Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – October 2025

Date: 07-10-2025 **Time:** 02.00pm to 03.30pm

School: SOE	**Program:** B.Tech	
Course Code : ECE3030	**Course Name:** Fuzzy Logic and It's Engineering Applications	
Semester: V	**Max Marks**:50	**Weightage**: 25%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**22**	**14**	**14**		

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	State two laws of Boolean logic which are True in Classical but **NOT TRUE** in fuzzy Logic	**2 Marks**	**L2**	**CO1**
2	Draw any two membership functions	**2 Marks**	**L2**	**CO2**
3	What do you mean by fuzzification and defuzzification.	**2 Marks**	**L2**	**CO2**
4	Given a fuzzy relation R(A, B), compute it's Range, Domain and Height $R(A,B)=\begin{bmatrix}0.7 & 0.2 & 0 & 3\\ 0.1 & 0.4 & 0.6\end{bmatrix}$	**2 Marks**	**L2**	**CO3**
5	Write the Zadeh's implication relation for the statement IF x is A, THEN y is B	**2 Marks**	**L2**	**CO3**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	You are asked to select an implementation technology for a numerical processor. Assume that all implementations will be in the same family (e.g., CMOS). Define the universe of potential clock frequencies as X = {1, 10, 20, 40, 80, 100} MHz, and define MSI, FPGA and MCM as fuzzy sets of clock frequencies that should be implemented in each of these technologies, where the following fuzzy sets define their membership values $MSI = M = \left\{\frac{1}{1} + \frac{.7}{10} + \frac{.4}{20} + \frac{0}{40} + \frac{0}{80} + \frac{0}{100}\right\}$ $FPGA = F = \left\{\frac{.3}{1} + \frac{1}{10} + \frac{1}{20} + \frac{.5}{40} + \frac{.2}{80} + \frac{0}{100}\right\}$ $MCM = C = \left\{\frac{0}{1} + \frac{0}{10} + \frac{.5}{20} + \frac{.7}{40} + \frac{1}{80} + \frac{1}{100}\right\}$ Compute the appropriate fuzzy sets for each of the following: (a) Fuzzyset of technologies for which one expects that either MSI or FPGA will be safe (b) Fuzzyset of technologies for which one expects that either MSI and FPGA are safe (c) Fuzzy set of technologies for which MCM is safe and (but) FPGA is not safe (d) Fuzzy set of technologies for which both MSI and MCM are not safe	**10 Marks**	**L2**	**CO 1**
		Or			
7.	**a.**	Fuzzy sets A and B are defined over the Universe of discourse $X = (1,2,3,4,5)$; Membership functions are given by $\mu_A(x) = \exp\left[\frac{-(x-a)^2}{2\sigma^2}\right]$ $\mu_B(x) = \exp\left[\frac{-(x-b)^2}{2\sigma^2}\right]$; $\sigma = 2$; $a = 4$; $b = 8$; Find $\overline{A} \cup \overline{B}$; λ *cut sets* $A_{0.5}, B_{0^{*};¿}$ *Show that the above fuzzy sets obey DeMorgan's laws*	**10 Marks**	**L2**	**CO 1**

<table>
<tr><td>8.</td><td>a.</td><td>Two fuzzy sets A and B, both defined on X, are as follows:
<table><tr><td>$\mu(x_i)$</td><td>x_1</td><td>x_2</td><td>x_3</td><td>x_4</td><td>x_5</td></tr><tr><td>A</td><td>0.1</td><td>0.7</td><td>0.8</td><td>1</td><td>0.7</td></tr><tr><td>B</td><td>1</td><td>0.9</td><td>0.5</td><td>0.2</td><td>0.1</td></tr></table>Express the following λ-cut sets using Zadeh's notation:
$(i)(A \cup B)_{0.8}$ (ii) $(A \cap B)_{0.6}$ (iii) $\overline{(A \cap B)}_{0.8}$ (iv)$\overline{(A \cup B)}_{0.6}$</td><td>10 Marks</td><td>L2</td><td>CO 1</td></tr>
<tr><td colspan="6">Or</td></tr>
<tr><td>9.</td><td>a.</td><td>Apply fuzzy logic principles to prove DeMorgan's theorems for both union and intersection.</td><td>10 Marks</td><td>L2</td><td>CO 1</td></tr>
<tr><td>10.</td><td>a.</td><td>The following raw data were determined in a pairwise comparison of new premium mobile phone preferences in poll of 100 people. When it was compared with Samsung (S), 79 of polled preferred Nokia(N), 85 preferred Apple (A), 59 preferred OnePlus(P) and 67 preferred LG(L). When a Nokia was compared, the preferences were 21-S, 23-A,37-P and 45-L. When Apple was compared, the preferences were 15-N, 77-S,35-P and 48-L. When a OnePlus was compared, the preferences were 41-S, 63-N,65-A and 51-L. Finally, When LG was compared, the preferences were 33-S, 55-N,52-P and 49-A. Using Rank ordering, plot the Membership function for the most preferred Mobile phone.</td><td>10 Marks</td><td>L3</td><td>CO 2</td></tr>
<tr><td colspan="6">Or</td></tr>
<tr><td>11.</td><td>a.</td><td>Music is not a precise science.Tactile movements by musicians on various instruments come from years of practice, and such movements are very subjective and imprecise. When a guitar player changes from A chord to C chord, the fingers have to move some distance measured in terms of frets (e.g. 1fret = 0.1). The finger positions on the guitar strings for the two chords are given in terms of the following membership functions:
$C\,chord = \left\{\frac{0}{6} + \frac{0.3}{5} + \frac{0.2}{4} + \frac{0}{3} + \frac{0.1}{2} + \frac{0}{1}\right\}$
$A\,chord = \left\{\frac{0}{6} + \frac{0}{5} + \frac{0.2}{4} + \frac{0.2}{3} + \frac{0.2}{2} + \frac{0}{1}\right\}$</td><td>10 Marks</td><td>L3</td><td>CO 2</td></tr>
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		Suppose the placement of fingers on the six strings for a G chord is given as $G\,chord = \left\{ \frac{0.3}{6} + \frac{0.2}{5} + \frac{0}{4} + \frac{0}{3} + \frac{0}{2} + \frac{0.3}{1} \right\}$ (a) Find the relation that expresses moving from an A chord to a G chord; call this R (b) Use max-product composition to determine $C \circ R$			

12.	**a.**	Suppose we are evaluating a new invention to determine its commercial potential. Two metrics 'uniqueness' and 'market size' are used to make the decisions regarding the innovation of the idea. For uniqueness, X={1, 2, 3, 4,5, 6}, and for market size Y={1, 2, 3, 4, 5, 6}. Given the fuzzy sets, $A = medium\,uniqueness = \left\{ \frac{0}{1} + \frac{0.6}{2} + \frac{1}{3} + \frac{0.2}{4} + \frac{0.3}{5} + \frac{0.2}{6} \right\}$ $B = medium\,market ¿ \left\{ \frac{0}{1} + \frac{0.4}{2} + \frac{1}{3} + \frac{0.8}{4} + \frac{0.3}{5} + \frac{0}{6} \right\}$ $C = diffuse\,market ¿ \left\{ \frac{0.3}{1} + \frac{0.5}{2} + \frac{0.6}{3} + \frac{0.6}{4} + \frac{0.5}{5} + \frac{0.3}{6} \right\}$ D Dtermine the implication relation using Zadeh's implication i) IF x is A THEN y is B; ii) IF x is A THEN y is B ELSE y is C. iii) IF x is A and B THEN y is C	**10 Marks**	**L3**	**CO 3**
		Or			
13.	**a.**	For controlling the motor two fuzzy sets A and B are defined as $A = motor\,speed\,OK = \left\{ \frac{.5}{20} + \frac{.4}{30} + \frac{.3}{40} + \frac{1}{50} + \frac{.5}{60} \right\}$; $B = \text{motor voltage nominal} = \left\{ \frac{.1}{1} + \frac{.3}{2} + \frac{.8}{3} + \frac{.1}{4} + \frac{.7}{5} \right\}$ Using Zadeh's implication, find the fuzzy relation for the rule, If "motor speed is OK", THEN "motor voltage is nominal". If the new antecedent is given as $A' = \text{motor speed little slow} = \left\{ \frac{.4}{20} + \frac{.7}{30} + \frac{1}{40} + \frac{.6}{50} + \frac{.3}{60} \right\}$. Us Using Max-min composition, find the new consequent using appropriate fuzzy inference mechanism.	**10 Marks**	**L3**	**CO 3**