Sanjay Ghodawat University, Kolhapur
Established as State Private University under Govt. of Maharashtra.
Act No XL, 2017

2018-19
EXM/P/09/00

Year and Program: 2018-19, M.Sc. II | **School of Science** | **Department of Mathematics**

Course Code – MTS612 | **Course Title – Fuzzy Logic** | **Semester – IV**

Day and Date – Thursday 30/5/2019 | **End Semester Examination** | **Time:** 30 min (2.30 to 3.00 p

Max Marks: 100

PRN number – | **Seat no-** | **Answer Booklet No.-**

A

Students' Signature - | **Invigilator's Signature –**

Instructions:

1) All questions are compulsory.
2) **Attempt Q.1 within first 30 minutes.**
3) Each MCQ type question is followed by four plausible alternatives, Tick (√) the correct one.
4) Answer to question 1 should be written in the question paper and submit to the Jr.Supervisor.
5) If you tick more than one option it will not be evaluated
6) Figures to the right indicate full marks
7) Use **Blue ball pen** only.

Q.1	**Tick Mark correct alternative**	Marks	Bloom's Level	Cos
a)	A relation $R(X,X)$ which is reflexive, symmetric & transitive is called I) Tolerance relation. II) Equivalence relation. III) Max-min relation. IV) Compatibility relation.	01	L1	CO1
b)	A fuzzy relation $R(X,X)$ is said to be reflexive if and only if I) $R(x,x)=1, \forall x \in X$ II) $R(x,x)=1, \textit{for some } x \in X$ III) $R(x,x) \neq 1, \forall x \in X$ IV) $R(x,x) \neq 1, \textit{for some } x \in X$	01	L1	CO1
c)	A function is called automorphism if it is I) isomorphism but not endomorphism. II) endomorphism but not isomorphism. III) both isomorphism and endomorphism. IV) neither isomorphism nor endomorphism.	01	L2	CO2
d)	A fuzzy relation $R(X,X)$ is i-transitive if and only if ___ $\forall x,y,z \in X$. I) $R(x,z) \geq i[R(x,y),R(y,z)]$ II) $R(x,z) \leq i[R(x,y),R(y,z)]$	01	L3	CO2

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II) $R(x,z) \geq u[R(x,y), R(y,z)]$ IV) $R(x,z) \leq u[R(x,y), R(y,z)]$

e) The necessary condition for the existence of the solution of $P \circ Q = R$ is ____, where Q & R are given. 01 L2 CO3

I) $S(Q,R) = \phi$ II) $S(Q,R) \neq \phi$ III) $S(P,R) = \phi$ IV) $S(P,R) \neq \phi$

f) In solving fuzzy equation $p \circ Q = r$, (where Q & r are given), $\hat{p}_j$ is given by, 01 L2 CO3

I) $\hat{p}_j = \max\limits_{j \in J} \sigma\left(q_{jk}, r_k\right)$ II) $\hat{p}_j = \min\limits_{k \in K} \sigma\left(q_{jk}, r_k\right)$

III) $\hat{p}_j = \max\limits_{k \in K} \sigma\left(q_{jk}, r_k\right)$ IV) $\hat{p}_j = \min\limits_{j \in J} \sigma\left(q_{jk}, r_k\right)$

g) In classical inference, Modus tollens is ___ 01 L3 CO4

I) $(\overline{q} \wedge (p \Rightarrow q)) \Rightarrow \overline{q}$ II) $\overline{p} \Rightarrow (p \Rightarrow q)$

III) $(p \wedge (p \Rightarrow q)) \Rightarrow q$ IV) $(p \Rightarrow q) \wedge (q \Rightarrow r) \Rightarrow (p \Rightarrow r)$

h) Let a modifier h is an increasing bijection function. Then h is called the strong modifier if ____, $\forall a \in [0,1]$ 01 L2 CO4

I) $h(a) > a$ II) $h(a) < a$ III) $h(a) = a$ IV) $h_\alpha(a) > a^\alpha, \alpha \in \mathbb{R}^+$

i) Which one of the following is absorption law? 01 L3 CO4

I) $p \vee (p \wedge q) \Leftrightarrow p$ II) $(\overline{p} \vee \overline{q}) = \overline{p \wedge q}$

III) $[(p \Rightarrow q) \wedge p] \Rightarrow q$ IV) $(p \Rightarrow q) \wedge (q \Rightarrow r) \Rightarrow (p \Rightarrow r)$

j) Which one of the following is identity law? 01 L4 CO4

I) $p \vee \overline{p} \Leftrightarrow f$ II) $p \wedge (p \vee q) \Leftrightarrow p$

III) $p \wedge p \Leftrightarrow p$ IV) $(p \wedge t) = p$

k) Let Predicate $p(x)$ over $X = \mathbb{R}$ be $x^2 = 25$ and 01 L4 CO4

I) $(\forall x) x^2 = 25$ II) $(\exists x) x^2 = 25$

I) Only I is true & II is False III) Only II is true & I is false

II) Both I and II are true IV) Both I and II are false

l) Predicate is 01 L1 CO4

I) declarative sentence containing constants

II) non-declarative sentence containing constants

III) declarative sentence containing variables

IV) non-declarative sentence containing variables

m) The hedge very interpreted as $h(a) =$ 01 L3 CO4

I) a^2 II) $\sqrt{a}$ III) $a^\alpha; \alpha \in \mathbb{Z}^+$ IV) $a^{2/3}$

n)	Proposition "p: If χ is A then γ is B" is of the type__ proposition. I) unconditional and unqualified II) unconditional and qualified III) conditional and unqualified IV) conditional and qualified	01	L2	CO4
o)	The ____ contains general knowledge pertaining to the problem domain I) meta-knowledge base II) knowledge base III) forward chaining IV) backward chaining	01	L1	CO5
p)	Inference Engine is used to make I) fuzzy inferences II) knowledge module III) proposition IV) kernel	01	L2	CO5
q)	The data-driven method is used in I) modus tollens II) knowledge base III) forward chaining IV) backward chaining	01	L4	CO5
r)	In R-implications, R denotes I)t-norms II) t-conorms III) complement IV) negation	01	L1	CO5
s)	The ___ facilitates communication between the user and the expert system. I) knowledge module II) explanatory interface III) data base IV) inference rule	01	L4	CO5
t)	___ is a computer based system that emulates reasoning process of human expert within a specific domain of knowledge. I) An inference rule II) A data base III) An explanatory interface IV) An expert system	01	L1	CO5

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Year and Program:2018-19, M.Sc. II	**School of Science**	**Department of Mathematics**
Course Code:	Course Title: **Fuzzy Logic.**	**Semester – IV**
Day and Date: Thursday 30/5/2019	**End Semester Examination** (ESE)	**Time:** 2.5 Hrs. 3.00 to 5.30 pm
		Max Marks: 100

Instructions:

1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Non-programmable calculator is allowed

B

Q.2	Solve any two	Marks	Bloom's Level	CO
a)	Determine transitive closure of a fuzzy relation $R(X,X)$ given by $R=\begin{bmatrix} 0.8 & 0.6 & 0.0 & 0.0 \\ 1.0 & 0.0 & 1.0 & 1.0 \\ 0.2 & 0.4 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9 & 0.8 \end{bmatrix}$	06	L5	CO1
b)	Define the following terms: i)Domain of binary fuzzy relation, ii) Range of binary fuzzy relation, iii) Height of binary fuzzy relation, iv) Inverse of binary fuzzy relation, v) Max-min composition & vi) Max-average composition.	06	L1	CO1
c)	Prove that max-min composition and min-join are associative operations on binary fuzzy relations	06	L3	CO1

Q.3	Solve any one			
a)	Show that $R=\begin{bmatrix} 1.0 & 0.8 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.8 & 1.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 1.0 & 0.8 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 1.0 & 0.8 & 0.7 & 0.5 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.8 & 0.8 & 1.0 & 0.7 & 0.5 & 0.7 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.7 & 0.7 & 1.0 & 0.4 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.5 & 0.5 & 0.4 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.7 & 0.0 & 0.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0 \end{bmatrix}$ is a compatibility relation and hence find all complete α-covers for R. For which values of α, α-cover becomes partition?	14	L5	CO2

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			Marks	Level	CO
	b)	For any $a, b, d \in [0,1]$, show that w_i satisfies following properties. I) $i(a,b) \le d$ *iff* $w_i(a,d) \ge b$ II) $w_i[w_i(a,b),d] \ge a$ III) $w_i[i(a,b),d] = w_i[a, w_i(b,d)]$ IV) $a \le b, \Rightarrow w_i(a,d) \ge w_i(b,d), w_i(d,a) \le w_i(d,b)$.	14	L2	CO2
Q.4		**Solve any one**	14		
	a)	Solve the fuzzy relation equation using max-min composition. $p \circ \begin{bmatrix} 0.5 & 0.4 & 0.6 & 0.7 \\ 0.2 & 0.0 & 0.6 & 0.8 \\ 0.1 & 0.4 & 0.6 & 0.7 \\ 0.0 & 0.3 & 0.0 & 1.0 \end{bmatrix} = \begin{bmatrix} 0.2 & 0.4 & 0.5 & 0.7 \end{bmatrix}$	14	L4	CO3
	b)	i) Let $Q = \begin{bmatrix} 0.1 \\ 0.2 \\ 0.3 \end{bmatrix}$ & $R = \begin{bmatrix} 0.12 \\ 0.18 \\ 0.27 \end{bmatrix}$. Find the solution of $P \overset{i}{\circ} Q = R$, where t-norm i be the product.	04	L1	CO3
		ii) If $S(Q,R) \neq \phi$ for $P \overset{w_i}{\circ} Q = R$, then show that $\hat{P} = \left(R \overset{w_i}{\circ} Q^{-1} \right)$ is the greatest member of $S(Q,R)$.	04	L1	CO3
		iii) Let the t-norm employed in $P \overset{w_i}{\circ} Q = R$ be the product and $P = \begin{bmatrix} 0.5 & 0.9 \\ 0.4 & 0.9 \end{bmatrix}$ & $R = \begin{bmatrix} 0.2 & 1.0 \\ 0.25 & 1.0 \end{bmatrix}$. Find the minimum solution $\breve{Q}$.	06	L1	
Q.5		**Solve any four**			
	a)	Verify following propositions for tautology, i) $\overline{p} \Rightarrow (p \Rightarrow q)$ ii) $(p \wedge q) \vee (q \wedge r) \vee (r \wedge p) \Rightarrow (p \vee q) \wedge (q \vee r) \vee (r \vee p)$.	05	L1	CO4
	b)	Explain three valued logic and multi-valued logic.	05	L2	CO4
	c)	Explain quantification for predicates and types with suitable examples.	05	L2	CO4
	d)	Consider proposition "p: There are about 3 students in I whose fluency in English $\vartheta(i)$ is high", Where $I = \{a, b, c, d, e\}$ and	05	L3	CO4

$\vartheta \in [0,100]$ is degree of fluency in English. $\vartheta(a) = 35$, $\vartheta(b) = 20$, $\vartheta(c) = 80$, $\vartheta(d) = 95$, $\vartheta(e) = 70$ .Find truth value of the proposition.

e)	Explain modifiers, types of modifiers and properties of modifiers.	05	L2	CO4
f)	The set of values of variables χ, γ and Z be defined on the sets $X = \{x_1, x_2, x_3\}$, $Y = \{y_1, y_2\}$ & $Z = \{z_1, z_2\}$ respectively. Given $A = \frac{0.5}{x_1} + \frac{1.0}{x_2} + \frac{0.6}{x_3}$, $B = \frac{1.0}{y_1} + \frac{0.4}{y_2}$ $C = \frac{0.2}{z_1} + \frac{1.0}{z_2}$ and $\Im(a,b) = \begin{cases} 1 \text{ if } a \le b \\ b \text{ if } a > b \end{cases}$. Then find $R_3(x, z)$.	05	L1	CO4

Q.6 **Solve any two**

a)	Explain Fuzzy expert system in brief with block diagram.	10	L2	CO5
b)	Explain R and QL implications with 4 examples of each type.	10	L2	CO5
c)	Explain applications of fuzzy set theory in medical field.	10	L5	CO5

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