

SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

**PG-DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING**

QUESTION BANK



PG-III SEMESTER

PCP503 – SOFT COMPUTING

Regulation – 2023

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Prepared by

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DEPARTMENT OF CSE & IT

Question Bank

SUBJECT : PCP503 – SOFT COMPUTING

SEM / YEAR: III SEM / II Year

UNIT I INTRODUCTION TO SOFT COMPUTING			
Evolution of Computing - Soft Computing Constituents - From Conventional AI to Computational Intelligence - Machine Learning Basics.			
PART – A			
Q.No	Questions	BT Level	Competence
1.	Define soft computing.	BTL1	Remembering
2.	Define ANN.	BTL1	Remembering
3.	List the features.	BTL1	Remembering
4.	Give the properties of biological neurons.	BTL1	Remembering
5.	Define competitive learning.	BTL1	Remembering
6.	Write the types of learning rules	BTL2	Understanding
7.	List the soft computing constituents.	BTL1	Remembering
8.	Define supervised learning.	BTL1	Remembering
9.	Classify the different types of ANN.	BTL2	Understanding
10.	Identify the architecture in NN .	BTL2	Understanding
11.	Describe the activation function .	BTL2	Understanding
12.	Write about neural character recognizer.	BTL2	Understanding
13.	Define physical symbol system hypothesis.	BTL1	Remembering
14.	What is machine intelligence?	BTL2	Understanding
15.	List the soft computing paradigms.	BTL1	Remembering
16.	Show the training a neural network.	BTL2	Understanding
17.	Outline the conventional AI approaches.	BTL2	Understanding
18.	Differentiate	BTL2	Understanding
19.	What are some applications of ANN.	BTL2	Understanding
20.	Describe linear separability.	BTL2	Understanding
21.	List out the limitations of linear separability.	BTL2	Understanding

22.	What are properties of ANN?	BTL1	Remembering
23.	What is meant by Hebb Net?	BTL1	Remembering
24.	Write about expert system.	BTL2	Understanding
PART – B			
1.	Analyze the concept of from conventional AI to computational intelligence. (16)	BTL4	Analyzing
2.	Define Soft Computing Constituents and explain it in detail. (16)	BTL4	Analyzing
3.	List the types of ANN and describe in detail. (16)	BTL4	Analyzing
4.	What is the evolution of computing. Narrate it. (16)	BTL5	Evaluating
5.	Justify the architecture of NN and give the training algorithm. (16)	BTL5	Evaluating
6.	i) Illustrate in detail about biological neuron and structure of neural cell.(8) ii) Summarize in detail about reinforced learning. (8)	BTL3	Applying
7.	Discover the following: i) Write about McCulloch-Pitts Neuron. (8) ii) Write about Multilayer feedforward NN. (8)	BTL4	Analyzing
8.	Discuss in detail on different learning rules. (16)	BTL5	Evaluating
9.	Explain in detail about Biological Neural Network and compare with ANN.(16)	BTL4	Analyzing
10.	i) Explain about perceptron algorithm. (8) ii) Examine on supervised learning. (8)	BTL3	Applying
11.	Implement the concept of unsupervised learning. (16)	BTL3	Applying
12.	Write notes on different types of activation function. (16)	BTL3	Applying
13.	Explain in detail about the architecture, Learning rule and algorithm of Perceptron Model. (16)	BTL4	Analyzing
14.	Explain in detail about the different types of architecture. (16)	BTL4	Analyzing
15.	Explain in detail about Hebb Net. (16)	BTL4	Analyzing
16.	Consider the following Train logical AND gate with binary input & bipolar target using perceptron algorithm with initial weights and bias as $w_1=2$, $w_2=2$ and $b=-4$. Write in detail about the same. (16)	BTL5	Evaluating
17.	Write in detail about different activation functions. (16)	BTL3	Applying

UNIT II GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA) - Applications of GA - Building Block Hypothesis- Representation- Fitness Measures - Genetic Operators-. GA based Machine Learning.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define local optima.	BTL1	Remembering

2.	What is genetic algorithm?	BTL1	Remembering
3.	List the operators of genetic algorithms.	BTL1	Remembering
4.	Tell me the example of string processing.	BTL1	Remembering
5.	Define schema processing.	BTL1	Remembering
6.	List the implicit parallelism in genetic algorithms?	BTL1	Remembering
7.	How can you describe population?	BTL2	Understanding
8.	Do you Justify goals of optimization.	BTL2	Understanding
9.	Infer simulated annealing.	BTL2	Understanding
10.	What is the use of building block hypothesis.	BTL2	Understanding
11.	List down robustness in genetic algorithms.	BTL2	Understanding
12.	Explain the process of scaling objective values in GAs. Why is it important for maintaining selection pressure?	BTL1	Remembering
13.	Can we explain about mutation process.	BTL2	Understanding
14.	Define exploration.	BTL1	Remembering
15.	What is the purpose of using randomness in genetic algorithms?	BTL1	Remembering
16.	Compare between exploration and exploitation.	BTL2	Understanding
17.	Distinguish deterministic and probabilistic transition rules in AI systems?	BTL2	Understanding
18.	Examine the selection process.	BTL2	Understanding
19.	Identify the 'blind search' in genetic algorithms.	BTL2	Understanding
20.	Infer Genetics-Based Machine Learning (GBML)?	BTL2	Understanding
21.	What is mutation and why is it used?	BTL1	Remembering
22.	Generalize the role of crossover in a genetic algorithm?	BTL2	Understanding
23.	How are genetic algorithms differ from traditional algorithms?	BTL2	Understanding
24.	Write about fitness function.	BTL2	Understanding
PART – B			
1.	Define Genetic Algorithms. Explain their basic working principles and components with an example. (16)	BTL3	Applying
2.	Define fitness function in genetic algorithms. How is fitness measured and why is it crucial to GA performance (16)	BTL3	Applying
3.	Describe the major differences between genetic algorithms and traditional optimization methods in terms of search strategy and robustness. (16)	BTL5	Evaluating
4.	Describe the role and implementation of genetic operators – selection, crossover, and mutation – in the GA cycle. 16)	BTL5	Evaluating
5.	Explain in detail the applications of Genetic Algorithms in different domains. Include at least three real-world use cases? (16)	BTL5	Evaluating
6.	Illustrate the concept of the Building Block Hypothesis in Genetic Algorithms. Why is it important for GA performance. (16)	BTL3	Applying
7.	Analyze briefly any three real-world applications of Genetic algorithms. (16)	BTL4	Analyzing

8.	Explain process of selection, crossover, and mutation in a genetic algorithm using a step-by-step example. (16)	BTL5	Evaluating
9.	Explain a schema in genetic algorithms? Define schema order and defining length with examples (16)	BTL5	Evaluating
10.	Explain Genetics-Based Machine Learning (GBML)? Describe how a classifier system functions as a learning system using GAs. (16)	BTL5	Evaluating
11.	Examine the different representation methods used in genetic algorithms and their significance in solving optimization problems? (16)	BTL3	Applying
12.	i) Infer why is fitness scaling used in genetic algorithms? Mention two scaling methods. (8) ii) Illustrate how mutation helps maintain diversity in Genetic Algorithms. (8)	BTL4	Analyzing
13.	Compare selection, crossover, and mutation operators with respect to their role in Genetic Algorithms. (16)	BTL4	Analyzing
14.	i) What is the Building Block Hypothesis in GAs? How does it affect the performance of the algorithm? Justify. (8) ii) Give the difference between genotype and phenotype in GA representation (8)	BTL4	Analyzing
15.	How are objective functions mapped to fitness values in GAs? Explain briefly. (16)	BTL5	Evaluating
16.	i) What is a classifier system in GA-based machine learning? Mention its key components. Justify. (8) ii) Evaluate how Genetic Algorithms are used in machine learning tasks. What makes them suitable for adaptive learning? (8)	BTL5	Evaluating
17.	Declare the main idea behind Genetic Algorithms? Briefly explain how they are inspired by natural evolution. (16)	BTL6	Creating

UNIT - III NEURAL NETWORKS

Machine Learning using Neural Network, Adaptive Networks - Feed Forward Networks - Supervised Learning Neural Networks - Radial Basis Function Networks - Reinforcement Learning - Unsupervised Learning Neural Networks - Adaptive Resonance Architectures - Advances in Neural Networks.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define the basic unit of a neural network?	BTL1	Remembering
2.	State the error signal in the context of supervised learning.	BTL1	Remembering
3.	How do adaptive networks learn from data?	BTL2	Understanding
4.	Give the two examples of adaptive networks.	BTL2	Understanding
5.	Define the machine learning in the context of neural networks.	BTL2	Understanding
6.	How does the information flow in a feedforward network??	BTL3	Applying
7.	Show two neural networks that use supervised learning.?	BTL3	Applying
8.	Discriminate between RBF and MLP.	BTL5	Evaluating
9.	Justify the purpose of the radial basis function in the hidden layer?	BTL5	Evaluating
10.	Express the three layers of an RBF network?	BTL6	Creating

11.	Define feedforward neural network?	BTL1	Remembering
12.	stability-plasticity dilemma in neural networks.	BTL2	Understanding
13.	What is the role of weights in a neural network??	BTL1	Remembering
14.	Illustrate the role of labeled data in supervised learning?	BTL 3	Applying
15.	What do you mean by an adaptive network??	BTL1	Remembering
16.	Discuss the significance of weight updating in adaptive systems?	BTL2	Understanding
17.	What are the any two activation functions used in neural networks.	BTL1	Remembering
18.	Examine what type of function is used in the hidden layer of an RBF network?	BTL 3	Applying
19.	Why are feedforward networks called “non-recurrent”.	BTL4	Analyzing
20.	Explain what is supervised learning?	BTL4	Analyzing
21.	Differentiate between adaptive and static networks.	BTL4	Analyzing
22.	Point out which learning algorithm is commonly used for training feedforward networks?	BTL4	Analyzing
23.	What is the application of feedforward networks.	BTL5	Evaluating
24.	Express the advantage of supervised learning in neural networks.	BTL6	Creating
PART – B			
1.	Define Reinforcement Learning? Explain its components (agent, environment, reward) and how it differs from supervised learning. (16)	BTL1	Remembering
2.	Explain the structure and working of a Feed Forward Neural Network. Describe its training using the backpropagation algorithm. (16)	BTL2	Understanding
3.	i) Determine the key components of a Feed Forward Neural Network. How does data flow in such a network? (8) ii) Examine adaptive networks and explain their role in learning from data. Provide one example. (8)	BTL3	Applying
4.	Describe various types of learning in neural networks: Supervised, Unsupervised, and Reinforcement learning with suitable examples. (16)	BTL3	Applying
5.	Discuss in detail about multilayer artificial neural NET. (16)	BTL4	Analyzing
6.	Summarize the network properties, load properties of artificial neural networks. (16)	BTL5	Evaluating
7.	Draw an adaptive network with the classification categories. (16)	BTL6	Creating
8.	Explain adaptive networks? Explain how learning takes place in adaptive systems. Differentiate between supervised and unsupervised adaptive networks in detail. (16)	BTL4	Analyzing
9.	What are the building blocks of artificial neural NET. (8) Outline the training process of neural networks. (8)	BTL5	Evaluating
10.	i) Determine the salient features of ANN. (8) ii) Interpret feed forward adaptive network. (8)	BTL3	Applying

11.	Describe the advantages of using neural networks for machine learning tasks over conventional algorithms. (16)	BTL2	Understanding
12.	Explain the architecture and working of Radial Basis Function (RBF) Networks. How do they differ from Multilayer Perceptron (MLPs)? (16)	BTL4	Analyzing
13.	i) Visualize the differentiate between supervised and unsupervised learning neural networks with one example each. (8) ii) What are Radial Basis Function (RBF) Networks? Explain their architecture briefly. (8)	BTL1	Remembering
14.	Summarize the functioning of Unsupervised Learning Neural Networks. Describe any two models such as Kohonen SOM or Hamming Net.(16)	BTL5	Evaluating
15.	i) Discuss about reinforcement learning? How does it differ from supervised learning in neural networks? (8) ii) Describe two models of unsupervised learning and briefly describe their function? (8)	BTL2	Understanding
16.	Describe the major advances in neural network architectures. Briefly describe autoencoders, convolutional neural networks (CNNs), and recurrent neural networks (RNNs). (16)	BTL1	Remembering
17.	Identify the suitable diagram, explain the working of a supervised learning neural network. How is error corrected during training? (16)	BTL1	Remembering

UNIT IV - FUZZY LOGIC

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define fuzzy number.	BTL1	Remembering
2.	What is fuzzy set?	BTL1	Remembering
3.	List any two properties of fuzzy sets.	BTL1	Remembering
4.	What is membership function in fuzzy logic?	BTL1	Remembering
5.	What is a type-2 fuzzy set?	BTL1	Remembering
6.	Describe the meaning of “support” in a fuzzy set.	BTL1	Remembering
7.	Express fuzzy union and give its formula.	BTL2	Understanding
8.	Discuss a level set in fuzzy logic?	BTL2	Understanding
9.	Summarize the fuzzy difference.?	BTL2	Understanding
10.	Give the t-norm in fuzzy operations?	BTL2	Understanding
11.	Illustrate convex fuzzy?	BTL3	Applying
12.	Show an example of a fuzzy set in daily life.	BTL3	Applying
13.	Examine fuzzy intersection with an example. ?	BTL3	Applying
14.	Point out the complement of a fuzzy set?	BTL4	Analyzing
15.	Explain any disjunctive sum in fuzzy sets.	BTL4	Analyzing

16.	Analyze De Morgan's law for fuzzy sets.	BTL4	Analyzing
	Discriminate difference between crisp and fuzzy sets?		
17.		BTL5	Evaluating
18.	Explain the inverse of a fuzzy relation.	BTL5	Evaluating
19.	Generalize in detail about the components of a fuzzy inference system.	BTL6	Creating
20.	Justify fuzzy IF-THEN rule.	BTL6	Creating
21.	Express the fuzzy relation.	BTL2	Understanding
22.	Illustrate a max-min composition in fuzzy relations.	BTL3	Applying
23.	Analyze the Mamdani fuzzy inference method.	BTL4	Analyzing
24.	Summarize the role of a fuzzy expert system.	BTL5	Evaluating
PART – B			
1.	Write the concept of fuzzy sets. How do fuzzy sets differ from classical (crisp) sets? Include examples and graphical representations. (16)	BTL1	Remembering
2.	Write the linguistic approximation in fuzzy systems? How is it used in output interpretation? (16)	BTL1	Remembering
3.	Describe in detail the standard operations on fuzzy sets: complement, union, and intersection. Support with membership function examples. (16)	BTL1	Remembering
4.	(i) Define process of defuzzification. List and briefly describe any two defuzzification methods. (8) (ii) Write about linguistic variables in fuzzy logic? How do they contribute to fuzzy rule formulation? (8)	BTL1	Remembering
5.	(i) Discuss membership functions? Explain different types and give examples of fuzzy set representations using membership functions. (8) (ii) Discuss fuzzy relations and their properties. Explain max-min composition with an example. (8)	BTL2	Understanding
6.	(i) Summarize the concepts of fuzzy rules and fuzzy reasoning. How are they implemented in fuzzy inference systems. (8) (ii) Discuss structure and functioning of a fuzzy inference system. Discuss Mamdani-type inference with an example. (8)	BTL2	Understanding
7.	Give the fuzzy expert systems? Explain the components and operation of a fuzzy logic controller used in expert systems. (16)	BTL2	Understanding
8.	Show the fuzzy decision-making. Illustrate with an example how fuzzy logic can aid in decision-making under uncertainty. (16)	BTL3	Applying
9.	Discover the concepts of α -cut and level sets in fuzzy sets. How are they used to interpret fuzzy sets as crisp sets? (16)	BTL3	Applying
10.	Explain about scalar, relative, and fuzzy cardinality of a fuzzy set. How are they calculated? Provide examples. (16)	BTL4	Analyzing
11.	i) Analyze the structure and use of fuzzy IF-THEN rules in fuzzy logic systems. (8) ii) Analyze the difference between fuzzy implication and classical implication? provide examples. (8)	BTL4	Analyzing

12.	i) Infer a generalized modus ponens with an example. (8) ii) Focus the components of a fuzzy inference system. Explain the role of fuzzification and defuzzification. (8)	BTL4	Analyzing
13.	(i) Explain the concept of a membership function. List different types with illustrations. (8)	BTL5	Evaluating
	(ii) Explain the Type-1 and Type-2 fuzzy sets with suitable examples. (8)		
14.	i) Design fuzzy expert systems. How are fuzzy rules applied within them? (8) ii) Compose the key differences between crisp and fuzzy decision-making approaches? (8)	BTL6	Creating
15.	Summarize convex fuzzy set. How do α -cuts relate to convexity. (16)	BTL2	Understanding
16.	Construct fuzzy rule base? Describe its decomposition and role in fuzzy control systems. (16)	BTL3	Applying
17.	Illustrate in brief about i) Standard fuzzy set operations: union, intersection, and complement. Give examples. (8) ii) Justify the fuzzy relation? How is max-min composition used in fuzzy reasoning? (8)	BTL5	Evaluating

UNIT V - NEURO-FUZZY MODELING

Adaptive Neuro-Fuzzy Inference Systems - Coactive Neuro-Fuzzy Modeling - Classification and Regression Trees - Data Clustering Algorithms - Rule based Structure Identification - Neuro- Fuzzy Control - Case Studies.

PART – A

Q.No	Questions	BT Level	Competence
1.	What is an Adaptive Neuro-Fuzzy Inference System (ANFIS)?	BTL1	Remembering
2.	Define fuzzy inference system?	BTL1	Remembering
3.	What are the components of ANFIS architecture?	BTL1	Remembering
4.	Define coactive neuro-fuzzy modeling?	BTL1	Remembering
5.	What is meant by rule-based structure identification?	BTL1	Remembering
6.	What is the purpose of a decision tree?	BTL1	Remembering
7.	Mention the types of data clustering algorithms?	BTL2	Understanding
8.	Define classification and regression trees?	BTL2	Understanding
9.	Differentiate supervised and unsupervised learning?	BTL2	Understanding
10.	What is backpropagation in neuro-fuzzy systems?	BTL2	Understanding
11.	How does pruning help in tree-based models?	BTL3	Applying
12.	Explain the term fuzzification?	BTL3	Applying
13.	State any two applications of neuro-fuzzy control?	BTL3	Applying
14.	What is meant by clustering validity?	BTL4	Analyzing
15.	Analyze fuzzy rules to represent IF-THEN statements?	BTL4	Analyzing
16.	Analyze the role of membership functions in fuzzy systems?	BTL4	Analyzing
17.	Illustrate the working of a node in a regression tree?	BTL5	Evaluating
18.	Compare K-means and hierarchical clustering?	BTL5	Evaluating

19.	Write a sample rule for ANFIS-based control system?	BTL6	Creating
20.	How does feature selection affect rule-based systems?	BTL6	Creating
21.	Evaluate the advantages of ANFIS over traditional fuzzy systems?	BTL2	Understanding
22.	Justify the use of fuzzy control in real-time systems?	BTL3	Applying
23.	Analyze an example where coactive neuro-fuzzy modeling is applicable.	BTL4	Analyzing
24.	Develop a simple fuzzy rule for temperature control system.	BTL5	Evaluating
PART-B			
1.	Explain the architecture of Adaptive Neuro-Fuzzy Inference Systems (ANFIS) with suitable examples. (16)	BTL1	Remembering
2.	Describe in detail the process of Coactive Neuro-Fuzzy Modeling and its applications. (16)	BTL1	Remembering
3.	Illustrate the Classification and Regression Trees (CART) methodology with an example. (16)	BTL1	Remembering
4.	Explain different Data Clustering Algorithms and their evaluation metrics. (16)	BTL1	Remembering
5.	Discuss the process of structure identification in rule-based fuzzy systems. (16)	BTL2	Understanding
6.	Apply ANFIS to solve a system modeling problem with step-by-step explanation? (16)	BTL2	Understanding
7.	Design a neuro-fuzzy control system for a temperature regulation scenario. (16)	BTL2	Understanding
8.	Analyze the role of fuzzification and defuzzification in control applications. (16)	BTL3	Applying
9.	Compare classification trees and regression trees with examples and use cases. (16)	BTL3	Applying
10.	Analyze the importance of structure learning in fuzzy rule-based systems. (16)	BTL4	Analyzing
11.	Evaluate the benefits and limitations of using ANFIS in pattern recognition. (16)	BTL4	Analyzing
12.	Evaluate the performance of different clustering algorithms based on clustering validity indices. (16)	BTL4	Analyzing
13.	Propose a fuzzy control model for a self-driving car steering system. (16)	BTL5	Evaluating
14.	Develop a hybrid neuro-fuzzy system for stock price prediction. (16)	BTL6	Creating
15.	Explain in detail the real-time case studies where neuro-fuzzy modeling has been implemented. (16)	BTL2	Understanding
16.	Design a fuzzy rule-based classifier using structure identification techniques. (16)	BTL3	Applying
17.	Discuss the synergy between neural networks and fuzzy logic in control systems. (16)	BTL5	Evaluating