

PP2



TECHNICAL UNIVERSITY OF MOMBASA

**FACULTY OF ENGINEERING AND TECHNOLOGY
ELECTRICAL AND ELECTRONICS ENGINEERING**

UNIVERSITY EXAMINATION FOR:

DEGREE

EEE 4422: FUZZY LOGIC AND NEURONETWORK

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: NOVEMBER 2025

TIME: 2 HOURS

DATE:

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt Question 1, Compulsory and any other Two Questions.

Do not write on the question paper.

Question one

- a) Define Artificial Neural Network and list its advantages. [4 MARKS]
- b) Compare and contrast biological neuron vs artificial neural network. [2 MARKS]
- c) Draw and describe the model of artificial neural network [4 MARKS]
- d) State 4 potential applications of neural network? [2MARKS]
- e) Using a neat sketch discuss the major components of fuzzy controller [8MARKS]
- f) Find crisp value corresponding to the following fuzzy output sets using various defuzzification smethods (Center of Gravity method, Center of Largest Area method, Weighted Area Method.) the Figure Question 1f [10 MARKS]

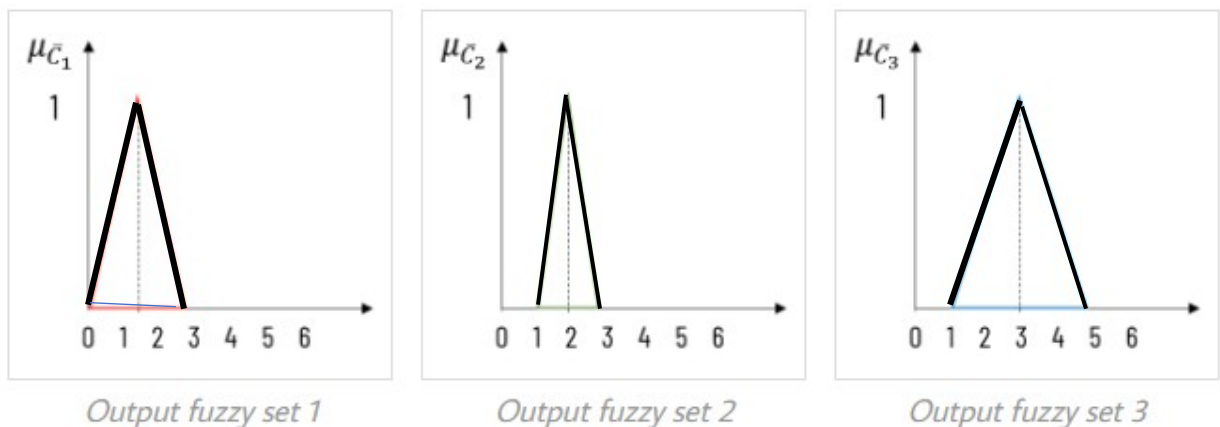


Figure QUESTION 1F

Question two

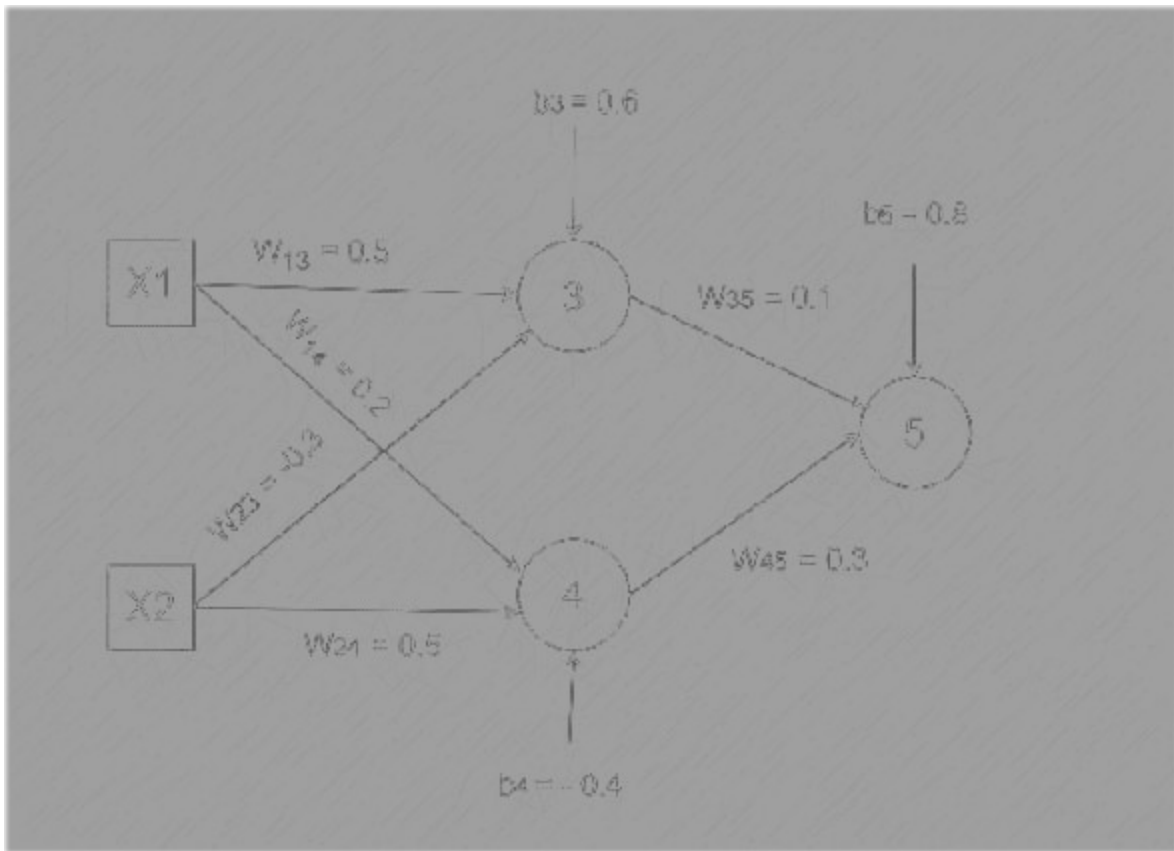
- a) Draw and explain the architecture of adaptive linear neuron (Adaline) and outline steps for training algorithm [5 MARKS]
- b) Consider a multilayer feed-forward neural network given below. Let the learning rate be 0.5. Assume initial values of weights and biases as given in

the table below. Train the network for the training tuples (1, 1, 0) and (0, 1, 1), where last number is target output. Show weight and bias updates by using back-propagation algorithm. Assume that sigmoid activation function is used in the network. **[10 MARKS]**

Weight and Bias values
Neural Network

W13	W14	W23	W24	W35	W45	B3	B4	B5
0.5	0.2	-0.3	0.5	0.1	0.3	0.6	-0.4	0.8

Weight and Bias values
Neural Network



- What is fuzzification? **[1 MARK]**
- Describe various activation functions that are employed in artificial neuron model and compare their merits and demerits **[4 marks]**

Question three

- a) Explain the purpose of defuzzification? **[2 marks]**
- b) Draw an architecture of single layer feed forward neural network defining the input and output pattern with its connection matrix **[6marks]**
- c) Define activation function as used in artificial neuro network (ANN) **[2 marks]**
- d) What is Multilayer Perceptron? and how it is different from a single-layer perceptron? **[6 marks]**
- e) What are Feedforward Neural Networks? **[2 marks]**
- f) What is backpropagation in a neural network? **[2 marks]**

Question four

- a) Define activation function as used in ANN **[1 MARK]**
- b) Discuss the various features of membership function **[3 marks]**
- c) Compare the similarities and differences between single layer and multi-layer perceptron and also discuss in what aspects multi-layer perceptron are advantageous over single layer perceptron **[6 marks]**
- d) Explain perceptron network training with and without bias by taking suitable examples **[4 marks]**
- e) Explain artificial neural network architecture? With its application **[6 marks]**

Question five

- a) What are crisp relations? How are they different from fuzzy relations?
Explain various properties of crisp relation and fuzzy relation. **[4 marks]**
- b) Briefly explain advantages of using neural networks over other machine algorithms **[4MARKS]**
- c) Describe how fuzzy sets can be applied in decision-making problems.
Provide a step-by-step example where fuzzy logic is used to make a decision based on uncertain or ambiguous information. **[2 marks]**
- d) Discuss the limitations of fuzzy logic and fuzzy sets. In what scenarios might fuzzy logic not be suitable or effective? **[2 marks]**
- e) Define what a fuzzy set is and contrast it with a crisp set. Provide an example to illustrate the difference. **[2 marks]**
- f) Discuss the operations (union, intersection, complement) on fuzzy sets.
Provide examples to illustrate each operation using simple fuzzy sets defined on a small universe of discourse. **[2 marks]**
- g) Explain the concept of fuzzy logic. How does it extend classical binary logic? Provide an example where fuzzy logic would be more appropriate than classical logic. **[2 marks]**
- h) Discuss the limitations of fuzzy logic and fuzzy sets. In what scenarios might fuzzy logic not be suitable or effective? **[2 marks]**