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

CLASS: B.TECH **SEMESTER : VI**
BRANCH: EEE **SESSION : SP/2025**

SUBJECT: EE449 ARTIFICIAL INTELLIGENCE FOR 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.

			CO	BL
Q.1(a)	Explain the components of Soft Computing in detail. How do they complement each other in a Hybrid Intelligent System?	[5]	1	2
Q.1(b)	Discuss the significance of multi-objective optimization in AI systems. Illustrate with an example where conflicting objectives are optimized.	[5]	1	2
Q.2(a)	Describe the structure of an artificial neuron and explain the working of the Back-Propagation Learning algorithm.	[5]	2	2
Q.2(b)	What are Generalized Neuron (GN) Models? Explain their application in Electrical Load Forecasting with a suitable example.	[5]	2	3
Q.3(a)	Define a fuzzy set. Explain operations on fuzzy sets such as union, intersection, complement, and α-cuts with suitable examples.	[5]	2	2
Q.3(b)	Discuss the methods of defining membership functions. What are the characteristics of fuzzy sets and how do they differ from classical sets?	[5]	3	3
Q.4(a)	Explain the complete process of modelling of DC Machine using the fuzzy logic approach.	[5]	4	3
Q.4(b)	In a fuzzy logic-based room temperature control system, the fuzzy controller determines the output for the heater power setting based on the following fuzzy membership values:	[5]	4	3

Heater Power Level (x_i) (%)	0	25	50	75	100
Membership Value $\mu(x_i)$	0.0	0.3	0.7	1.0	0.4

Using the Centroid (Center of Gravity) method, compute the crisp output that specifies the precise heater power percentage to be applied.

Q.5(a)	Explain the fundamental components of a Genetic Algorithm, including population size, crossover, mutation, and survival of the fittest. How do these components collectively contribute to the optimization process?	[5]	5	2
Q.5(b)	Maximise the function $$f(x) = x * \sin(10 * pi * x) + 1$$ where x values range from 0 to 1. Consider the population size n = 4 and the initial population as 4 individuals of your choice. Use binary encoding with 5 bits for representing x and crossover operator as single point crossover. Use the fitness function f(x) directly for selection and perform the computation up to one generation (selection, crossover, and mutation) only.	[5]	5	4

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