

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: M.TECH
BRANCH: EEE**

**SEMESTER : I
SESSION : MO/2025**

SUBJECT: EE571 SOFT COMPUTING TECHNIQUES IN ELECTRICAL ENGINEERING

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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		CO	BL
Q.1(a) Explain the major components of soft computing in detail. How do these components complement one another when integrated within a hybrid intelligent system?	[5]	1	2
Q.1(b) What is Hybrid Intelligent Systems? Discuss the importance of multi-objective optimization in AI systems.	[5]	1	2
Q.2(a) Describe the structure of an artificial neuron and discuss the working mechanism of the back-propagation learning algorithm.	[5]	2	2
Q.2(b) What are Generalized Neuron (GN) models? Discuss their use in electrical load forecasting, supported with an appropriate example.	[5]	5	3
Q.3(a) Define a fuzzy set. Discuss key operations on fuzzy sets—union, intersection, complement, and α -cuts—and support your explanation with suitable examples.	[5]	2	2
Q.3(b) Discuss the membership functions. What key characteristics distinguish fuzzy sets from classical (crisp) sets?	[5]	2	3
Q.4(a) Describe different Defuzzification methods.	[5]	4	2
Q.4(b) For the two fuzzy sets \tilde{A}_1 and \tilde{A}_2	[5]	3	3
$\tilde{A}_1 = \left\{ \frac{0.3}{1} + \frac{0.7}{1.5} + \frac{0.3}{2} + \frac{0.15}{2.5} + \frac{0}{3} \right\}$ $\tilde{A}_2 = \left\{ \frac{1}{1} + \frac{0.4}{1.5} + \frac{0.6}{2} + \frac{0.1}{2.5} + \frac{0}{3} \right\}$			
Find (a) $\tilde{A}_1 \cup \tilde{A}_2$ (b) $\tilde{A}_1 \cap \tilde{A}_2$ (c) $\overline{\tilde{A}_1}$ (d) $\overline{\tilde{A}_2}$			
Q.5(a) Explain how a DC machine can be modelled using a fuzzy logic-based approach.	[5]	3	4
Q.5(b) Maximize the function $f(x) = x^2$ where $0 \leq x \leq 31$. Each chromosome is 5 bits long. Use binary encoding technique and single point crossover. Consider population size (n) = 4 and the initial population (x value) = 13, 24, 8, 19. Perform one generation of selection and single-point crossover. Assume suitable selection and crossover probabilities.	[5]	4	3