U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

Programme: B.E. **Semester: V**

Branch: Industrial Engineering and Management **Duration: 3 hrs.**

Course Code: 23IM5PCOPR **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.

		UNIT - I	CO	PO	Marks
1	a)	Define OR. Give its origin and development of OR. Give its applications.	CO1	PO1	**10**
	b)	A firm makes two types of pie of furniture, chairs and tables. The contribution for each product as calculated by the accounting department are Rs.200 per chair and Rs.300 per table. Both products are processed on three machines M1, M2 and M3. The time required to produce each product and the total tune available per week on each machine are as follows i) Formulate this as LPP ii) How should the manufacturer schedule his production in order to maximize the contribution. Machine | Chair | Table | Available hours M1 | 3 | 3 | 36 M2 | 5 | 2 | 50 M3 | 2 | 6 | 60	CO2	PO2	**10**
		OR			
2	a)	Solve the problem LPP using Simplex method Maximize $Z = 2x_1+10x_2+x_3$ Subjected to $5x_1+2x_2+x_3+s_1 \le 15$ $2x_1+x_2+7x_3+s_2 \le 20$ $x_1+3x_2+2x_3+s_3 \le 25$ $x_1, x_2, x_3 \ge 0$	CO2	PO2	**10**
	b)	Solve the following by Big M method. Maximize $Z = 4x_1+5x_2-3x_3$ Subjected to $x_1+x_2+x_3 = 10$ $x_1-x_2 \ge 1$ $2x_1+3x_2+x_3 \le 40$ $x_1, x_2, x_3 \ge 0$	CO2	PO2	**10**

			UNIT - II			
	3	a)	To solve the transportation problem what are the information must be known and what are the information mode and write the application of transportation model.	*CO3*	*PO1*	**10**
		b)	Three jobs are to be done by 4 machines each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following M_1 M_2 M_3 M_4 J_1 18 24 28 32 J_2 8 13 17 19 J_3 10 15 15 22 What are the job assignments which will minimize the total cost?	*CO3*	*PO2*	**10**
			OR			
	4	a)	Maximize the following transportation matrix M_1 M_2 M_3 M_4 Supply S_1 15 51 42 33 23 S_2 80 42 26 81 44 S_3 90 40 66 60 33 Demand 23 31 16 30	*CO3*	*PO2*	**10**
		b)	A company has 4 salesman A, B, C and D. These salesman are to be allotted 4 cities 1, 2, 3 and 4. The estimated profit per day for each salesman in each city is given in the following table 1 2 3 4 A 16 10 14 11 B 14 11 15 15 C 15 15 13 12 D 13 12 14 15 What is the optimum assignment which will yield maximum profit?	*CO3*	*PO2*	**10**
			UNIT - III			
	5	a)	Explain the Queuing system, explain the characteristics of queuing system.	*CO3*	*PO2*	**10**
		b)	In a hair trimming salon with one barber, the customer arrival follows Poisson distribution at an average rate of 1 every 45 minutes. The service time is exponentially distributed with a mean of 30 minutes. Find i) Average number of customer in the salon ii) Average waiting time of a customer before service iii) Average idle time of the barber	*CO3*	*PO2*	**10**
			OR			
	6	a)	At an emergency ward of a private hospital which can handle only one patient at a time, 96 patients arrive in a day on an average it takes on an average 10 minutes to treatment to a patient. The cost of treatment is Rs.200 per patient for 10 minutes. The cost creates at Rs.20 per minute of time reduced. How much minutes the cost increased at Rs.20 per minute of time. How much amount would be budgeted by the clinic to reduce the queue size to 1/2 ?	*CO4*	*PO3*	**10**

		b)	A supermarket has 2 salesgirls bringing into the sales at counter if the service time for each customer is exponentially distributed with a mean of 4 minutes and the people arrive in Poisson distribution at counters at the rate of 10 per hour , determine all the measures of multiple service model.	*CO4*	*PO3*	**10**
			UNIT - IV			
	7	a)	Explain the features of a game. Give the game theory terminology.	*CO2*	*PO2*	**10**
		b)	Solve the following game. Determine the optimum strategies and the values of the game. $\begin{array}{c} \\ A_1 \\ A_2 \end{array}\begin{array}{c} \begin{array}{cc} B_1 & B_2 \end{array} \\ \begin{bmatrix} 8 & -3 \\ -3 & 1 \end{bmatrix} \end{array}$	*CO2*	*PO2*	**10**
			OR			
	8	a)	Solve the game by graphical method. 1 2 3 4 5 1 3 0 6 -1 7 2 -1 5 -2 2 1	*CO2*	*PO2*	**10**
		b)	Write the general decision tree model and explain it.	*CO1*	*PO1*	**10**
			UNIT - V			
	9	a)	The following table gives the list of the jobs. Job / Immediate predecessor / Duration (days) A / — / 5 B / — / 10 C / A / 6 D / B / 8 E / C, D / 7 F / C / 4 G / C / 8 H / E, F, B / 7 I / A, H, D / 6 i) Draw the network ii) List all the paths and identify the critical path	*CO3*	*PO2*	**10**
		b)	The following table gives a list of jobs along with their time estimates. Job / Optimistic time / Most likely time / Pessimistic time 1 – 2 / 3 / 6 / 15 1 – 6 / 2 / 5 / 14 2 – 3 / 6 / 12 / 30 2 - 4 / 2 / 3 / 8 3 – 5 / 5 / 11 / 17 4 – 5 / 3 / 6 / 15 6 – 7 / 3 / 9 / 27 5 – 8 / 1 / 4 / 8 7 – 8 / 4 / 19 / 28	*CO3*	*PO2*	**10**

<table>
<tr><td></td><td></td><td></td><td>i) Draw the project network
ii) What is the approximate probability that jobs in the critical path will be compiled by the due days
iii) What is the approximate probability that jobs on the next most critical path will be compelled by the due date
iv) What is your estimate of probability that the entire project will be compiled by the due date
v) Which due date has 90% chance of being met ?</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>10</td><td>a)</td><td>Explain the following
i) Optimistic time
ii) Pessimistic time
iii) Most likely time</td><td>CO3</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>b)</td><td>The time estimation of the activities of a project is given in the following table
<table>
<tr><th>Activity</th><th>Optimistic time</th><th>Most likely time</th><th>Pessimistic time</th></tr>
<tr><td>1 – 2</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>2 – 3</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>2 – 4</td><td>1</td><td>3</td><td>5</td></tr>
<tr><td>3 – 5</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>4 – 5</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>4 – 6</td><td>3</td><td>5</td><td>7</td></tr>
<tr><td>5 – 7</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>6 – 7</td><td>2</td><td>4</td><td>6</td></tr>
<tr><td>7 – 8</td><td>4</td><td>6</td><td>8</td></tr>
<tr><td>7 - 9</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>8 – 10</td><td>3</td><td>5</td><td>7</td></tr>
<tr><td>9 - 10</td><td></td><td></td><td></td></tr>
</table>
i) Construct a network
ii) Identify critical path and all critical activities
iii) What is the estimated time of the project ?
iv) What is the probability of completing the project in 30 days ?
v) What is the probability that the project will not be completed in 29 days ?
vi) What is the probability that the project will be completed in 3 days later than expected ?
vii) What is the probability that the project will be completed in 2 days earlier than expected ?
viii) What due date has 90% chance of being met ?</td><td>CO3</td><td>PO2</td><td>14</td></tr>
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