

International Islamic University Chittagong
Department of Electronic and Telecommunication Engineering
Final Examination, Autumn 2021
Course Code: ETE-4837
Course Title: Neural Networks and Fuzzy Logic

Full Marks: 50 **Time: 2h 30min**
[Answer any two from Part-A and any three from Part-B of the following questions]

Part-A

- 1.(a) The task is to recognize English alphabetical characters (F, E, X, Y, I, T) in an image processing system. 7 CO1+CO2

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. $(\tilde{I} \cup \tilde{F})^c = \tilde{I}^c \cap \tilde{F}^c$

- (b) Simplify $(\sim(P \wedge Q) \Rightarrow R) \wedge P \wedge Q$ 3 CO1+CO2
- 2.a) Explain fuzzy union, intersection and complement with examples. 4 CO1+CO2
- b) Show that $(P \Rightarrow Q) = (\sim P \vee Q)$. 3 CO1+CO2
- c) Justify “ $((P \Rightarrow Q) \wedge (Q \Rightarrow P)) = (P = Q)$ a tautology”? 3
- 3.a) State and prove De Morgan’s law with examples for fuzzy logic systems. 3 CO1+CO2
- b) Show with examples: 7 CO1+CO2
- i) Equality of fuzzy sets
 - ii) Product of a fuzzy set with crisp number
 - iii) Power of a fuzzy set

Part-B

- 4.a) Show the general scheme of evolutionary process. Also the taxonomy of search optimization techniques. 5 CO1+CO2
- b) Let $\tilde{A} = \{(x_1, 0.2), (x_2, 0.8), (x_3, 0.4)\}$ and $\tilde{B} = \{(x_1, 0.4), (x_2, 0), (x_3, 0.1)\}$. 5 CO1+CO2

Find $\mu_{\tilde{A} \cap \tilde{B}}(x)$ and $\mu_{\tilde{A} \cup \tilde{B}}(x)$.

5 CO1+CO2

5.a) For two fuzzy sets

$$\tilde{A} = \{(x_1, 0.4), (x_2, 0.8), (x_3, 0.6)\}$$

$$\tilde{B} = \{(x_1, 0.2), (x_2, 0.6), (x_3, 0.9)\}$$

Evaluate $\tilde{A} \oplus \tilde{B}$

5 CO1+CO2

b) Explain

- i) Modus ponens
- ii) Modus tollens
- iii) Chain rule

6 CO1+CO2

6.a) Construct the flowchart for genetic programming.

4 CO1+CO2

b) Given

(i) $C \vee D$

(ii) $\sim H \Rightarrow (A \wedge \sim B)$

(iii) $(C \vee D) \Rightarrow \sim H$

(iv) $(A \wedge \sim B) \Rightarrow (R \vee S)$

Argue whether $(R \vee S)$ be inferred from the above?

5 CO1+CO2

7.a) What is an expert system? Describe expert system components and human interfaces with figure.

5 CO1+CO2

b) Explain the characteristics of expert systems.