VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: A1+TA1+TAA1

REG.NO.:

2GBMEO2

SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -I
WINTER SEMESTER 2025-2026

Programme Name & Branch	**: B.Tech Mechanical**
Course Code	**: BMEE215L**
Course Name	**: Engineering Optimization**
Faculty Name(s)	**: Dr.Ramanujam R/Dr.Rajyalakshmi G/ Dr. Soumen Pal/Dr. Sundramali G/ Dr.Tapano Kumar Hotta/Dr. Joel J**
Class Number(s)	**: VL202526050 1042/1032/1038/1036/3092/3091**
Date of Examination	**: 27/01/2025 AN EN**
Exam Duration	**: 90 minutes**

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes Statements:
  CO. 1: Formulate and solve linear programming problems.
  CO. 2: Understand and apply suitable approaches for solving transportation and assignment problems.
  CO. 3: Demonstrate the usage of network optimization algorithms for traditional applications.

<table>
<tr><th>Q. No</th><th>Question</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>a) A manufacturing company is engaged in producing three types of products: A, B, and C. The production department produces, say, components sufficient to make 50 units of A, 25 units of B, and 30 units of C. The management is concerned with the problem of optimum utilization of the products in the assembly department, where only 100 man-hours are available daily for assembling the products.
The following additional information is available:
<table>
<tr><th>Type of Product</th><th>Profit Contribution per Unit of Product (Rs)</th><th>Assembly Time per Product (hrs)</th><th>Daily Production Capacity (units)</th></tr>
<tr><td>A</td><td>12</td><td>0.8</td><td>50</td></tr>
<tr><td>B</td><td>20</td><td>1.7</td><td>25</td></tr>
<tr><td>C</td><td>45</td><td>2.5</td><td>30</td></tr>
</table>
The company has a daily order commitment for 20 units of products A and a total of 15 units of products B and C. Formulate this problem as a Linear Programming (LP) model for the objective function and constraints.</td><td>10</td><td>1</td><td>4</td></tr>
<tr><td></td><td>b) Solve using Graphical Method,
Maximize $Z = 15x_1 + 10x_2$
Subject to the constraints:
$4x_1 + 6x_2 \leq 360$
$3x_1 \leq 180$
$5x_2 \leq 200$
and $x_1, x_2 \geq 0$</td><td></td><td></td><td></td></tr>
</table>

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2.	Using Big M Method, Minimize $Z = 600x_1 + 500x_2$ Subject to the constraints: (i) $2x_1 + x_2 \geq 80$ (ii) $x_1 + 2x_2 \geq 60$ and $x_1, x_2 \geq 0$	10	1	3
3.	Table 1 Given the Initial Basic Feasible Solution in Table 1, Find the optimal solution.	10	2	3
4.	A marketing manager has five salesmen and five sales districts. Considering the capabilities of the salesmen and the nature of districts, the marketing manager estimates that the sales per month (in hundred rupees) for each salesman in each district given in Table 2: How should the jobs be allocated, one per salesman, to Maximise the sales?	10	2	3
5.	The weighted undirected graph with vertices {a, b, c, d, e, f, g} and edge weights as given in Table 3. Apply a) Prim's and b) Kruskal's Algorithm Find the Minimum Spanning Tree (MST) of the given graph. Clearly show each step of the algorithm, indicate the edges selected at every stage, and calculate the total cost of the MST.	10	3	3

	P	Q	R	S	Supply
A	6	3 (12)	5 (1)	4 (9)	22
B	5	9	2 (15)	7	15
C	5 (7)	7	8 (1)	6	8
Demand	7	12	17	9	

Table 1

Salesman	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Table 2

Weight	4	8	9	8	10	2	1	7	9	5	6	2
Edge	a - b	a - c	b - c	b - d	b - e	c - d	c - f	d - e	d - f	e - f	e - g	f - g

Table 3

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