C9-R4: SOFT COMPUTING

NOTE:

1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) Differentiate between Hard computing and Soft computing. What are the applications of Soft Computing in pure and applied mathematics?

b) Compare Expert system, Fuzzy system, Neural Network and Genetic Algorithms.

c) *'Neural Network always learns faster than other Classifier'*. Justify.

d) What is mutation? State it's importance. What is meant by mutation rate? What should be the value of mutation rate for optimization problem?

e) Draw and explain Fuzzy-Neural Model. Explain where it can be helpful?

f) What is the importance of population? Which operator is applied first to the population?

g) Differentiate between Competitive learning and supervised Learning.

(7x4)

2.

a) Define Genetic algorithms (GAs). Explain Goals, scopes and objective of GAs. Classify search techniques in GA. Justify the statement: 'Genetic Algorithms always perform better'. If the population size in a genetic algorithm is restricted to 1, what search algorithm it would be. Explain your answer.

b) An Airline company operates 3 plains and employs 5 cabin crews. Only one crew can operate on any plain on a single day, and each crew cannot work for more than two days in a row. The company uses all planes every day. A Genetic Algorithm is used to work out the best combination of crews on any particular day.
   i) Suggest what chromosome could represent an individual in this algorithm?
   ii) Suggest a fitness function for this problem.
   iii) How many solutions are in this problem? Is it necessary to use Genetic Algorithms for solving it?

c) Describe the idea behind the Simulated Annealing algorithm making reference to its origins as an optimization methodology. Also explain Hill Climbing.

(6+6+6)

3.

a) What is deletion and duplication in terms of Genetic Algorithm.? What is segregation? What it meant by inversion? Justify: "Inversion and deletion can't improve the performance". Explain crossover with their types. Explain problems with crossover.

b) Define Optimization. Explain complicated factor for Optimization. Derivate Free Optimization in detail.

c) Explain Least Squares estimator in detail. Write down regression function. How modeling error can be computed?

(6+6+6)

4.

a) Explain Hybrid Neuro-Fuzzy model with neat sketch.

b) Explain Cooperative Neuro-fuzzy model and Concurrent Neuro-fuzzy model.

c) Draw and explain Adaptive Neuro-Fuzzy Inference System (ANFIS) architecture. Show that a two-input first order Sugeno fuzzy model with two rules are equivalent to ANFIS architecture.

(6+6+6)

5.

a) Explain how partitions are evolving in Neuro-Fuzzy system.

b) Explain Stone-Weierstrass theorem in detail. Explain Algebraic Closure-Additive and Algebraic closure- Multiplicative in detail.

c) Explain Fuzzy Filtered Neural Network.

(6+6+6)

6.

a) Explain Inverse Learning in terms of Neuro-Fuzzy.

b) Explain Back-propagation through Time and Real Time through Real time Recurrent Learning through the case study of inverted pendulum system in Neuro-Fuzzy.

c) Explain how to evolve Neural Nets genetically.

(6+6+6)

7.

a) Draw and explain structure of Genetic-Fuzzy system. How knowledge bases and rules can be evolved in to Genetic Fuzzy system.

b) Explain Neuro-Genetic systems. Write down challenges with Neuro-evolution method.

c) Explain with neat sketch Genetic Algorithm cycle of reproduction.

(6+6+6)