

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:

SOFT COMPUTING TECHNIQUES- 3160619

Unit 1: Introduction to Soft Computing

Repeated Questions:

1. **Differentiate between "Soft" computing versus "Hard" computing.**
 - (S25 - Q1c, 07 marks)
 - (W24 - Q1c, 07 marks)
 - (S24 - Q1a, 03 marks)
 - (S23 - Q1b, 04 marks)
 - (W23 - Q1a, 03 marks)
 - (S22 - Q1a, 03 marks)
2. **What is soft computing? How it differs from hard computing? / Define Soft Computing.**
 - (S25 - Q1a, 03 marks)
 - (W23 - Q1a, 03 marks)
 - (S23 - Q1b, 04 marks)
 - (W22 - Q1b, 04 marks)
 - (S22 - Q1a, 03 marks)
3. **Discuss the characteristics and applications of soft computing techniques. / Write a detailed note on applications of soft computing. / Mention the applications of soft computing.**
 - (S24 - Q1c, 07 marks)
 - (W23 - Q1c, 07 marks)
 - (S23 - Q1c, 07 marks)
 - (W22 - Q2b, 04 marks)
 - (S22 - Q1a, 03 marks)

Other Important Questions:

1. **Explain the concept of computation.** (W25 - Q1a, 03 marks)
 2. **Describe characteristics of soft computing and give any two examples of soft computing in civil engineering.** (W23 - Q1c, 07 marks) (S22 - Q1c, 07 marks)
 3. **Explain the concept of Neural networks and the various types of learning.** (S25 - Q1b, 04 marks)
 4. **Explain the terms: (a) Fuzziness, (b) Power set, (c) Union of two sets.** (W24 - Q1a, 03 marks)
 5. **Write the applications of soft computing techniques.** (W24 - Q1b, 04 marks)
 6. **State difference between Hard Computing and Soft Computing?** (W25 - Q1b, 04 marks)
 7. **Enlist types of Soft Computing Techniques and explain in detail their applications in the field of Civil Engineering.** (W25 - Q1c, 07 marks)
 8. **What are the different fuzzy sets? Define them.** (S24 - Q1a, 03 marks)
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Unit 2: Fuzzy Logic

Repeated Questions:

1. **What is membership function? Draw the various membership functions... / With the help of a figure, explain the features of fuzzy membership functions.**
 - (S25 - Q2c, 07 marks)
 - (W23 - Q2a, 03 marks)
 - (W22 - Q2a, 03 marks)
2. **What is fuzzy set and membership function?**
 - (W23 - Q1b, 04 marks)
 - (S22 - Q1b, 04 marks)
3. **Define defuzzification and explain the different defuzzification methods. / Illustrate various types of defuzzification techniques. / Classify the different methods of defuzzification process.**
 - (W24 - Q2c, 07 marks)
 - (S24 - Q2c OR, 07 marks)
 - (W22 - Q1c, 07 marks)
 - (S22 - Q3b, 04 marks)
4. **Explain union and intersection operation with example.**
 - (W23 - Q2b, 04 marks)
 - (S22 - Q2b, 04 marks)
5. **Distinguish between Classical set and Fuzzy set.** (W25 - Q2a, 03 marks) *(Similar to "Compare non-fuzzy logic and fuzzy logic approaches" - S24 Q3b)*

Other Important Questions:

1. **Explain methods of defuzzification in detail.** (W25 - Q2b, 04 marks)
2. **What is membership function? Enlist and explain its features.** (W25 - Q2c, 07 marks)
3. **Two types of steel are tested four times each for their tensile strength... Compare the tensile strength...** (W25 - Q2c OR, 07 marks) [*Numerical Question*]
4. **With the help of a block diagram, explain a fuzzy rule-based system.** (W23 - Q2c, 07 marks) (W22 - Q2c, 07 marks)
5. **Write a note on fuzzy implications and interferences.** (W23 - Q2c OR, 07 marks) (W22 - Q2c OR, 07 marks)
6. **Explain the significance of Fuzzy Logic and Fuzzy Sets in detail.** (S25 - Q2b, 04 marks)
7. **Define with examples (1) Fuzzy Sets, (2) Grade ship function, (3) Fuzzy Rules (If else rules).** (S25 - Q2c OR, 07 marks)
8. **Compare the classical relation versus fuzzy relation.** (W23 - Q3a, 03 marks)
9. **Write a short note on Mamdani FIS for the formation of inference rules.** (W23 - Q3b, 04 marks)
10. **Explain fuzzy Cartesian and composition with a suitable example.** (W24 - Q3c, 07 marks)
11. **Give the difference between conditional fuzzy proposition and unconditional fuzzy proposition.** (W24 - Q3a, 03 marks)
12. **Explain the various ways by which membership values can be assigned to fuzzy variables.** (W24 - Q3b, 04 marks)
13. **What are the roles of α -cut in fuzzy set theory?** (S24 - Q2a, 03 marks)
14. **Explain the evolution phases of Fuzzy logic.** (S24 - Q2b, 04 marks)
15. **Explain the fuzzy inference with suitable Example.** (S24 - Q2c, 07 marks)
16. **Enlist and explain the properties of fuzzy sets.** (S23 - Q2b, 04 marks)
17. **Write a short note on fuzzy expert systems.** (S23 - Q2a, 03 marks)
18. **Explain Mamdani's and Zadeh's interpretation of fuzzy rule.** (S23 - Q3b, 04 marks)
19. **Define support, core and normality terminology.** (S22 - Q2a, 03 marks)
20. **Explain application of fuzzy logic in civil engineering and day to day practice.** (S22 - Q2c, 07 marks)
21. **Give crisp set $A = \{1,2,3,4\}$ find the relation matrix for the relation...** (S22 - Q2c OR, 07 marks) [*Numerical Question*]

22. **Derive R·S (max. min. composition) for x and y = {1,3,5}...** (S22 - Q3c, 07 marks) [*Numerical Question*]
23. **Represent the standard fuzzy set operations using vein diagram.** (W22 - Q3b, 04 marks)
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Unit 3: Genetic Algorithms

Repeated Questions:

- Define Genetic Algorithm and state its importance. / What is meant by Genetic Algorithm? / Explain Genetic Algorithm with examples.**
 - (W25 - Q3a, 03 marks)
 - (S25 - Q3a, 03 marks) (S25 - Q3 OR a, 03 marks)
 - (S22 - Q3a, 03 marks)
- Explain the workflow of a GA. / Draw the framework/flowchart of GA.**
 - (W25 - Q3b, 04 marks)
 - (S25 - Q3b, 04 marks)
 - (S23 - Q3a, 03 marks)
 - (W22 - Q4c, 07 marks)
- Explain crossover and mutation in detail. / What is meant by Crossover and Mutation. / Explain the terms: Chromosome, crossover, mutation.**
 - (W23 - Q4c, 07 marks)
 - (S22 - Q4c, 07 marks)
 - (S25 - Q4 OR a, 03 marks)
 - (W22 - Q4 OR a, 03 marks)
- What is Roulette wheel selection in GA? Explain in detail.**
 - (W24 - Q3b, 04 marks)
 - (S24 - Q3c, 07 marks)
- Briefly describe various crossover techniques employed in genetic algorithm. / Define crossover? Explain different types of crossover techniques.**
 - (W22 - Q3c, 07 marks)
 - (S23 - Q3c, 07 marks)

Other Important Questions:

- To make concrete, the main four components are Cement... (W25 - Q3c, 07 marks) [Numerical/Derivation Question]**
- Define GA operators: Selection, Crossover, Mutation. (W25 - Q3 OR a, 03 marks)**
- Describe applications of GA in Civil Engineering and Explain any one in detail. (W25 - Q3 OR b, 04 marks)**
- Explain in detail various Selection Schemes in GA. (W25 - Q3 OR c, 07 marks)**
- Determine a fitness value of a function $f(x,y) = (x - 6)^2 + (y - 3)^2$ for a string 110010,000100,100001... (W23 - Q3c, 07 marks) (S22 - Q3c, 07 marks) [Numerical Question]**
- Realize the Mc-Culloch-Pitts neuron model for AND gate (take binary data). (W23 - Q3c, 07 marks)**
- What are the applications of GA in civil engineering? (S25 - Q3 OR b, 04 marks)**
- Write the disadvantages of GA. (W24 - Q2a, 03 marks)**
- Explain different cross over operations performed in GA. (W24 - Q2c OR, 07 marks)**
- Define: (a) Swap mutation, (b) Inversion mutation and (c) Scramble mutation. (W24 - Q3 OR a, 03 marks)**
- Discuss the fitness function in GA. (W24 - Q4b, 04 marks)**
- Describe the basic steps of Genetic Algorithm used for solving optimization techniques... (W24 - Q4c, 07 marks)**
- What are the basic Genetic Algorithm Operators? (S24 - Q3a, 03 marks)**
- Write Short note on: (i) Convergence of GA (ii) Multi-Level Optimization. (S24 - Q3c, 07 marks)**
- How do you select mutation in GA? (S24 - Q3 OR a, 03 marks)**
- How is Genetic Algorithm differing from traditional algorithm? (S24 - Q3 OR b, 04 marks)**
- Explain the major components of Genetic Algorithm. (S23 - Q3 OR a, 03 marks)**
- Explain bit-wise operation in genetic algorithm. (S23 - Q3 OR b, 04 marks)**

19. **Write a note on: (i) Tournament selection (ii) Chromosomes.** (S23 - Q3c, 07 marks)
 20. **Define Encoding in Genetic algorithm. Describe the different encoding methods.** (S23 - Q4b, 04 marks)
 21. **Explain basic GA. Framework.** (S22 - Q3 OR a, 03 marks)
 22. **Enlist simple genetic algorithm parameter and its features.** (S22 - Q3 OR b, 04 marks)
 23. **Explain chromosomes, gene, and allele in brief.** (W23 - Q4a, 03 marks) (S22 - Q4 OR a, 03 marks)
 24. **Enlist the step for solving problem using GA in MATLAB.** (W23 - Q4b, 04 marks) (S22 - Q4 OR b, 04 marks)
 25. **Mention the role of fitness function in genetic algorithm.** (W22 - Q3a, 03 marks)
 26. **State the concept of delta rule used in adaptive linear neurons.** (W22 - Q3 OR a, 03 marks)
 27. **Explain convergence of genetic algorithm.** (W22 - Q3 OR c, 07 marks)
 28. **Write drawbacks of genetic algorithm.** (W22 - Q4b, 04 marks)
 29. **Explain how GA used for weight optimization in neural network.** (W22 - Q4 OR c, 07 marks)
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Unit 4: Artificial Neural Networks

Repeated Questions:

1. **Differentiate artificial neural network and biological neural network. / Compare between biological neural network and artificial neural network.**
 - (W25 - Q4b, 04 marks)
 - (W23 - Q4a, 03 marks)
 - (S22 - Q4a, 03 marks)
 - (W22 - Q3 OR b, 04 marks)
 - (S24 - Q4 OR a, 03 marks)
2. **Explain different ANN architectures.**
 - (W25 - Q4c, 07 marks)
 - (W23 - Q4c, 07 marks)
 - (S22 - Q4 OR c, 07 marks)
 - (W22 - Q4 OR b, 04 marks)
3. **Describe biological neurons and its working. / Describe biological and it's working.**
 - (W25 - Q5b, 04 marks)
 - (S22 - Q4b, 04 marks)
4. **What are the different Steps involved in ANN analysis. (W25 - Q4a, 03 marks) (Appears verbatim in two options)**

Other Important Questions:

1. **Explain the working of a Back propagation neural network with a neat architecture. (S23 - Q4c, 07 marks)**
2. **Explain input layer, hidden layer & output layer computations in Backpropagation Network. (W24 - Q3c, 07 marks)**
3. **Explain the basic architecture of McCulloch - Pitts neuron model. (W24 - Q4c, 07 marks)**
4. **Distinguish between supervised learning and unsupervised learning.**
 - (S24 - Q4a, 03 marks)
 - (S23 - Q4 OR a, 03 marks)
 - (W22 - Q4a, 03 marks)
5. **What is Rank selection in GA? Explain in brief. (S24 - Q4b, 04 marks)**
6. **Why activation function is used in artificial neuron? Explain different activation functions. (S24 - Q4c, 07 marks)**
7. **Distinguish between artificial neuron & biological neuron. (S24 - Q4 OR a, 03 marks)**
8. **Explain the taxonomy of artificial neural network architectures. (S24 - Q4 OR b, 04 marks)**
9. **With neat sketch, differentiate multilayer feed forward networks and recurrent neural networks. (S24 - Q4 OR c, 07 marks)**
10. **Write a short note on character recognition using ANN. (S23 - Q4a, 03 marks)**
11. **Differentiate between supervised learning and unsupervised learning. (S23 - Q4 OR a, 03 marks)**
12. **Explain Hebbian learning with its flowchart. (S23 - Q4 OR b, 04 marks)**
13. **Define perceptron. Explain the learning rule of perceptron. (S23 - Q4 OR c, 07 marks)**
14. **Discuss applications of ANN to solve engineering and technical problems. (S25 - Q3c, 07 marks)**
15. **What are the advantages and drawbacks of ANN, provide comparative analysis. (S25 - Q3 OR c, 07 marks)**
16. **List different types of activation functions used in ANN's. (S25 - Q4b, 04 marks)**
17. **Write the advantages and applications of ANN. (W24 - Q4a, 03 marks)**
18. **Explain sigmoid and tanh activation functions of ANN. (W24 - Q4b, 04 marks)**
19. **Briefly explain Associative Memory. (W24 - Q4a, 03 marks)**
20. **Give a few basic topological structures of ANN. (W22 - Q5a, 03 marks)**
21. **Explain the concept of simulation of biological neurons to problem solving. (W22 - Q5c, 07 marks)**

22. **Elaborate Adaline network. Also discuss the applications of the Adaline network.** (S23 - Q5b, 04 marks)
 23. **Explain ANN and enlist the element of neural network.** (S22 - Q5a, 03 marks)
 24. **Sketch the architecture of Boltzmann network and mention the steps for recall Procedure.** (S24 - Q5b, 04 marks)
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Unit 5: Hybrid Systems

Repeated Questions:

- What are hybrid systems in soft computing. List the various types of hybrid systems. / What do you mean by hybrid system in Soft computing / What do you mean by hybrid systems? Enlist various hybrid systems...**
 - (W25 - Q5a, 03 marks)
 - (S25 - Q5a, 03 marks)
 - (S24 - Q5a, 03 marks)
 - (S22 - Q5a, 03 marks)
- Explain genetic neural system in detail. / Explain genetic-neural system (Neuro-Genetic) in detail.**
 - (W25 - Q5c, 07 marks)
 - (S25 - Q5 OR a, 03 marks)
 - (S22 - Q5c, 07 marks)
- Write a short note on fuzzy neural system.**
 - (W25 - Q5b, 04 marks)
 - (S22 - Q5b, 04 marks)
- Explain the concept of genetic-fuzzy systems.**
 - (W23 - Q5b, 04 marks)
 - (W22 - Q5b, 04 marks)

Other Important Questions:

- Explain Genetic Neural System with a flowchart. State its advantages, disadvantages. (W25 - Q5c OR, 07 marks)**
- Write a short note on fuzzy neural system. / Describe Fuzzy Neural (Neuro- Fuzzy) System. Explain with the help of example. (S25 - Q5c, 07 marks)**
- How does hybrid computing can be used in technical analysis. (S25 - Q5b, 04 marks)**
- How genetic neural system is helpful in engineering solutions. (S25 - Q5 OR b, 04 marks)**
- Explain various applications of Hybrid and soft computing techniques. (S25 - Q5 OR c, 07 marks)**
- List few applications of Neuro fuzzy systems. (W24 - Q5a, 03 marks)**
- Implement a perceptron to solve simple AND problem with two inputs. (W24 - Q5b, 04 marks)**
- What do you mean by neuro fuzzy controller? Explain in detail. (W24 - Q5c, 07 marks)**
- List few applications of hybrid fuzzy Genetic algorithm systems. (W24 - Q5 OR a, 03 marks)**
- Explain briefly the features and importance of neuro- genetic system. (W24 - Q5 OR b, 04 marks)**
- With suitable block diagram, explain the principle involved in a water level control sensor using neuro- fuzzy technique. (W24 - Q5 OR c, 07 marks)**
- Draw and explain models of Neuro Fuzzy System. (S24 - Q5c, 07 marks)**
- Write the comparisons between fuzzy systems and neural network. (S24 - Q5 OR a, 03 marks)**
- Write and explain applications of Neuro Fuzzy System. (S24 - Q5 OR b, 04 marks)**
- Define and explain fuzzy- Genetic hybrid Systems. (S24 - Q5 OR c, 07 marks)**
- Write the advantages of Genetic fuzzy hybrids. (S23 - Q5a, 03 marks)**
- What is a neuro- fuzzy system? In which areas neuro fuzzy systems are useful? (S23 - Q5c, 07 marks)**
- Write the characteristics of Neuro genetic hybrids. (S23 - Q5 OR a, 03 marks)**
- List few applications of hybrid Fuzzy genetic algorithm systems. (S23 - Q5 OR b, 04 marks)**
- With suitable block diagram, explain the principle involved in a liquid level controller using neuro fuzzy technique. (S23 - Q5 OR c, 07 marks)**
- What are the advantages of hybrid systems? (S22 - Q5b, 04 marks)**

22. **Describe fuzzy neural system with its working flow advantages and disadvantages.** (S22 - Q5c OR, 07 marks)
23. **Give the advantages of neuro- genetic hybrids.** (W22 - Q5 OR a, 03 marks)
24. **Write the applications of fuzzy-neural systems.** (W22 - Q5 OR b, 04 marks)
