time and the ideal times on the machines? **L1 L3 CO5 12M**

		A	B	C	D	E	F	G
Tasks time on Machines	**1**	3	8	7	4	9	8	7
	2	4	3	2	5	1	4	3
	3	6	7	5	11	5	6	12

7. (a) What is mean by sequencing Problem and Define total elapsed time ? **L1 CO5 6M**

(b) Determine the sequence for the jobs and the total elapsed time? **L3 CO5 6M**

Job	A	B	C	D	E
Machine1	3	7	4	5	7
Machine2	8	2	7	3	4

8. Determine a sequence for five jobs that will minimize the elapsed time T and also calculate the total Idle time for machines in this period? **L3 CO5 12M**

Processing Time (hours)					
Job	1	2	3	4	5
Time for A	5	1	9	3	10
Time for B	2	6	7	8	4

9. (a)What are the sequential steps involved in sequencing jobs? **L1 C05 4M**
(b) Explain Failure mechanism items. **L2 C05 4M**
(c) Discuss briefly about Individual Replacement model. **L2 C05 4M**

10. **(a)** Explain the Bellman's principle of optimality **L2 CO5 6M**
(b)Describe the various types of replacement situations and Explain about group Replacement. **L1 CO5 6M**