B.Tech Even Semester Examination, May, 2025

Computer Science & Engineering

(6th Semester)

Course No: CSE-603(4)

(Soft Computing)

Full Marks: 50

Pass Marks: 25

Time: 2 hours

Note:

1. Attempt any five questions.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

1 (a) Compare and contrast soft computing and hard computing paradigms. Explain with examples where each approach is more suitable. 5

(b) Explain the architecture of a feedforward neural network and the role of activation functions. 5

2. (a) Derive the perceptron learning rule and explain its convergence properties for linearly separable problems. 7.5

(b) How many hidden layers can there be in a neural network? 2.5

3. (a) Define membership functions. Compare triangular, trapezoidal, and Gaussian membership functions with diagrams and use cases. 7.5

(b) Define fuzzy linguistic variables. 2.5

4. (a) Design triangular membership functions for input variable Speed with linguistic values:

· Slow (0–40),

· Moderate (30–70),

· Fast (60–100).

Draw the graph and write the membership function expressions. 7.5

(b) Discuss bias and momentum. 2.5

5. (a) Suppose a dataset has 5 features. Represent feature subsets using binary strings (e.g., 11010). Apply one iteration of GA for feature selection:

· Initial population: {10101, 11100, 00110, 01111}

· Fitness (accuracy): {0.76, 0.85, 0.62, 0.81}

Perform tournament selection and one-point crossover between top two chromosomes. 7.5

(b) Discuss Crowded Binary Tournament Selection Algorithm. 2.5

6. Consider a problem with two objectives to minimize:

· $f1(x)=x2$,

· $f2(x)=(x–2)2$,

for $x \in [0,3]$.

List at least 5 candidate solutions and compute (f1, f2) values. Identify non-dominated solutions and plot an approximate Pareto front. 10

7. Given the following individuals and their objective values:

Individual	F1	F2
A	3	9
B	4	8
C	2	10
D	6	5
E	7	3

Compute crowding distances for individuals in the first front. 10

8. (a) Explain the backpropagation algorithm. 2.5

(b) Given a simple 2-layer network with:

· Input = 0.6,

· Target output = 0.9,

· Weight = 0.5,

· Learning rate $\alpha=0.1$\alpha = 0.1$\alpha=0.1$,

· Activation function: Sigmoid.

Perform one iteration of weight update using the backpropagation function:

$$\Delta w = \alpha.(t–o).\ f'(net).x$$

(Use $f'(net)=o(1–o)$, where o is the output from sigmoid) 7.5

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