

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

May-June 2026		
B. Tech / All Branches Scheme/ III		
Regular Examination/ TY/ Semester VI		
Course Code: ILC6055		Course Name: Operation Research
Date of Exam: 25/05/2026	Duration: 02.5 Hours	Max. Marks: 60

Instructions:

1. All questions are compulsory.
2. Draw neat diagrams wherever applicable.
3. Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any two questions out of three: (05 marks each)	10		
a)	Why is a non-degenerate solution a prerequisite for the optimality test of a transportation solution?		CO2	U
b)	Explain the algorithm of the Hungarian method to solve the assignment problem		CO2	U
c)	Consider a firm that produces two products X_1 and X_2 with 3 fixed resources Z_1, Z_2 , and Z_3 . The profit contribution is Rs. 20 per unit of X_1 and Rs. 25 per unit of X_2 sold. Production of unit X_1 requires 10 units of Z_1 and 15 units of Z_2 , while that of X_2 requires 10 units of Z_2 and 30 units of Z_3 . The available amounts of Z_1, Z_2 , and Z_3 are 5000, 9000, and 12000, respectively. Find the profit-maximizing product mix using the graphical method.		CO1	AP
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	Explain the applications and significance of Game Theory.		CO3,5	U
b)	Solve the following Linear Programming problem by the simplex method Max. $Z = 40X_1 + 80X_2$ Subject to $2X_1 + 3X_2 \leq 48$ $X_1 \leq 15$ $X_2 \leq 10$ $X_1, X_2 \geq 0$		CO1	AP
c)	Compare the assignment problem with the transportation problem		CO2	U
Q.3	Solve any two questions out of three. (10 marks each)	20		
a)	A small project consists of the following activities. Construct a network diagram for the project and identify the critical path and project completion time. Also find i.) Project competition time. ii.) Critical Path.		CO5	AP

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	iii.) Floating time for each activity. <table><tr><td>Activity</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td></tr><tr><td>Preceding Activity</td><td>-</td><td>-</td><td>-</td><td>A</td><td>B</td><td>C</td><td>C</td><td>D</td><td>E, F</td><td>G</td></tr><tr><td>Time (Days)</td><td>5</td><td>7</td><td>3</td><td>4</td><td>3</td><td>2</td><td>4</td><td>1</td><td>3</td><td>4</td></tr></table>	Activity	A	B	C	D	E	F	G	H	I	J	Preceding Activity	-	-	-	A	B	C	C	D	E, F	G	Time (Days)	5	7	3	4	3	2	4	1	3	4										
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b)	In a factory, five jobs are to be assigned to five workers, one-to-one. Cost in (in Rs. Hundreds) for each employee and job combination is given. Find the optimal assignment of employees and jobs and the optimal cost. <table><tr><td rowspan="2">Workers</td><td colspan="5">Job</td></tr><tr><td>J1</td><td>J2</td><td>J3</td><td>J4</td><td>J5</td></tr><tr><td>W1</td><td>28</td><td>22</td><td>26</td><td>20</td><td>27</td></tr><tr><td>W2</td><td>17</td><td>16</td><td>18</td><td>20</td><td>22</td></tr><tr><td>W3</td><td>11</td><td>13</td><td>14</td><td>16</td><td>17</td></tr><tr><td>W4</td><td>13</td><td>12</td><td>11</td><td>8</td><td>10</td></tr><tr><td>W5</td><td>11</td><td>10</td><td>6</td><td>8</td><td>9</td></tr></table>	Workers	Job					J1	J2	J3	J4	J5	W1	28	22	26	20	27	W2	17	16	18	20	22	W3	11	13	14	16	17	W4	13	12	11	8	10	W5	11	10	6	8	9	CO3	AP
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c)	A company has 3 plants P1, P2, and P3 and three warehouses W1, W2, and W3. Profit per unit from each plant to each warehouse is given in Rs. As below Find the optimal solution and optimal profit. <table><tr><td rowspan="4">plant \ Warehouse</td><td>W1</td><td>W2</td><td>W3</td></tr><tr><td>P1</td><td>58</td><td>56</td><td>60</td></tr><tr><td>P2</td><td>50</td><td>54</td><td>46</td></tr><tr><td>P3</td><td>70</td><td>74</td><td>76</td></tr></table> <table><tr><td>Plant</td><td>Capacity</td><td>Warehouse</td><td>Capacity</td></tr><tr><td>P1</td><td>2000</td><td>W1</td><td>1500</td></tr><tr><td>P2</td><td>2000</td><td>W2</td><td>3000</td></tr><tr><td>P3</td><td>2000</td><td>W3</td><td>1500</td></tr></table>	plant \ Warehouse	W1	W2	W3	P1	58	56	60	P2	50	54	46	P3	70	74	76	Plant	Capacity	Warehouse	Capacity	P1	2000	W1	1500	P2	2000	W2	3000	P3	2000	W3	1500	CO3	AP									
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Q.4	Solve any two questions out of three. (10 marks each)	20																																										
a)	There are three factories, A, B, and C, and three markets, X, Y, and Z. The factories' supplies are 60, 80, and 85 units, respectively. Demand at the marketplace is 75, 110, and 40 units. The supply and demand of Units with a unit cost of Transportation (in rupees), and the schedule followed from	CO2	AP																																									

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	factories to markets are given below: (The numbers which are shown in the circle indicate the number of units transported from the factories to the market) <table><tr><th>Customers . Factories</th><th>A</th><th>B</th><th>C</th><th>Supply</th></tr><tr><td>X</td><td>(35) 6</td><td>(25) 3</td><td>5</td><td>60</td></tr><tr><td>Y</td><td>(40) 5</td><td>2</td><td>(40) 2</td><td>80</td></tr><tr><td>Z</td><td>12</td><td>(85) 7</td><td>8</td><td>85</td></tr><tr><td>Demand</td><td>75</td><td>110</td><td>40</td><td>225</td></tr></table> Test the given solution for optimality and find optimal transportation solution. Also Comment on the managerial significance of alternative/multiple optimal transportation solutions.	Customers . Factories	A	B	C	Supply	X	(35) 6	(25) 3	5	60	Y	(40) 5	2	(40) 2	80	Z	12	(85) 7	8	85	Demand	75	110	40	225		
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b)	A company has three plants, A, B, and C, with capacities of 7, 10, and 18 units, respectively. It has four warehouses, P, Q, R, and S, with demands of 5, 8, 7, and 15 units, respectively. Unit Transportation cost is given in Rs. (Use LCM) <table><tr><th>Plants WH</th><th>P</th><th>Q</th><th>R</th><th>S</th></tr><tr><td>A</td><td>38</td><td>60</td><td>100</td><td>24</td></tr><tr><td>B</td><td>140</td><td>60</td><td>80</td><td>120</td></tr><tr><td>C</td><td>80</td><td>20</td><td>120</td><td>40</td></tr></table>	Plants WH	P	Q	R	S	A	38	60	100	24	B	140	60	80	120	C	80	20	120	40	CO3	AP					
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A	38	60	100	24																								
B	140	60	80	120																								
C	80	20	120	40																								
c)	Explain in brief the following terms of the game theory problem with example i.) Players iii.) Play ii.) Strategies iv.) Payoff v.) Payoff matrix	CO3	U																									
