

**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 ' $\tilde{A}$ ' and ' $\tilde{B}$ ' 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.

$$\tilde{A} = \left\{ \frac{0.4}{1}, \frac{0.35}{2}, \frac{0.5}{3}, \frac{0.6}{4} \right\}; \tilde{B} = \left\{ \frac{0.7}{1}, \frac{0.75}{2}, \frac{0.65}{3}, \frac{0.8}{4} \right\}$$

- (i) Union:  $\tilde{A} \cup \tilde{B}$
- (ii) Intersection:  $\tilde{A} \cap \tilde{B}$
- (iii) Complement:  $\tilde{A}^c, \tilde{B}^c$
- (iv) Difference:  $\tilde{A} - \tilde{B}, \tilde{B} - \tilde{A}$
- 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  $\tilde{C}$ , Sand  $\tilde{S}$ , Water  $\tilde{W}$ , and Aggregates  $\tilde{A}$ . 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:

$$\tilde{C} = \left\{ \frac{0.4}{10} + \frac{0.3}{20} + \frac{0.9}{30} + \frac{0.6}{40} + \frac{0.4}{50} \right\} \text{ on a universe of cubic-feet of Cement.}$$

$$\tilde{S} = \left\{ \frac{0.3}{15} + \frac{0.4}{30} + \frac{0.8}{45} + \frac{0.7}{60} + \frac{0.4}{75} \right\} \text{ on a universe of cubic-feet of Sand.}$$

Then, 40% by volume of water is added to the mixture, to produce

$$\tilde{W} = \left\{ \frac{0.4}{15} + \frac{0.7}{30} + \frac{0.7}{45} + \frac{0.6}{60} + \frac{0.5}{75} \right\} \text{ on a universe of volumes of water in cubic-feet.}$$

- (i) Using fuzzy Cartesian product, find  $\tilde{P} = \tilde{C} \times \tilde{S}$ , where  $\tilde{P}$  represents a fuzzy set called the proportion.

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

**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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