



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

SLOT: A2+TA2

REG.NO.:

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

2.

A rotating machine in a manufacturing plant may experience abnormal vibration due to one of the following mechanical faults:

F_1 : Bearing Fault, F_2 : Shaft Misalignment, F_3 : Gear Defect

From historical maintenance data, the prior probabilities of these faults occurring are given below:

Fault Type	Prior Probability
Bearing Fault $P(F_1)$	0.30
Shaft Misalignment $P(F_2)$	0.45
Gear Defect $P(F_3)$	0.25

A vibration monitoring system detects High Vibration (V) in the machine. The probability of detecting high vibration under each fault condition is:

Condition	Probability
$P(V F_1)$	0.80
$P(V F_2)$	0.60
$P(V F_3)$	0.50

During machine operation, the monitoring system reports High Vibration. Evaluate the following,

- Using Bayes Rule, calculate the posterior probabilities: $P(F_1 | V)$, $P(F_2 | V)$, and $P(F_3 | V)$.
- Identify the most likely cause of the vibration.
- Based on the calculated probabilities, which mechanical component should the maintenance engineer inspect first?

10

4

5

3.

Ramu installed a new burglar alarm at his home to detect burglary. The alarm reliably responds at detecting a burglary but also responds for fire. Ramu has two neighbors Raju and Rani, who have taken a responsibility to inform Ramu at work when they hear the alarm. Raju always calls Ramu when he hears the alarm, but sometimes he got confused with the phone ringing and calls at that time too. On the other hand, Rani likes to listen to high music, so sometimes she misses to hear the alarm. Here we would like to compute the probability of Burglary Alarm.

10

4

5



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

SLOT: A2+TA2

REG.NO.:

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

Programme Name & Branch : B.Tech (BME, BMA, and BMM)
Course Code : BMEE407L
Course Name : Artificial Intelligence
Faculty Name(s) : Dr. Gunji Bala Murali and Dr. DEEPAK KUMAR BISWAL
Class Number(s) : VL2025260502969 and VL2025260502973
Date of Examination : 15-3-2025
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: Construct the logical agents and familiar in the application of fuzzy in AI.

CO-4: Design the decision-making algorithm with the reasoning of uncertainties.

CO-5: Develop machine learning programs based on supervised, unsupervised and reinforcement learning.

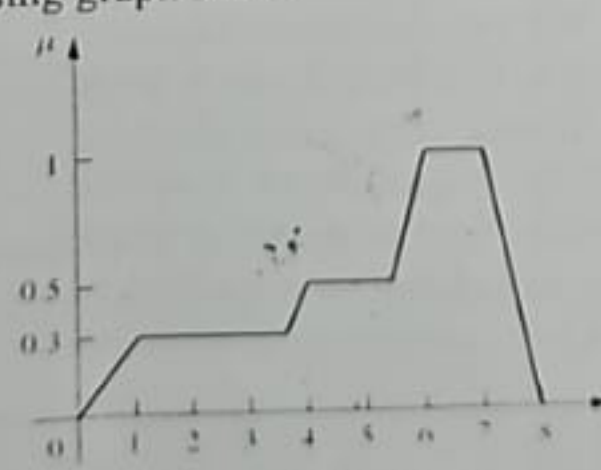
Q. No	Question	M	CO	BL
1	A smart restaurant uses a fuzzy logic controller to decide the food serving quantity based on customer hunger level and food temperature. The given details are the range of the inputs and output parameters. Input Variable 1: Hunger Level (0-10) Input Variable 2: Food Temperature (0- 80°C) and Output Variable: Serving Size (0- 10). On one day the Given Customer Hunger Level = 6 and Food Temperature = 45°C. Perform fuzzification for both inputs and output. Compute the final serving size using defuzzification step for the given fuzzy sets using graph sheet. 	10	3	3

Figure-1: Fuzzy sets



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

SLOT: A2+TA2

REG.NO.:

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

Find the probability that 'Raju is true (Raju has called 'Ramu') and 'Rani' is true (Rani has called 'Ramu') when the alarm 'A' rang, but no burglary 'B' and fire 'F' has occurred. Probability of Alarm 'A', Person Raju and Person Rani are as follows:

B	F	P(A=T)
T	T	0.95
T	F	0.94
F	T	0.29
F	F	0.001

A	P(P1=T)
T	0.95
F	0.05

A	P(P2=T)
T	0.80
F	0.01

✓ A. A restaurant AI system predicts whether a food item is Safe to Serve or Not Safe to Serve. The prediction results for 10 food samples are given in the next page.

Sample	Actual	Predicted
1	Safe	Safe
2	Safe	Safe
3	Safe	Not Safe
4	Not Safe	Safe
5	Safe	Safe
6	Not Safe	Not Safe
7	Safe	Safe
8	Not Safe	Not Safe
9	Safe	Not Safe
10	Not Safe	Safe

✓ S. A manufacturing company wants to group machines based on their temperature (°C) and vibration level (mm/s). The following dataset represents six machines:



VIT[®]

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

SLOT: A2+TA2

REG.NO.:

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

Machine	Temperature (°C)	Vibration (mm/s)				
M1	2	10				
M2	2	5				
M3	8	4				
M4	5	8				
M5	7	5				
M6	6	4				

Apply the K-Means clustering algorithm for number of clusters $K = 2$. Take initial centroids as: $C_1 = (2, 10)$ and, $C_2 = (8, 4)$. The distance between points is calculated using L_2 -norm in Euclidean Space.
