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Code No. : 16531 A

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**

*Accredited by NAAC with A++ Grade*

**B.E. (Mech. Engg.) VI-Semester Main & Backlog Examinations, June-2022**

**Operations Research**

Time: 3 hours

Max. Marks: 60

*Note: Answer all questions from Part-A and any FIVE from Part-B*

**Part-A (10 × 2 = 20 Marks)**

Q. No.	Stem of the question	M	L	CO	PO																								
1.	Distinguish between Slack and surplus variables.	2	1	1	4																								
2.	Is graphical method is applied for 4 variables for a given problem, explain.	2	2	1	4																								
3.	Define Infeasible solution.	2	1	2	4																								
4.	When post optimal analysis will be used?	2	1	2	4																								
5.	Write the differences between transportation and Assignment problems.	2	2	3	4																								
6.	What is a travelling salesman problem?	2	1	3	4																								
7.	What is Time value of money?	2	1	4	4																								
8.	Write the applications of Theory of games.	2	1	4	4																								
9.	Write the Assumptions in sequencing.	2	1	5	4																								
10.	Define Queuing.	2	1	5	4																								
<b>Part-B (5 × 8 = 40 Marks)</b>																													
11. a)	Solve Graphically $\text{Max } Z=3X_1+ 2X_2$ STC $X_1 + X_2 \leq 1$ $X_1 + X_2 \geq 3$ and $X_1, X_2 \geq 0$	6	3	1	4																								
b)	List applications of operations research.	2	2	1	4																								
12. a)	Use Dual simplex method to $\text{Maximize } P = 2X_1 + X_2$ subject to $X_1 + X_2 \leq 10$ $-X_1 + X_2 \geq 2$ and $X_1, X_2 \geq 0$	5	3	2	4																								
b)	Differentiate between Primal and dual relationships.	3	2	2	4																								
13. a)	A company has three plant locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs (in Rupees)	5	4	3	4																								
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>D</th> <th>E</th> <th>F</th> <th>G</th> <th>H</th> </tr> </thead> <tbody> <tr> <th>A</th> <td>5</td> <td>8</td> <td>6</td> <td>6</td> <td>3</td> </tr> <tr> <th>B</th> <td>4</td> <td>7</td> <td>7</td> <td>6</td> <td>5</td> </tr> <tr> <th>C</th> <td>8</td> <td>4</td> <td>6</td> <td>6</td> <td>4</td> </tr> </tbody> </table>							D	E	F	G	H	A	5	8	6	6	3	B	4	7	7	6	5	C	8	4	6	6	4
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Determine an optimum distribution for the company to minimize the total transportation cost.																													

b)	Solve the following Assignment problem using Hungarian method <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Worker</th> <th>Job I</th> <th>Job II</th> <th>Job III</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>4</td> <td>2</td> <td>7</td> </tr> <tr> <td>B</td> <td>8</td> <td>5</td> <td>3</td> </tr> <tr> <td>C</td> <td>4</td> <td>5</td> <td>6</td> </tr> </tbody> </table>	Worker	Job I	Job II	Job III	A	4	2	7	B	8	5	3	C	4	5	6	3 3 3 4				
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14. a)	A company buys a machine for Rs 6000/-. The maintenance cost are expected to be Rs 300/- in each year for the first 2 years and go up to annually as follows 700, 1000, 1500, 2000, and 2500. Assume the money is worth of 20% per year. When the machine should be replaced.	6 4 4 4																				
b)	Write the assumptions in replacement.	2 2 4 4																				
15. a)	Solve the following 'n' jobs '3' machines problem given the processing times is shown on each machine. Calculate the total elapsed time	6 3 5 4																				
	<table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Job</th> <th>M1</th> <th>M2</th> <th>M3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>13</td> <td>3</td> <td>8</td> </tr> <tr> <td>2</td> <td>18</td> <td>8</td> <td>4</td> </tr> <tr> <td>3</td> <td>8</td> <td>6</td> <td>13</td> </tr> <tr> <td>4</td> <td>23</td> <td>6</td> <td>8</td> </tr> </tbody> </table>	Job	M1	M2	M3	1	13	3	8	2	18	8	4	3	8	6	13	4	23	6	8	
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1	13	3	8																			
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b)	Briefly explain queuing system and its characteristics	2 2 5 4																				
16. a)	A company runs two recycling centers. Center 1 costs Rs40 to run for an eight-hour day. In a typical day 140 kg's of glass and 60 kg's of aluminum are deposited at Center 1. Center 2 costs Rs50 for an eight-hour day, with 100 Kg's of glass and 180 Kg's of aluminum deposited per day. The company has a commitment to deliver at least 1540 kg's of glass and 1440 kg's of aluminum per week to encourage the company to open up a plant in town. How many days per week should the company open each center to minimize its cost and still meet the recycler's needs?	4 2 1 4																				
b)	Find dual for the following LPP $\text{MAX } z = x_1 - 2x_2 + 4x_3 \quad \text{subject to}$ $x_1 + x_2 + x_3 \leq 8$ $2x_1 - x_2 - x_3 \leq 6$ $2x_1 - 2x_2 - 3x_3 \leq 7 \text{ and } x_1, x_2, x_3 \geq 0$	4 3 2 4																				
17.	Answer any <i>two</i> of the following:																					
a)	Explain how to resolve degeneracy in transportation method.	4 2 3 4																				
b)	Reduce following pay-off matrix using theory of Dominance	4 3 4 4																				
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a	2	-4	-9																			
b	-1	-2	-3																			
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c)	Write the applications of queuing theory.	4 2 5 4																				

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	31.25%
iii)	Blooms Taxonomy Level – 3 & 4	48.75%

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