SLOT: A2+TA2+TAA2

REG.NO.:

VIT

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

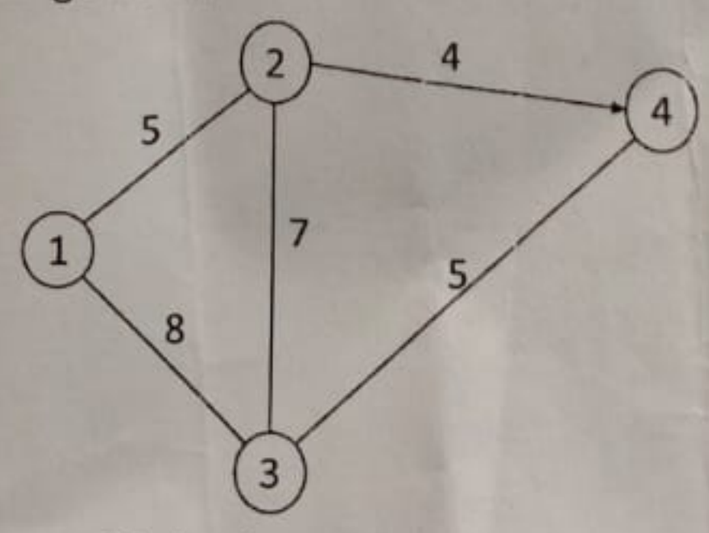
SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -II
WINTER SEMESTER 2025-2026

Programme Name & Branch	: B. Tech Mechanical
Course Code	: BMEE215L
Course Name	: Engineering Optimization
Faculty Name(s)	: Dr. JEEVA P A, Dr. SOUMEN PAL, Dr. SUNDARAMALI G, Dr. JOEL J, Dr. TAPANO KUMAR HOTTA, Dr. SENTHIL KUMAR A
Class Number(s)	: VL202526050 1040/1045/3094/3097/3098/ 6598
Date of Examination	: 15.03.2026 FN
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. 3: Demonstrate the usage of network optimization algorithms for traditional applications.
  - CO. 4: Apply goal programming and dynamic programming approach for solving problems of appropriate applications.
  - CO. 5: Apply classical optimization technique and suitable algorithms for non-linear programming problems.
- Graph sheet to be used in appropriate question
- Standard normal distribution table permitted.

Q. No	Question	M	CO	BL
1.	A logistics company aims to optimize delivery routes for its drivers to minimize fuel costs and delivery times. The company operates in a region with various delivery points connected by roads of differing lengths in km (see figure below). Find the shortest route between every two delivery points using Floyd's algorithm.  Arc (2, 4) is directional i.e. no traffic is allowed from 4 to 2. All the other arcs allow two-way traffic (i.e. they are bidirectional)	10	3	3
2.	In a 0/1 knapsack problem, there are 3 items of different weights/unit and different value/unit and these are given below:	10	4	3

Item (i)	Weight/Unit (w_i Kg/Unit)	Value/Unit (p_i Rs/Unit)
1	2	2
2	4	6
3	3	7

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	The maximum load (weight) is restricted to 10. How many units of each item be loaded to maximize the value?			
3.	Find the maximum of the function $f(X) = 4x_1 - x_1^2 + 8x_2 - x_2^2$ subject to $g(X) = x_1 + x_2 = 2$ where $x_1, x_2 \geq 0$, using the Lagrange multiplier method.	10	5	3
4.	An automobile parts company maintaining 8-hour work shift produces two products namely P1 and P2 using two machines. The table given below provides the processing times in minutes per unit for the two products.	10	4	3

Machine	Product P1	Product P2
1	10	8
2	12	6

Each of the machines are available for 8 hours i.e. 480 minutes in a day. The minimum daily production criteria for product P1 and product P2 are 90 and 80 respectively. The company owner has made four goals (G1, G2, G3 and G4) according to priority as follows:

G1 (1st priority): The daily production criteria for product P1 to be minimum 90

G2 (2nd priority): The daily production criteria for product P2 to be minimum 80

G3 (3rd priority): The total machining time on machine 1 should be within 480 minutes per day

G4 (4th priority): The total machining time on machine 2 should be within 480 minutes per day

Formulate the above scenario as a goal programming model and find solution by the graphical method.

5.	A semiconductor chip making company wishes to launch a new product in the upcoming season. List of activities (node to node) associated with this project and their expected duration (in days) is given in the following table:	10	3	3

Activity	Optimistic	Most likely	Pessimistic
1-2	3	6	9
1-3	7	9	10
1-4	6	9	10
2-3	2	3	4
2-5	7	8	10
3-6	4	6	8
4-7	8	9	10
5-8	6	7	8
6-7	8	9	10
6-9	7	8	9
7-9	5	7	9
8-9	4	7	8

a) Draw the network for the given activities.

b) Find earliest and latest expected occurrence time of each node.

c) Determine the critical path and expected length of the project.

d) What is the probability of completing the project 3 days earlier than the expected duration?

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