U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Institutional Elective **Duration: 3 hrs.**

Course Code: 23IM6OEOPR / 22IM6OEOPR **Max Marks: 100**

Course: Operations Research

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

				CO	PO	Marks
			UNIT - I			
1	a)	Define the following terms related to LP: (i) Infeasible solution (ii) Degenerated solution (iii) Multiple solution		CO1	PO1	**06**
	b)	Solve the LPP using Simplex algorithm MIN Z = 5x1 + 3x2 subject to 2x1 + 4x2 <= 12, 2x1 + 2x2 = 10 5x1 + 2x2 >= 10 and x1, x2 >= 0		CO2	PO2	**14**
		OR				
2	a)	Any one standard definition of Operations Research and brief explanation on OR's Scope		CO1	PO1	**05**
	b)	Explain Phases of OR		CO1	PO1	**05**
	c)	The standard weight of a special purpose brick is 5 kg and it must contain two basic ingredients B1 and B2. B1costs Rs 5 per kg and B2 costs Rs 8 per kg. Strength considerations dictate that the brick should contain not more than 4 kg of B1 and minimum 2 kg of B2. Since the demand for the product is likely to be related to the price of the brick, find the minimum cost of brick satisfying the above conditions. Formulate this situation as an LPP and solve it graphically.		CO2	PO2	**10**
			UNIT - II			
3	a)	List the assumptions considered in the Transportation model		CO1	PO1	**05**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		b)	A company has four factories P, Q, R and S which supply to three warehouses A, B, and C. the monthly Demand in tons at A, B and C is 120, 80 and 200 respectively, the monthly Production capacities in tons at factories P, Q, R and S is 60, 50, 140 and 50 respectively. The transportation cost in Rupees per ton is given in the matrix below. Using VAM, determine the transportation schedule that minimizes the total transportation cost.	*CO2*	*PO2*	**15**

		A	B	C
Furnaces	P	4	3	7
	Q	5	8	4
	R	2	4	7
	S	5	8	4

		OR				
4	a)	Analyze the transportation cost using Least Cost Method and check the optimality using MODI method for the following problem	*CO2*	*PO2*	**10**

	A	B	C	D	E	Supply
X	8	8	9	4	3	800
Y	5	8	5	11	6	500
Z	8	9	7	3	3	900
Demand	400	350	300	250	900	

	b)	Analyze the transportation cost using VAM and check the optimality using MODI method for the following problem	*CO2*	*PO2*	**10**

	1	2	3	4	5	Supply
A	1	9	13	36	51	50
B	24	12	16	20	1	100
C	14	33	1	23	26	150
Demand	100	70	50	40	40	

		UNIT - III				
5	a)	Differentiate between Assignment problem and Travelling salesmen problem	*CO1*	*PO1*	**04**
	b)	Find Solution of Travelling salesman problem	*CO2*	*PO2*	**08**

Work\Job	A	B	C	D	E
A	∞	5	8	4	5
B	5	∞	7	4	5
C	8	7	∞	8	6
D	4	4	8	∞	8
E	5	5	6	8	∞

		c)	Find the optimal Assignment that will result in minimum cost Firm\Job 1 2 3 4 5 6 A 44 67 41 53 48 64 B 46 69 40 45 45 68 C 43 73 37 51 44 62 D 50 65 35 50 46 65	*CO2*	*PO2*	**08**
			OR			
	6	a)	Find the optimal assignment and optimum cost for the following problem shown below Jobs: 1 2 3 4 5 M/c A 12 13 8 11 10 M/c B 10 11 12 9 13 M/c C 13 10 15 12 11 M/c D 15 14 13 10 12 M/c E 11 12 14 13 15	*CO2*	*PO2*	**10**
		b)	A person has to visit 5 cities and cost of going from one city to another is shown below. Find the optimum route and optimum cost using Hungarian method To: A B C D E From A - 20 18 17 21 From B 19 - 17 16 15 From C 18 16 - 20 14 From D 16 17 19 - 18 From E 17 18 20 19 -	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Define the following w.r.t network analysis: i) Path ii) Activity iii) Looping iv) Network	*CO1*	*PO1*	**04**

	b)	A small project consists activities for which the relevant data is given below: i) Draw the network and find the project completion time ii) Calculate earliest and latest times. iii) Calculate the total float, free float and independent floats for each activity.	*CO3*	*PO3*	**16**

Activity	A	B	C	D	E	F	G
Preceding Activity	-	-	-	A , B	A, B	C , D, E	C , D, E
Duration (Days)	4	7	6	5	7	6	5

		OR	
8	a)	Differentiate between PERT & CPM	*CO1* *PO1* **04**
	b)	The time estimates (in weeks) for the activities of a network are given below: ISRO is planning a project to launch manned mission to moon and has listed activities and are as follows: (i) Draw the network and determine the critical path and variance (ii) What is the probability that the project will be completed no more than 4 months later than the expected time? (iii) What should be the scheduled completion time for the probability of completion to be 50%	*CO3* *PO3* **16**

Activity	Time estimates in Months		
1 - 2	7	1	1
1 – 3	7	1	4
1 – 4	8	2	2
2 – 5	1	1	1
3 – 5	14	2	5
4 – 6	8	2	5
5 - 6	15	3	6

		UNIT - V	
9	a)	Four jobs 1, 2, 3 & 4 are to be processed on each of Five machines A, B, C & D in the order ABCDE. Find the total minimum elapsed time if no passing of jobs is permitted. Also determine idle time for each machine.	*CO4* *PO4* **10**

M/C & Jobs	A	B	C	D	E
1	7	5	2	3	9
2	6	6	4	5	10
3	5	4	5	6	8
4	8	3	3	2	6

	b)	Use graphical method to minimize the time required to process the following jobs on the machines shown below. For each machine specify the job which should be done first. Also calculate the total elapsed time and idle time to complete both jobs. Plot Gantt chart for both the jobs.	*CO4*	*PO4*	**10**

		Machines				
Job 1	Sequence	A	B	C	D	E
	Time (hrs)	6	8	4	12	4
Job 2	Sequence	B	C	A	D	E
	Time (hrs)	10	8	6	4	12

		OR				
10	a)	There are seven jobs, each of which has to be processed on machine A and then on Machine B (order of machining is AB). Processing time is given in hours. Find the optimal sequence in which the jobs are to be processed so as to minimize the total time elapsed.	*CO4*	*PO4*	**08**

JOB:	1	2	3	4	5	6	7
MACHINE: A (TIME IN HOURS).	3	12	15	6	10	11	9
MACHINE: B (TIME IN HOURS).	8	10	10	6	12	1	3

	b)	List any 5 assumptions made in Sequencing problems	*CO1*	*PO1*	**04**
	c)	Find the sequence of job 1 and 2 on four machines for the given technological order.	*CO4*	*PO4*	**08**

Job 1	Order of machining:	A	B	C	D
	Time in hours.	2	3	3	4
Job 2	Order of machining:	A	B	C	D
	Time in hours.	2	3	3	4

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