M.Sc. IV SEMESTER [MAIN/ATKT] EXAMINATION MAY - JUNE 2025

MATHEMATICS

Paper - III

[Advanced Fuzzy Mathematics - II]

[Max. Marks : 75]   *[Time : 3:00 Hrs.]*   *[Min. Marks : 26]*

Note : Candidate should write his/her Roll Number at the prescribed space on the question paper.
Student should not write anything on question paper.
Attempt all five questions. Each question carries an internal choice.
Each question carries **15 marks.**

Q. 1 Let $\tilde{R}_1$ is reflexive and $\tilde{R}_2$ is an arbitrary fuzzy relation from $\tilde{R}$ where,

$$\tilde{R}_1 = \begin{pmatrix} 1 & .7 & .3 \\ .4 & 1 & .8 \\ .7 & .5 & 1 \end{pmatrix} \quad \text{and} \quad \tilde{R}_2 = \begin{pmatrix} .7 & 0 & 1 \\ .4 & .5 & 0 \\ 0 & 1 & .5 \end{pmatrix}$$

Show that -

i) $\tilde{R}_1 \subset \tilde{R}_1 \ 0 \ \tilde{R}_1$

ii) $\tilde{R}_2 \subset \tilde{R}_1 \ 0 \ \tilde{R}_2$

iii) $\tilde{R}_2 \subset \tilde{R}_2 \ 0 \ \tilde{R}_1$

OR

Solve the following fuzzy relation using max - min composition.

$$\tilde{P} \ 0 \begin{pmatrix} .9 & .6 & 1 \\ .8 & .8 & .5 \\ .6 & .4 & .6 \end{pmatrix} = [.6 \quad .6 \quad .5]$$

Q. 2 Define fuzzy measure and write Dempster's rule of combined evidence. Also write relation between necessity measure (nec $\tilde{A}$) and possibility measure (Pos $\tilde{A}$)

OR

P.T.O.

In a compound generator two experts E_1 and E_2 give the information (evidence measure) about each focal element Ai for OC, FC and UC as given below -

Focal Element Ai	Expert 1 Measure	Expert 2 Measure
OC	0	0
FC	.05	.15
UC	.05	.05
OCUFC	.15	.05
OCUUC	.05	.05
FCUUC	.10	.20
OCUFCUUC	.60	.50
Total	1	1

Calculate combined evidence m_{12} using Dempster rule of combination.

Q. 3 Define Well Formed Formula (WFF). Verify following argument is valid or not. If valid, give proof otherwise give counter example -
If a baby is hungry, the baby cries.

If the baby is not mad, then he does not cry.

If a baby is mad then he has a red face.

Therefore, if a baby is hungry, then he has a red face.

OR

A the fuzzy modus ponens rule to deduce "rotation is quite slow", when it is given that, -
i)   If the temperature is high (H), then rotation is Quite Slow (Q.S.).

ii) The temperature is very high.

for X = {30, 40, 50, 60, 70, 80, 90, 100} set of temp.

 Y = {10, 20, 30, 40, 50 ,60} set of rotation fuzzy set,

$\underset{\sim}{H}$ = {(70, 1), (80, 1), (90, 0.3)}

$\underset{\sim}{VH}$ = {(90, .9), (40, 1), (50, .6)}

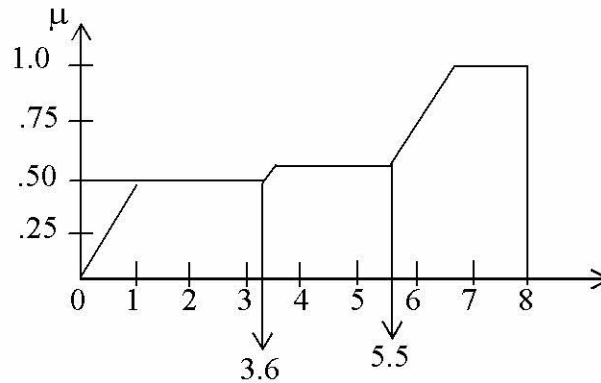$\underset{\sim}{QS}$ = {(10, 1), (20, .8)} for rotation.

Q. 4 Explain - i) Fuzzy rule based system.   ii) Fuzzy fication.
      iii) Defuzzy fication

OR

Let aggregate of fuzzy set of three fuzzy set $\widetilde{A}_1$, $\widetilde{A}_2$ and $\widetilde{A}_3$ are shown in figure below

Defuzzify $\widetilde{A}_1$, $\widetilde{A}_2$, $\widetilde{A}_3$ using

i) Centroid Method.

ii) Center of Sums Method.

Q. 5 Write - i) The steps in designing a simple fuzzy logic control system and

ii) Equations demonstrate fuzzy relation equations commonly used fuzzy control system models.

OR

In Air conditioner controller, determine to what extent the dial should be turned to supply air (hot, worm, cool, cold) will nullify the change in temperature $\Delta T = 2.5^0$ C and d/dt $\Delta T = -1^0$ c / min. The fuzzy sets for the system input namely ΔT and d/dt ΔT output Dial turn z s -