REG.NO.: 23BIT0224

VIT
Vellore Institute of Technology

SCHOOL OF COMPUTER SCIENCE ENGINEERING AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2025-2026

SLOT: G1+TG1

Programme Name & Branch	: B. Tech (IT)
Course Code and Course Name	: BITE405L - Soft Computing
Faculty Name(s)	: Dr. B. K. Tripathy, Dr. Chiranji Lal Chowdhary
Class Number(s)	: VL2025260503375, VL2025260502191
Date of Examination	: 02.02.2026
Exam Duration	: 90 minutes

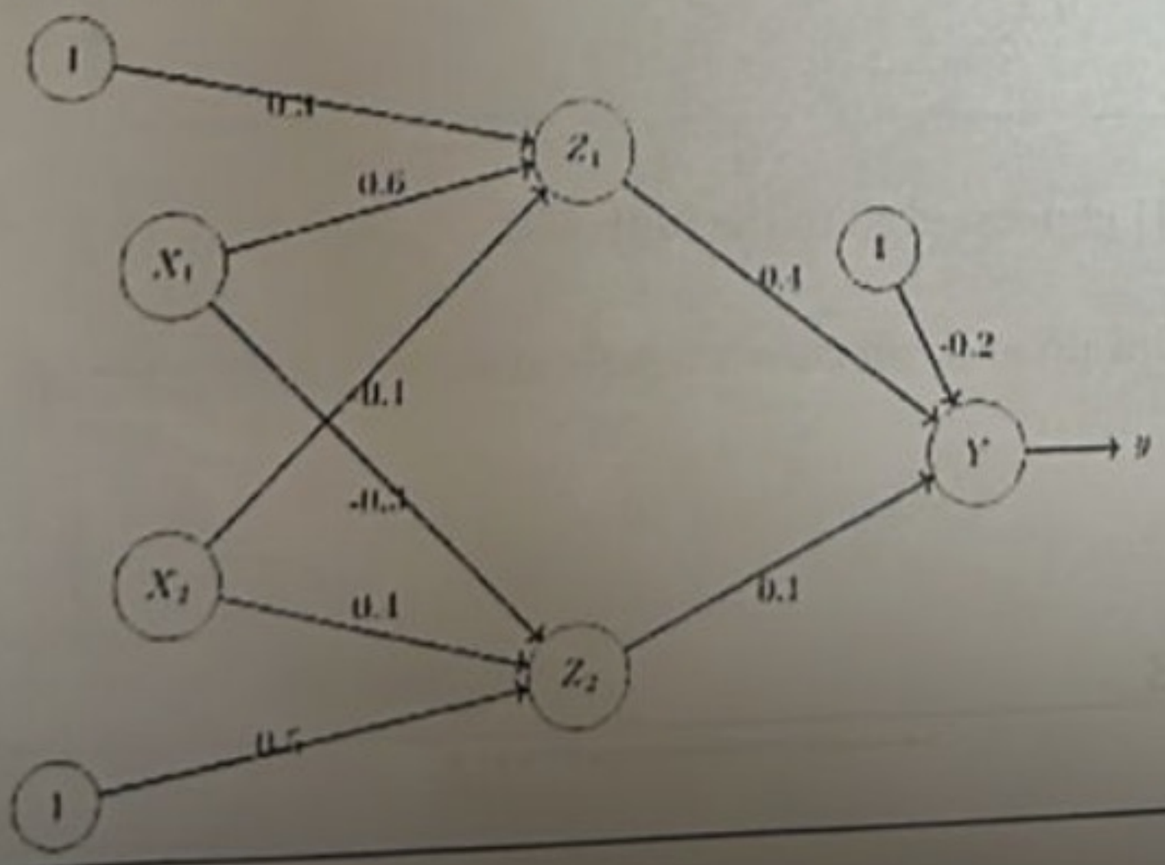
Maximum Marks: 50

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

  CO1- Analyze various real-time problems and decide an appropriate soft computing technique

  CO2-Apply Artificial Neural networks for the classification/prediction in many real-world 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>Summarize the role of Soft Computing techniques in enabling intelligent behaviour in modern applications, focusing on medical diagnosis and image processing.</td><td>10</td><td>1</td><td>2</td></tr>
<tr><td>2.</td><td>Implement a single-layer perceptron to realize the AND logic function using bipolar inputs and outputs. Assume that all initial weights and bias are zero, and the learning rate (η) is 1. Show the weight and bias updates during training until the perceptron correctly classifies all input patterns.
<table>
<tr><th>x1</th><th>x2</th><th>t</th></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>-1</td><td>-1</td></tr>
<tr><td>-1</td><td>1</td><td>-1</td></tr>
<tr><td>-1</td><td>-1</td><td>-1</td></tr>
</table></td><td>10</td><td>1</td><td>3</td></tr>
<tr><td>3.</td><td>Consider a three-layer feedforward neural network with two input neurons (X_1, X_2), two hidden neurons (Z_1, Z_2), and one output neuron (Y). The network uses a binary sigmoid activation function for both hidden and output layers. The initial weights and bias are given below in the network:

</td><td>10</td><td>1</td><td>3</td></tr>
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	The input pattern X = [X1, X2]=[0, 1] is applied to the network and the target output is T = 1. a) Perform the forward pass to compute the outputs of the hidden and output neurons. b) Determine the output error and propagate it backward to obtain the hidden layer error terms. c) Using these, compute the updated weights for the hidden–output and input–hidden layers. d) Show all intermediate steps clearly. **Given:** Learning rate (η) = 0.25			
4.	Construct an auto-associative memory network using the outer-product learning rule to store the following bipolar vectors: s(1)=[1 1 −1], s(2)=[−1 1 1], s(3)=[−1 −1 1] Computer the following tasks: a) Using the outer-product rule, determine the weight matrix of the network. b) Test the network by presenting the stored vector s(3) and report the output. c) Test the network with one missing component in the vector s(2). d) Test the network with two incorrect components in the vector s(1). Assume bipolar threshold activation and show all intermediate steps clearly. **Hint:** Outer-product learning rule: $$\mathbf{W} = \sum_{p=1}^{P} \mathbf{s}^{(p)} \left(\mathbf{s}^{(p)}\right)^{T}$$	10	2	3
5.	Consider an ART1 neural network with four F1 units and three F2 units. After some training, the bottom-up and top-down weight matrices are given below: Bottom-up weights (F1 → F2): $\begin{bmatrix} 0.57 & 0 & 0.2 \\ 0 & 0 & 0.2 \\ 0 & 0.37 & 0.2 \\ 0 & 0.37 & 0.2 \end{bmatrix}$ Top-down weights (F2 → F1): $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$ A new input vector x=[0,0,1,1] is presented to the network. Determine the updated bottom-up and top-down weight matrices after learning for the following cases: (a) Vigilance parameter ρ=0.4 (b)Vigilance parameter ρ=0.8	10	2	4

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