Sl. No.

C9-R4 : SOFT COMPUTING

NOTE :
1. **Answer the Question number 1 which is compulsory and any four questions from Question number 2 to Question number 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

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

1. (a) Give an example of a problem that can be solved using hard computing and another example that can be solved using soft computing.

    (b) Explain the differences between Genetic algorithm and traditional methods.

    (c) What do you mean by Fitness Function in Genetic Modelling ? Explain with suitable example.

    (d) Explain Least Square Methods for system identification in brief.

    (e) Explain the concept of Neuro Fuzzy Modelling in brief.

    (f) Explain the concept of Rule extraction and evolution in Neuro- fuzzy modelling in brief.

    (g) What do you mean by Neuro fuzzy control in Neuro Fuzzy Modelling ? Explain in brief.   **(7x4)**

2. (a) Explain artificial Neural network with an example.

    (b) Explain Hill Climbing Problem.

    (c) Find the maximum value of the function $f(x) = x^2 - 5x + 6$ in the range [0, 5] using Hill Climbing.   **(6+6+6)**

3. (a) What are some challenges associated with genetic modeling and predicting the expression of complex traits ?

    (b) How can genetic modeling be used to study the evolution of populations and species over time ?

    (c) What strategies can be used to combine the inverse and deletion operators in a genetic algorithm to achieve better performance ?   **(6+6+6)**

4. (a) What is the difference between linear and nonlinear optimization, and when should each be used ?

    (b) What are some commonly used derivative-free optimization algorithms, and how do they work ?

    (c) What is the effect of the choice of the initial estimate on the convergence of a recursive least square estimator ?   **(6+6+6)**

5. (a) What are the best practices for training a neuro fuzzy model, and how can overfitting be avoided ?

(b) What are the limitations of the Cooperative Neuro-Fuzzy approach, and how can they be addressed ?

(c) What are some potential applications of the neuro-fuzzy approach in the field of robotics, and how could it improve robot performance and autonomy ?   **(6+6+6)**

6. (a) What is ANFIS, and how does it differ from traditional fuzzy systems and neural networks ?

(b) Can ANFIS be used for real-time rule extraction ? Justify your answer.

(c) How can reinforcement learning be integrated into a neuro-fuzzy control system for optimal control ?   **(6+6+6)**

7. (a) How does the choice of fuzzy inference system affect the performance of inverse learning in a neuro-fuzzy control system ?

(b) How are genetic algorithms used to optimize the parameters of a fuzzy system ?

(c) How can the interpretability of a genetic fuzzy neural network be improved ?

(6+6+6)

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