



B.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Sixth Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

U18EIE0010: Advanced Intelligent Controllers

COURSE OUTCOMES

CO1: Apply Various Soft Computing Frame Works.

CO2: Design Of Various Neural Networks.

CO3: Use of Fuzzy Logic.

CO4: Apply Genetic Programming.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Categorize single-layer net and multilayer net. | CO1 | [K ₂] |
| 2. Implement a logical AND gate using McCulloch Pitts neuron. | CO1 | [K ₃] |
| 3. List the activation functions used in ANN. | CO2 | [K ₁] |
| 4. Compare supervised learning with unsupervised learning. | CO2 | [K ₂] |
| 5. Differentiate between the fuzzy set and the crisp set. | CO3 | [K ₂] |
| 6. List out the various types of fuzzy membership functions. | CO3 | [K ₁] |
| 7. What is the role of the fitness function in the genetic algorithm? | CO4 | [K ₁] |
| 8. Define the term mutation in the genetic algorithm | CO4 | [K ₁] |
| 9. Consider the problem of finding the shortest route through several cities, such that each city is visited only once and, in the end, returns to the starting city (the Travelling Salesman problem). Suppose that to solve this problem we use a genetic algorithm, in which genes represent links between pairs of cities. For example, a link between London and Paris is represented by a single gene 'LP'. Let's also assume that our direction is unimportant, so LP = PL. Determine how many genes will be in the alphabet of the algorithm. | CO4 | [K ₃] |
| 10. Mention the three types of hybrid soft computing systems. | CO4 | [K ₁] |

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Differentiate between biological neurons and artificial neurons based on the structure and function of a single neuron. 8 CO1 [K₂]
- b) Differentiate the features of soft computing and hard computing. 8 CO1 [K₂]
12. a) Draw a simple artificial neuron and discuss the calculation of net input. 8 CO2 [K₂]
- b) Enumerate linear separability. Why can a single layer of perceptron not be used to solve linear inseparable problems? 8 CO2 [K₂]
13. a) State the algorithm of Hebb Net with its architecture. 8 CO2 [K₂]
- b) Discuss in detail the architecture and algorithm of the standard backpropagation algorithm. 8 CO2 [K₂]
14. a) Consider the two fuzzy sets. CO3 [K₃]
- $$A = \left\{ \frac{1}{1.0} + \frac{0.75}{1.5} + \frac{0.3}{2.0} + \frac{0.15}{2.5} + \frac{0}{3.0} \right\}, B = \left\{ \frac{1}{1.0} + \frac{0.6}{1.5} + \frac{0.2}{2.0} + \frac{0.1}{2.5} + \frac{0}{3.0} \right\}$$
- (i) Perform complement over fuzzy set A and B, Union, Intersection, and Difference. 4
- (ii) Verify De Morgan's Principle. 4
- b) State and discuss in brief any four properties the of fuzzy set. 8 CO3 [K₂]
15. a) Enumerate the architecture of Fuzzy Logic Control (FLC) with a neat sketch and discuss in detail the major components of FLC. 8 CO3 [K₂]
- b) Discuss the basic concepts of the genetic algorithm and the steps involved in it with a simple flowchart. 8 CO4 [K₂]
16. a) Suppose a genetic algorithm uses chromosomes of form $x = a b c d e f g h$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as:

$$f(x) = (a + b) - (c + d) + (e + f) - (g + h)$$

and let the initial population consist of four individuals with the following chromosomes:

$$x1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$$

$$x2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$$

$$x3 = 2\ 3\ 9\ 2\ 1\ 2\ 8\ 5 \quad 4$$

$$x4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$$

1) Evaluate each individual fitness function, showing all your workings, and arrange them in order with the fittest first and the least fit last. (4 Marks) 4

2) Perform the following crossover operations:

(i) Cross the fittest two individuals using a one-point crossover at the middle point. (2 Marks)

(ii) Cross the second and third fittest individuals using a two-point crossover (points b and f). (2 Marks)

b) Summarize in brief the simplified fuzzy ARTMAP with the necessary diagram. 8 CO4 [K₂]
