2055

M.E. (Computer Science and Engineering)
Second Semester
CS-8203: Soft Computing

(Common with ME Comp. Sci. Cyber Security CSN 8202)

Time allowed: 3 Hours   Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 (Section-A) which is compulsory and selecting two questions each from Section B-C.
x-x-x

Section-A

Q1. a) Compare Supervised, Unsupervised, and Reinforcement Learning in the context of ANNs.   10

b) Explain the Delta rule in supervised learning.

c) Differentiate between Fuzzy Systems and traditional AI models?

d) List the advantages and limitations of Boltzmann Machines in deep learning.

e) What is the importance of maintaining population diversity in Genetic Algorithms?

Section-B

Q2. a) Define artificial intelligence. How can AI be used to detect and diagnose diseases such as cancer or   6
COVID-19?

b) What are Genetic Algorithms? Describe the steps involved in a Genetic Algorithm with an illustrative   4
example.

Q3. The McCulloch-Pitts Neuron is a fundamental building block of ANN.   10

a) Derive the mathematical model of a McCulloch-Pitts neuron and explain its activation function.

b) Show how an MP neuron can implement the logical AND, OR, and NOT functions.

Q4. a) Write short note on Learning Vector Quantization.   5

b) Explain how the Madaline network (Multiple Adaline) improves upon Adaline and can classify   5
linearly inseparable data.

Section-C

Q5. a) Explain the mathematical formulation of RBF neurons. How are basis functions selected in RBF   5
networks?

b) Describe the learning process in Boltzmann Machines. Explain how weights are updated using the   5
contrastive divergence algorithm.

Q6. a) A factory produces 30% defective items. A quality test detects defects with 85% accuracy, but also   5
incorrectly identifies 10% non-defective items as defective. If an item is found defective, what is the
probability that it is actually defective?

b) Explain how a fuzzy logic-based washing machine determines the washing time based on the dirt level
of clothes. Make suitable assumptions and derive effective rule-base.   5

Q7. a)Given a population with fitness values ($F1 = 4$, $F2 = 10$, $F3 = 6$, $F4 = 8$):   6

i)   Compute the selection probability for each individual.

ii) Simulate Roulette Wheel Selection with a random number $r = 0.55$.

b) Explain the role of Mutation in Genetic Algorithms. Why is it necessary?   4

x-x-x