Reg. No.																

Question Paper Code	14512

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Second Semester

M.E. - Power Electronics and Drives

24PPEEL202 - SOFT COMPUTING TECHNIQUE

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	Swarm Intelligence systems are generally characterized by: a) Centralized control b) Localized interactions c) High precision requirements d) Lack of adaptability	1	K2	CO1
2.	Which model uses binary activation and does not learn weights automatically? a) Perceptron b) Adaline c) McCulloch-Pitts d) MLP	1	K1	CO1
3.	In backpropagation, if the learning rate is set too high, what practical effect occurs? a) Faster convergence with stable minima b) Overshooting and divergence from minima c) Slower convergence but stable learning d) No effect on training	1	K3	CO1
4.	Which network uses a combination of competitive and outstar learning? a) Hopfield b) ART c) Perceptron d) CPN	1	K1	CO2
5.	What is the primary characteristic of a Hopfield Network? a) Supervised training b) Feed-forward structure c) Recurrent (feedback) connections d) Unsupervised clustering	1	K2	CO2
6.	If vigilance is set too high in ART, what practical outcome occurs? a) Categories become too broad b) Categories become too specific, leading to overfitting c) Network fails to learn any categories d) Network ignores feedback loops	1	K3	CO2
7.	Which layer in the ART architecture is responsible for the competitive "Winner-Take-All" process? a) F1 Layer (Comparison field) b) Reset Module c) F2 Layer (Recognition field) d) Gain Control Unit	1	K1	CO3
8.	Which fuzzy logic variant is most suitable for nonlinear system modeling? a) Crisp logic b) Boolean logic c) Self-organizing fuzzy logic d) Classical control	1	K1	CO3
9.	In a fuzzy controller, which component converts a fuzzy set result (e.g., Centroid of Area) into a crisp, actionable control signal? a) Fuzzifier b) Rule Base c) Inference Engine d) Defuzzifier	1	K3	CO3
10.	What is the primary advantage of a Self-Organizing Fuzzy Logic Controller (SOFLC)? a) It only works on linear systems b) It has a constant membership function c) It requires pre-programmed expert rules d) It adjusts its own rules based on performance	1	K2	CO3
11.	A genetic algorithm uses a chromosome represented as [1, 0, 1, 1, 0]. After applying a bit-flip mutation on the third gene, what will the new chromosome be? a) [1, 0, 0, 1, 0] b) [0, 0, 1, 1, 0] c) [1, 0, 1, 0, 0] d) [1, 0, 1, 1, 1]	1	K3	CO4

12.	In the procedure of an evolutionary algorithm, what is the correct sequence of operations? a) Selection, Mutation, Crossover, Evaluation b) Initialization. Evaluation, Selection, Crossover/Mutation c) Mutation, Crossover, Evaluation, Selection d) Initialization, Selection, Mutation, Evaluation	*1*	*K2*	*CO4*
13.	What does the "fitness function" do? a) Defines the number of generations b) Measures how good a solution is c) Performs crossover d) Initializes the population	*1*	*K1*	*CO4*
14.	A genetic algorithm uses single-point crossover. Parents are [111111] and [000000]. If the crossover point is chosen after the first bit, what are the possible offspring? a) [100000] and [011111] b) [111111] and [000000] c) [110000] and [001111] d) [101010] and [010101]	*1*	*K3*	*CO4*
15.	You are optimizing fuzzy membership functions for a nonlinear control system. Which approach would be most effective? a) Manual tuning b) Genetic algorithms c) Particle swarm optimization only d) Crisp logic approximation	*1*	*K3*	*CO5*
16.	Which MATLAB tool would best be used to create an adaptive system that adjusts its membership functions based on input-output training data? a) Neural Network Toolbox b) ANFIS Toolbox c) FLC Toolbox d) Curve Fitting Toolbox	*1*	*K2*	*CO5*

PART – A (ii) (Short Answer Questions)
(8 × 3 = 24 Marks)
Answer ALL Questions

17.	Determine the number of weights required for a fully connected feedforward network with a given number of input, hidden and output units.	*3*	*K3*	*CO1*
18.	Construct the architecture of multilayer feedforward neural networks and discuss the role of activation functions.	*3*	*K3*	*CO1*
19.	Compare the stability characteristics of Hopfield networks and Boltzmann machines in associative memory applications.	*3*	*K3*	*CO2*
20.	Differentiate between ART networks and CPN networks.	*3*	*K4*	*CO2*
21.	Represent any two fuzzy set operation using Venn diagram.	*3*	*K3*	*CO3*
22.	State the importance of evolutionary programming.	*3*	*K3*	*CO4*
23.	Identify the five preparatory steps involved in genetic programming.	*3*	*K3*	*CO4*
24.	Classify the shapes of the membership function available in fuzzy logic tool box.	*3*	*K4*	*CO5*

PART - B (Descriptive Answer Questions)
(5 × 12 = 60 Marks)
Answer ALL Questions

25.	a)	A neural network is required to classify two categories of input patterns. Explain how a perceptron model can be used for this classification. Illustrate the learning rule and weight update process with an example.	*12*	*K3*	*CO1*
		OR			
	b)	Apply the back propagation learning algorithm to train a multilayer feed forward neural network for a pattern classification problem.	*12*	*K3*	*CO1*
26.	a)	Analyze the operation of a Hopfield network in retrieving stored patterns when a partially corrupted input pattern is applied.	*12*	*K4*	*CO2*
		OR			
	b)	Consider the two pairs of patterns with bipolar symbols A1= (+1, +1, -1) and B1= (-1, +1, -1, +1); A2= (+1, -1, +1) and B2= (+1, -1, +1, -1). Calculate the weights for 2 *X* 2 Bidirectional associative memory.	*12*	*K4*	*CO2*

27.	a)	Let A and B be two fuzzy relations defined here: A= 0.4 0.8 0.3 B = 0.8 0.7 0.4 0.6 1.0 0.2 0.8 0.9 0.5 0.0 1.0 0.2 Each element inside the matrix depicts the membership value. Compute the result of A O B using max-min composition.	*12*	*K3*	*CO3*
		OR			
	b)	Construct the working of a fuzzy logic control system by examining fuzzification, inference mechanism, and defuzzification stages for a nonlinear system.	*12*	*K3*	*CO3*
28.	a)	Examine the effectiveness of Genetic Algorithms in solving continuous and multi-objective optimization problems.	*12*	*K4*	*CO4*
		OR			
	b)	Classify the procedure involved in using Evolutionary programming for multi-objective problems.	*12*	*K4*	*CO4*
29.	a)	Apply Neuro-Fuzzy systems and evaluate the optimization of membership functions using Genetic Algorithms with respect to system performance.	*12*	*K3*	*CO5*
		OR			
	b)	Apply the role of Support Vector Machines and Particle Swarm Optimization in hybrid soft computing applications.	*12*	*K3*	*CO5*