REG.NO.:

VIT®

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

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

SLOT: G2

Programme Name & Branch	**: BTech, ECE**
Course Code and Course Name	**: BECE309L, Artificial Intelligence and Machine Learning**
Faculty Name(s)	**: Dr. Suraj Prakash Sahoo, Dr. Pradheep T**
Class Number(s)	**: VL2025[redacted]05-20871**
Date of Examination	**: 23.03.2026**
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:
  4. Employ intelligent agents for decision making.
  5. Handle real-time issues using various learning methodologies.

<table>
<tr><th>Q. No</th><th>Question</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>Build a Bayesian Network for a smart irrigation monitoring system with the following statements:
1. If it rains (R), then soil moisture will be high (S).
2. If soil moisture is high (S), then crops are healthy (C).
3. If the irrigation system is ON (I), then soil moisture will be high (S).

<table>
<tr><th colspan="3">Conditional Probabilities</th><th colspan="2">Prior Probabilities</th></tr>
<tr><th colspan="3">1. Soil Moisture (S)</th><th colspan="2">2. Crop Health (C)</th><th></th></tr>
<tr><td>R</td><td>I</td><td>P(S = True)</td><td>S</td><td>P(C = True)</td><td>P(R = True) = 0.3
P(I = True) = 0.4</td></tr>
<tr><td>T</td><td>T</td><td>0.95</td><td>T</td><td>0.90</td><td></td></tr>
<tr><td>T</td><td>F</td><td>0.80</td><td>F</td><td>0.20</td><td></td></tr>
<tr><td>F</td><td>T</td><td>0.85</td><td></td><td></td><td></td></tr>
<tr><td>F</td><td>F</td><td>0.10</td><td></td><td></td><td></td></tr>
</table>
(a) Draw the Bayesian Network and derive its joint probability expression.
(b) Compute the probability that crops are healthy, there is no rain and irrigation is OFF, irrespective of the condition of soil moisture.</td><td>10</td><td>4</td><td>3</td></tr>
<tr><td>2.</td><td>A plant disease detection system is modelled using a Hidden Markov Model (HMM). The hidden states are 'Healthy', 'Infected' and corresponding transition matrix is $\begin{bmatrix}0.6 & 0.4\\0.3 & 0.7\end{bmatrix}$. The observation symbols are 'Low Chlorophyll', 'High Chlorophyll', 'Leaf Spots' and corresponding Observation Probability Matrix is $\begin{bmatrix}0.2 & 0.7 & 0.1\\0.6 & 0.2 & 0.2\end{bmatrix}$. Compute the probability of the observation [Leaf Spots, Low Chlorophyll] over two days.</td><td>10</td><td>4</td><td>3</td></tr>
<tr><td>3.</td><td>We have four data points in a dataset: [(2,4), (3, 5), (5,7), (6,8)].
• Find the linear regression line that fits these data.
• Calculate the error in the form of the sum of squared errors (SSE) for the linear regressor line.</td><td>10</td><td>5</td><td>3</td></tr>
</table>

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4. Fill in the missing values using (i) a global constant, (ii) a measure of central tendency, (iii) a measure of central tendency of a class. — 10 — 5

Leaf_Moisture (%)	Temperature (°C)	Soil_pH	Spot_Count	Class Label
45	28	6.5	0	0
50	30	?	5	1
?	29	6.8	3	1
40	?	7.2	0	0
55	32	5.9	?	2
60	33	5.8	7	2
48	27	?	1	0
?	31	6	6	2
52	?	6.7	4	1

5. Plot the 2D points given in the table on a Cartesian plane. Draw the new orthogonal axes corresponding to the principal components on the same plot using principal component analysis. Project the data onto the first principal component. — 10

X	1	2	3	4
Y	1	2	3	2

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