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

SIDDHARTH INSTITUTE OF ENGINEEING & TECHNOLOGY:: PUTTUR

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QUESTION BANK (DESCRIPTIVE)

Subject with Code: OPERATIONSRESARCH (19ME0325) Course & Branch : B.Tech - MECH
Regulation: R19 Year & Semester: IV-B Tech & I

UNIT —I
INTRODUCTION TO OR AND LINEAR PROGRAMMING

1. Solve the following LPP Minimize $Z= X_1 - 3X_2+3X_3$ 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 $X_1,X_2,X_3 \geq 0$	**L3 CO1 12M**
2. Solve the following by using Big-M method 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 $X_1,X_2,X_3 \geq 0$	**L3 CO1 12M**
3. Solve the following LPP using Simplex method 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 $X_1,X_2,X_3 \geq 0$	**L3 CO1 12M**
4. Solve the following problem by using Big-M- method 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 $X_1,X_2,X_3,X_4 \geq 0$	**L3 CO1 12M**
5. Solve the following Degeneracy in simplex method Maximize $3X_1 + 9X_2$, Subjected to $X_1 +4X_2 \leq 8$, $X_1 + 2X_2 \leq 4$, $X_1, X_2 \geq 0$	**L3 CO1 12M**
6. Find the Geometrical solution maximize $Z= 5X_1+3X_2$, Subject to the constraints $3X_1+5X_2 = 15$, $5X_1+ 2X_2 = 10$.	**L3 CO1 12M**
7. Solve the following LPP by Simplex method Minimize $Z = 3X_1+ 2X_2+5X_3$, Subjected to $X_1+2X_2+X_3 < 430$, $3X_1+2X_3 < 460$, $X_2+4X_2 < 420$ & X_1, X_2 & $X_3 > 0$	**L3 CO1 12M**
8. Solve following by using Big-M Method Maximize $Z = 6X_1 +4 X_2$, Subjected to $2X_1 + 3X_2 < 30$, $3X_1 + 2X_2 < 24$, $X_1 + X_2 > 3$, $X_1, X_2 > 0$	**L1 CO1 4M**
9. A. Define operations research. How OR is useful for decision makers B. Discuss the importance model in the solution of OR problem C. What are the limitations of linear programming technique	**L6 CO1 4M** **L1 CO1 4M**
10. A. What are the characteristics of operation Research B. Discuss the types of operation Research models C. Explain the procedure to solve the LPP	**L1 CO1 4M** **L6 CO1 4M** **L2 CO1 4M**

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UNIT - II

TRANSPORTAION PROBLEM AND ASSIGNMENT PROBLEM

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

I

	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	

2. Solve the following transportation problem **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**	

Determine the Shipping scheme by the Northwest corner Rule and Test the above solution for Optimality

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

	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	

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.

L6 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. 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

6. 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	

7. There are three parties who supply the following quantities ofcoal 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

8 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 min.

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

9. 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

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

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

L1 CO3 6M

B. Find the optimal strategy of following GAME

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

L1 CO3 6M

2. A Find the saddle point following GAME

Player A	Payer B			
		B_1	B_2	B_3
	A_1	-3	-1	6
	A_2	2	0	2
	A_3	5	-2	-4

L1 CO3 6M

L3 CO3 6M

B Solve the following GAME whose payoff matrix to the player A

Player A	Payer B			
		B_1	B_2	B_3
	A_1	1	7	2
	A_2	6	2	7
	A_3	5	2	6

L3 CO3 12M

3. Solve the following GAME, using the Dominance Principle

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

L3 CO3 12M

4. Use the relation of Dominance to solve the rectangular game matrix

	I	II	III	IV
1	18	4	6	4
II	6	2	13	7
III	11	5	17	3
IV	7	6	12	2

5. Solve the following game, using the Dominance Principle. **L3 CO3 12M**

Firm A	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

6. 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 ofcustomers queuing for service b) Probability ofhaving more than 10 customers in the system. c) Probability that a customer has to queue for more than 2 minutes **L1 L3 CO3 12M**

7. 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**

8. A TV repairman finds that time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in an order in which they come in and if the arrival of set is approximately poison with an average rate of 10 per 8- hour day, what is the repairman's Expected idle time each day and how many jobs are ahead of the average set just brought in. **L1 CO3 12M**

9. A. State briefly the applications of queuing models. **L1 CO3 6M**
   B What are the limitations for Applications of queuing Theory **L1 CO3 6M**

10 A. What is game theory? What are the various types ofgames? **L1 CO3 4M**
   B What is Queuing Theory and what are the elements of Queuing system? **LI CO3 4M**
   C Explain Pure strategy and Mixed strategy **L2 CO3 4M**

UNIT -IV

PERT & CPM

1 A project has the following schedule. Construct PERT network and compute the totalfloat 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		

2. 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**

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

L1 L6 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		

4. 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 L6 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	

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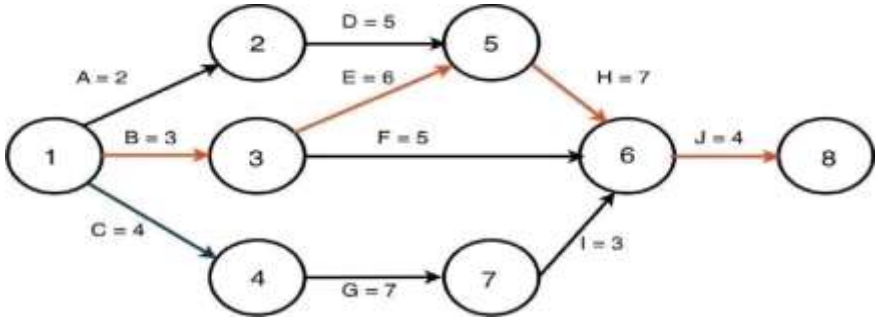
5. The following table lists the jobs ofa network with their estimates

i) Draw the project network ii) Calculate the length and variance of the critical path and iii) What is the approximate probability that the jobs on the critical path will be completed in 41 Days L1 L6 CO4 10M

JOBS	**Optimistic (o)**	**Most** likely **(tq)**	**Pessimistic (tp)**
1-2	3	6	15
1-6	2	5	14
2-3	6	12	30
2-4	2	5	8
3-5	5	11	17
4-5	3	6	15
6-7	3	9	27
5-8	1	4	7
7-8	4	19	28

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



7. A project schedule has the following characteristics

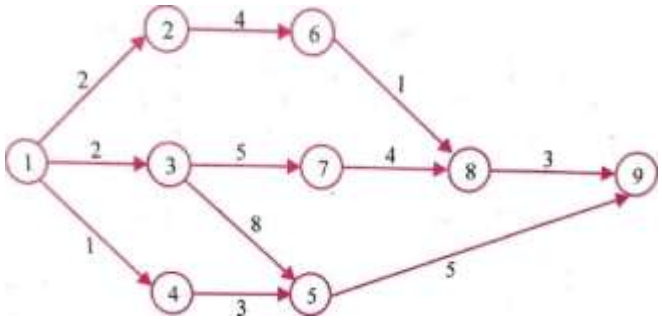
L1 L6 CO4 12M

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 the PERT network and 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



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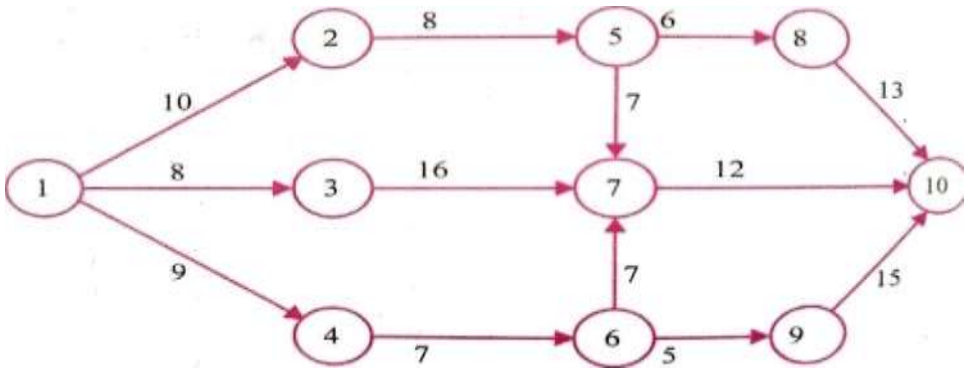
9. Determine the early start (Tr) and Late start (TL) in respect of all node points and identify the critical path in respect of the following network. **L1 L6 CO4 12M**



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 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**

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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

8. 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**

	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

9. 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

10. 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**