B.E. COMPUTER SCIENCE AND ENGINEERING FOURTH YEAR SECOND SEMESTER -2019

Subject: SOFT COMPUTING   Time: 3 hours   Full marks:100

Answer all questions

1	i.	a)	What is soft computing?	2
		b)	How does soft computing differ from Hard Computing techniques?	3
		c)	Briefly demonstrate different features of fuzzy membership.	5
		d)	Why are fuzzification and defuzzification necessary to build a fuzzy system?	5
		e)	Between "Batch mode gradient descent" and "stochastic gradient descent"- which one is preferred usually and why?	5

OR

	ii.	a)	Compare between Fuzzy set and Rough set with proper examples.	6
		b)	What do you mean by supervised learning?	2
		c)	Find the advantages of GA over Simulated annealing techniques	5
		d)	What is Probabilistic reasoning? How does it deal with uncertainty- explain with proper example.	2+5

2 i a) Using your own intuition and your own definitions of the universe of discourse,   5
plot fuzzy membership functions for the following variables:
(a) age of people
   (i) very young, (ii) young, (iii) middle-aged, (iv) old,(v) very old
(b) education of people
   (i) fairly educated, (ii) educated, (iii) highly educated, (iv) not highly educated, (v) more or less educated

   b) Explain the concept of Fuzzy Approximation Theorem with proper example.   5

   c) Why is back-propagation algorithm used within MLP? Derive the formula of the back-propagation   3+7
algorithm through proper diagram.

3 i a) For the data shown in the accompanying table, show the first iteration in trying to compute the membership   10
values for the input variables x_1, x_2, and x_3 in the output regions R_1 and R_2. Use a $3 \times 3 \times 2$ neural network
for this purpose. Assume a random set of weights for your neural network.

x_1	x_2	x_3	R^1	R^2
1.0	0.5	2.3	1.0	0.0

[Turn over

OR

The ductility of a long slender steel rod under tension may be characterized by a decrease in diameter, d, together with a significant increase in elongation, L. Let $x = d/L$, where x is dimensionless. As x approaches zero the elongation is maximized and the subsequent failure of the member in tension will occur. However, before the member will fail, it will first go from an elastic state to a plastic state. Failure can be defined as exceeding the elastic limit, or in breaking apart in the plastic state. We define two failure states as a function of x: state (1) is where the member exceeds the elastic limit, but can still support further tension; state (2) where the member exceeds the onset of plastic deformation and will break if further tension is applied. The following table defines tests on 12 slender rods, whose final state is shown. Divide x into fuzzy partitions and develop the associated membership functions using inductive reasoning.

State	Deformations
$x = d/L$	0.11, 0.10, 0.08, 0.06, 0.04, 0.03, 0.01, 0.009, 0.007, 0.005, 0.003, 0
State	1, 1, 1, 1, 1, 2, 1, 1, 2, 2, 2, 2

b) What are the fundamental differences between Mamdani and Sugeno fuzzy inference system? Explain with proper example.   5

c) How can you use the Genetic algorithm to deal with uncertainty? Explain with a proper real life example.   5

a) Analyze the merits and demerits of gradient descent rules. How is it different from Perceptron based rules?   5

b)   5

	Age	LEMS	Walk
x_1	16-30	50	Yes
x_2	16-30	0	No
x_3	31-45	1-25	No
x_4	31-45	1-25	Yes
x_5	46-60	26-49	No
x_6	16-30	26-49	Yes
x_7	46-60	26-49	No

Identify the lower approximation, upper approximation and rough set from the above table.

c) Design Fuzzy motor speed controller for air conditioner using the following input, output fuzzy set and the corresponding rules.   10

Input Fuzzy Set
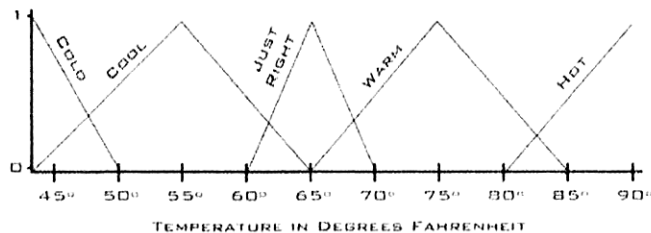
MOTOR SPEED

Output Fuzzy Set
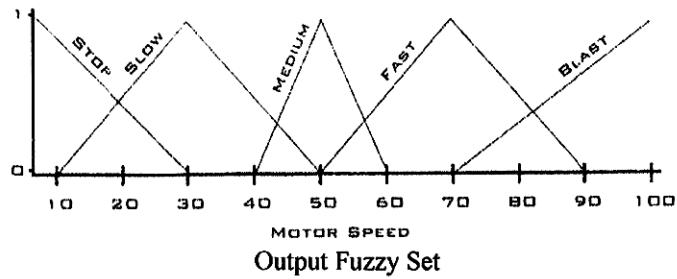
Rules:
–If the temperature is cold then motor speed stop
– If the temperature is cool, then motor speed slows
– If the temperature is just right then motor speed is medium
– If the temperature is warm, then motor speed is fast
– If temperature is hot then motor speed blasts
From the developed system derive the speed of the motor when the temperature is 63 degrees Fahrenheit.

5 i. a) What do you mean by simulated annealing? How do you use simulated annealing to solve real-life problems? Explain with relevant examples. 3+7

b) Explain the significance of activation function to solve the real-life problems using Neural network. 5

c) Two fuzzy relations are given by 5

R	a	b	c	d
1	0.1	0.2	0.0	1.0
2	0.3	0.3	0.0	0.2
3	0.8	0.9	1.0	0.4

S	α	β	γ
a	0.9	0.0	0.3
b	0.2	1.0	0.8
c	0.8	0.0	0.7
d	0.4	0.2	0.3

Obtain fuzzy relations $R \circ S$ as max-min composition and max-average composition between these two fuzzy relations.

OR

ii. a) Use the following table to extract different rules using Rough set based dissimilarity functions. 15

Patient	Headache	Muscle-pain	Temperature	Flu
p1	no	yes	high	yes
p2	yes	no	high	yes
p3	yes	yes	very high	yes
p4	no	yes	normal	no
p5	yes	no	high	no
p6	no	yes	very high	yes

b) Among Centroid, Center of sum and weighted average based defuzzification techniques method which one will you select to solve a problem and why? 5