

International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunication Engineering (ETE)

Final Examination

Program: **B.sc (Eng.)**
 Course Code: **ETE-4857**
 Total Marks: **50**

Semester: **Autumn 2022**
 Course Title: **Neural Network and Fuzzy Logic**
 Time: **2 Hours 30 Minutes**

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.								
(ii) Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.								
Course Learning Outcomes (CLOs) of the Questions								
CLO1	Understand the principles and fundamentals of neural networks and fuzzy logic.							
CLO2	Apply neural networks and fuzzy logic techniques to solve real-world problems.							
CLO3	Evaluate, analyze, and optimize neural network and fuzzy logic models.							
Bloom's Levels of the Questions								
Letter Symbols	R	U	Ap	An	E	C		
Meaning	Remember	Understand	Apply	Analyse	Evaluate	Create		
PART A								
Q1.	a)	Define the radial basis function with some examples.				CLO1	R	2
	b)	"In Radial Basis Function, we transform a complex pattern classification task to a high dimensional space in a nonlinear manner and then separate the classes in the output layer using covers theorem," analyze covers theorem in light of the statement.				CLO2	Ap/An	6
	c)	Compare between multilayer perceptron (MLP) and radial basis function (RBF)				CLO1	U	2
Q2.	(a)	The task is to recognize English alphabetical characters (F, E, X, Y, I, T) in an image processing system. Define two fuzzy sets \tilde{I} and \tilde{F} to represent the identification of characters I and F. $\tilde{I} = \{(F, 0.4), (E, 0.3), (X, 0.1), (Y, 0.1), (I, 0.9), (T, 0.8)\}$ $\tilde{F} = \{(F, 0.99), (E, 0.8), (X, 0.1), (Y, 0.2), (I, 0.5), (T, 0.5)\}$ Evaluate the following, i. $\tilde{I} \cup \tilde{F}$ ii. $\tilde{I} - \tilde{F}$ iii. $\tilde{F} \cup \tilde{F}^C$ iv. $(\tilde{I} \cup \tilde{F})^C = \tilde{I}^C \cap \tilde{F}^C$				CO1+CO2	E	5

	b)	Given Relation Matrices of the relation R and S, the max-min composition is defined as for $T=R \circ S$, $T(x,z)=\max(\min(R(x,y), S(y,z)))$ and $y \in Y$. Let R: $\{(x,y) y=x+2\}$, $S\{(x,y) x \leq y\}$. Show the relation matrix. Here, $R=S= \{1,3,5\}$	CLO2	Ap/An	5
OR					
Q2.	a)	Define fuzzy sets.	CLO1	R	1
	b)	Consider the following fuzzy. \tilde{A} and \tilde{B} defined in the interval $x= [0,5]$ of real numbers by the membership grade functions $\mu_{\tilde{A}}(x)=x/(x+1)$, $\mu_{\tilde{B}}(x)=2^{-x}$. Determine the mathematical formulae and graphs of the membership grade functions of these sets. I. A^c and B^c II. $(A \cup B)$ III. $A \cap B$	CLO3	AP/C	6
	c)	Describe the radial basis function network with a graphical representation.	CLO2	U/An	3
PART B					
Q3.	a)	What is a fuzzy inference system? What are the characteristics?	CLO1	U/R	2
	b)	Construct a fuzzy inference system with a functional block.	CLO3	Ap/C	3
	c)	Explain the method of the Mamdani fuzzy inference system with an example	CLO3	An/C	5
Q4.	a)	What is a genetic algorithm? Explain the necessity of the genetic algorithm.	CLO1	U/R	2
	b)	Generate three chromosomes, each containing 12 bits. I. Apply single-point and two-point crossover. II. Apply mutation generating random number r of [0,1] where $r < p$	CLO3	Ap/An	6
	c)	What is evolutionary computation? Write pseudo code for a simple evolutionary process.	CLO2	An/An	2
Q5.	a)	What is optimization? Define alleles.	CLO1	U/R	2
	b)	Evolutionary Algorithms to maximize the function $f(x) = x^2$ with x in the integer interval [0, 31], i.e., $x=1... \dots 30,31$, Assume that the population size is 4. Evaluate which string has a maximum chance for selection.	CLO3	Ap/E	5
	c)	Show the general scheme of an evolutionary process.	CLO2	Un/An	3
OR					

Q5.	a)	What is pattern classification?	CLO1	R	2
	b)	How can you use a neural network as a communication engineer? Explain	CLO2	U	4
	c)	"Fuzzy systems, based on fuzzy logic, have various applications across domains." Describe it based on your perspective.	CLO3	E	4