Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI EXAMINATION – WINTER 2025

Subject Code:3160619 Date:19-11-2025

Subject Name:Soft Computing Techniques

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain the concept of computation.	**03**
	(b)	State difference between Hard Computing and Soft Computing?	**04**
	(c)	Enlist types of Soft Computing Techniques and explain in detail their applications in the field of Civil Engineering.	**07**
Q.2	**(a)**	Distinguish between Classical set and Fuzzy set.	**03**
	(b)	Explain methods of defuzzification in detail.	**04**
	(c)	What is membership function? Enlist and explain its features.	**07**
		OR	
	(c)	Two types of steel are tested four times each for their tensile strength. Let us consider fuzzy sets '$\widetilde{A}$' and '$\widetilde{B}$' to be the two types of steel on the universe of strengths (in MPa) where four tests X = {1, 2, 3, 4} were conducted on each of the two steel types. The following given sets represent the tensile strengths of each steel. Compare the tensile strength of these two steels by finding the following. $\widetilde{A} = \left\{\frac{0.4}{1}, \frac{0.35}{2}, \frac{0.5}{3}, \frac{0.6}{4}\right\}$; $\widetilde{B} = \left\{\frac{0.7}{1}, \frac{0.75}{2}, \frac{0.65}{3}, \frac{0.8}{4}\right\}$ (i) Union: $\widetilde{A} \cup \widetilde{B}$ (ii) Intersection: $\widetilde{A} \cap \widetilde{B}$ (iii) Complement: $\overline{\widetilde{A}}$, $\overline{\widetilde{B}}$ (iv) Difference: $\widetilde{A} - \widetilde{B}$, $\widetilde{B} - \widetilde{A}$	**07**
Q.3	**(a)**	Define Genetic Algorithm and state its importance.	**03**
	(b)	Explain the workflow of a GA.	**04**
	(c)	To make concrete, the main four components are Cement $\widetilde{C}$, Sand $\widetilde{S}$, Water $\widetilde{W}$, and Aggregates $\widetilde{A}$. The mixture is considered to be the best if the proportions of Cement, Sand and Aggregates are 1:1.5:1. An amount of 40% by volume of water is added to make concrete paste. Now, to fill the slab with concrete the contractor needs the exact proportion of concrete that produces no shortage and no waste. The mix proportion for different components in shown in fuzzy sets that follow: $\widetilde{C} = \left\{\frac{0.4}{10} + \frac{0.3}{20} + \frac{0.9}{30} + \frac{0.6}{40} + \frac{0.4}{50}\right\}$ on a universe of cubic-feet of Cement. $\widetilde{S} = \left\{\frac{0.3}{15} + \frac{0.4}{30} + \frac{0.8}{45} + \frac{0.7}{60} + \frac{0.4}{75}\right\}$ on a universe of cubic-feet of Sand. Then, 40% by volume of water is added to the mixture, to produce $\widetilde{W} = \left\{\frac{0.4}{15} + \frac{0.7}{30} + \frac{0.7}{45} + \frac{0.6}{60} + \frac{0.5}{75}\right\}$ on a universe of volumes of water in cubic-feet. (i) Using fuzzy Cartesian product, find $\widetilde{P} = \widetilde{C}\, X\, \widetilde{S}$, where $\widetilde{P}$ represents a fuzzy set called the proportion.	**07**

(ii) Using max-min composition, find $\widetilde{Q} = \widetilde{W} \circ \widetilde{P}$, where $\widetilde{Q}$ represents a fuzzy set called the overall performance of the concrete.

(iii) Using max-product composition, find $\widetilde{Q} = \widetilde{W} \circ \widetilde{P}$.

OR

Q.3	**(a)**	Define GA operators: Selection, Crossover, Mutation	**03**
	(b)	Describe applications of GA in Civil Engineering and Explain any one in detail.	**04**
	(c)	Explain in detail various Selection Schemes in GA.	**07**
Q.4	**(a)**	What are the different Steps involved in ANN analysis.	**03**
	(b)	Differentiate Artificial Neural Network and Biological Neural Network.	**04**
	(c)	Explain different ANN architectures.	**07**

OR

Q.4	**(a)**	What is Artificial Neural Network. Enlist the Applications of ANNs to solve some real-life problems.	**03**
	(b)	Explain different Training techniques for ANNs.	**04**
	(c)	State the advantages and disadvantages of ANN.	**07**
Q.5	**(a)**	What are the limitations of the traditional optimization approaches.	**03**
	(b)	Describe Biological neurons and its working.	**04**
	(c)	Write a short note on fuzzy neural system.	**07**

OR

Q.5	**(a)**	What are hybrid systems in soft computing. List the various types of hybrid systems	**03**
	(b)	State the Advantages and Disadvantages of Hybrid Systems.	**04**
	(c)	Explain Genetic Neural System with a flowchart. State its advantages, disadvantages.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160619 Date:28-11-2024

Subject Name:Soft Computing Techniques

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain the terms: (a) Fuzziness, (b) Power set, (c) Union of two sets.	**03**
	(b)	Write the applications of soft computing techniques.	**04**
	(c)	Differentiate between hard computing and soft computing. Also discuss the characteristics of soft computing.	**07**
Q.2	**(a)**	Write the disadvantages of GA.	**03**
	(b)	Write the components of a fuzzy logic system and explain them.	**04**
	(c)	Define defuzzification and explain the different defuzzification methods.	**07**
		OR	
	(c)	Explain different cross over operations performed in GA	**07**
Q.3	**(a)**	Give the difference between conditional fuzzy proposition and unconditional fuzzy proposition.	**03**
	(b)	Explain the various ways by which membership values can be assigned to fuzzy variables.	**04**
	(c)	Explain fuzzy Cartesian and composition with a suitable example.	**07**
		OR	
Q.3	**(a)**	Define: (a) Swap mutation, (b) Inversion mutation and (c) Scramble mutation.	**03**
	(b)	What is Roulette wheel selection in GA? Explain in detail.	**04**
	(c)	Explain input layer, hidden layer & output layer computations in Backpropagation Network.	**07**
Q.4	**(a)**	Briefly explain Associative Memory.	**03**
	(b)	Discuss the fitness function in GA.	**04**
	(c)	Describe the basic steps of Genetic Algorithm used for solving optimization techniques and compare the features of Genetic Algorithm with other optimization techniques..	**07**
		OR	
Q.4	**(a)**	Write the advantages and applications of ANN.	**03**
	(b)	Explain sigmoid and tanh activation functions of ANN.	**04**
	(c)	Explain the basic architecture of McCulloch – Pitts neuron model.	**07**
Q.5	**(a)**	List few applications of Neuro fuzzy systems.	**03**
	(b)	Implement a perceptron to solve simple AND problem with two inputs.	**04**
	(c)	What do you mean by neuro fuzzy controller? Explain in detail.	**07**
		OR	
Q.5	**(a)**	List few applications of hybrid fuzzy Genetic algorithm systems.	**03**
	(b)	Explain briefly the features and importance of neuro-genetic system.	**04**
	(c)	With suitable block diagram, explain the principle involved in a water level control sensor using neuro-fuzzy technique.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3160619 Date:07-12-2023

Subject Name: Soft Computing Techniques

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Differentiate "Soft" computing versus "Hard" computing.	**03**
	(b)	What is fuzzy set and membership function?	**04**
	(c)	Describe characteristics of soft computing and give any two examples of soft computing in civil engineering.	**07**
Q.2	**(a)**	With the help of a figure, explain the features of fuzzy membership functions.	**03**
	(b)	Explain union and intersection operation with example.	**04**
	(c)	With the help of a block diagram, explain a fuzzy rule-based system	**07**
		OR	
	(c)	Write a note on fuzzy implications and interferences	**07**
Q.3	**(a)**	Compare the classical relation versus fuzzy relation.	**03**
	(b)	With suitable example, explain how membership function assignment is performed using intution.	**04**
	(c)	Determine a fitness value of a function f(x,y) = (x-6)2 + (y-3)2 for a string 110010,000100,100001 having string length of first 3 bits for X and remaining 3 bits are for Y.	**07**
		OR	
Q.3	**(a)**	What is defuzzification? List out various methods of defuzzification. Explain any one method of defuzzification in details.	**03**
	(b)	Write a short note on Mamdani FIS for the formation of inference rules.	**04**
	(c)	Realize the Mc-Culloch-Pitts neuron model for AND gate (take binary data).	**07**
Q.4	**(a)**	Differentiate artificial neural network and biological neural network.	**03**
	(b)	Describe biological and it's working.	**04**
	(c)	Explain crossover and mutation in detail	**07**
		OR	
Q.4	**(a)**	Explain chromosomes, gene, and allele in brief.	**03**
	(b)	Enlist the step for solving problem using GA in MATLAB.	**04**
	(c)	Explain different ANN architectures.	**07**
Q.5	**(a)**	State the importance of Genetic algorithm.	**03**
	(b)	Explain the concept of genetic-fuzzy systems	**04**
	(c)	How are data represented in genetic programming?	**07**
		OR	
Q.5	**(a)**	What are hybrid systems? List the various types of hybrid systems.	**03**
	(b)	Write a short note on fuzzy neural system.	**04**
	(c)	With the help of block diagram and flow chart, explain the one application of neural network in civil engineering.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022

Subject Code:3160619 Date:15-12-2022

Subject Name:Soft Computing Techniques

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Distinguish between hard and soft computing	**03**
	(b)	Define soft computing. Mention the applications of soft computing	**04**
	(c)	Define defuzzification. Illustrate various types of defuzzification techniques	**07**
Q.2	**(a)**	With the help of a figure, explain the features of fuzzy membership functions	**03**
	(b)	Discuss the characteristics of soft computing	**04**
	(c)	With the help of a block diagram, explain a fuzzy rule-based system	**07**
		OR	
	(c)	Write a note on fuzzy implications and interferences	**07**
Q.3	**(a)**	Mention the role of fitness function in genetic algorithm	**03**
	(b)	Represent the standard fuzzy set operations using venn diagram	**04**
	(c)	Briefly describe various crossover techniques employed in genetic algorithm	**07**
		OR	
Q.3	**(a)**	State the concept of delta rule used in adaptive linear neurons	**03**
	(b)	Compare between biological neural network and artificial neural network	**04**
	(c)	Explain convergence of genetic algorithm	**07**
Q.4	**(a)**	Compare supervised and unsupervised learning approaches in ANN learning	**03**
	(b)	Write drawbacks of genetic algorithm	**04**
	(c)	What is GA? With a neat flowchart, explain the operation of a simple GA	**07**
		OR	
Q.4	**(a)**	Explain the terms: Chromosome, crossover, mutation	**03**
	(b)	Explain different neural network architecture	**04**
	(c)	Explain how GA used for weight optimization in neural network	**07**
Q.5	**(a)**	Give a few basic topological structures of ANN	**03**
	(b)	Explain the concept of genetic-fuzzy systems	**04**
	(c)	Explain the concept of simulation of biological neurons to problem solving	**07**
		OR	
Q.5	**(a)**	Give the advantages of neuro-genetic hybrids	**03**
	(b)	Write the applications of fuzzy-neural systems	**04**

(c) What are the classifications of neuro-fuzzy hybrid systems? Discuss in detail **07**

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