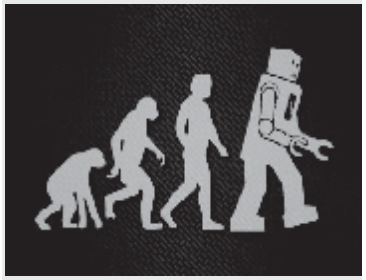
# 16EE407 AI TECHNIQUES IN ELECTRICAL ENGINEERING



Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

Total Hours :

| L | T | P |
|---|---|---|
| 45 | - | - |

| WA/RA | SSH/HSH | CS | SA | S | BS |
|---|---|---|---|---|---|
| 10 | 30 | 2 | 5 | 5 | 5 |

## Course Description and Objectives:

This course deals with concepts of artificial intelligence such as artificial neural networks, ,fuzzy logic and genetic algorithms for solving electrical engineering problems. The objective of the course is to understand the operation of artificial neuron models, various topologies of artificial neural networks, fuzzy logic, genetic algorithm to model and study the behaviour of electrical systems.

## Course Outcomes:

The student will be able to:

- understand and apply fuzzy logic technique to optimization of electrical engineering problems.
- understand and apply the concepts of artificial neural networks to optimization of electrical engineering problems.
- apply genetic algorithms for optimization of electrical engineering problems.

## SKILLS:

- ✓ *Design neural network for simple digital logic circuit.*
- ✓ *Design simple neural network for solving electrical engineering problems.*
- ✓ *Design fuzzy logic controller for solving electrical engineering problems.*
- ✓ *Implement genetic algorithm for solving electrical engineering problems.*

**ACTIVITIES:**

- *Realize simple Boolean expressions using an artificial neural network.*
- *Design an artificial neural network for speed control of DC Motor*
- *Design an artificial neural network for speed control of a ceiling fan.*
- *Design fuzzy logic controller for speed control of DC Motor*
- *Design fuzzy logic controller for speed control of AC Motor*
- *Implement genetic algorithm for speed control of DC Motor*

**UNIT - 1** **L-9**

**FUNDAMENTALS OF NEURAL NETWORKS :** Working of biological neuron, Model of an artificial neuron, Basic concepts of neural networks, Neural network architectures, Characteristics of neural networks, Learning methods, Taxonomy of neural network architectures, Broad application areas in electrical engineering.

**UNIT - 2** **L-9**

**BACKPROPAGATION NETWORKS :** Architecture of a backpropagation network, Backpropagation learning, Illustration, Applications, Effect of tuning parameters of the backpropagation neural network, Selection of various parameters in BPN.

**UNIT - 3** **L-9**

**CLASSICAL AND FUZZY SETS:** Introduction to classical sets - Properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, Properties, Fuzzy relations, Cardinalities, Membership functions.

**UNIT - 4** **L-9**

**FUZZY LOGIC SYSTEM COMPONENTS:** Fuzzification, Membership value assignment, Development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods, Fuzzy logic applications - Fuzzy logic control and fuzzy classification; Application of fuzzy logic in basic problems of electrical engineering.

**UNIT - 5** **L-9**

**GENETIC ALGORITHMS :** History, Basic concepts, Creation of offsprings, Working principle, Encoding, Fitness function, Reproduction, Inheritance operators, Cross over, Inversion and Deletion, Mutation operator, Bit-wise operators, Generational cycle, Convergence application of GA in power systems and power electronics (Qualitative treatment only).

**TEXT BOOKS:**

1. Rajasekharan and Pai, “Neural Networks, Fuzzy logic, and Genetic algorithms: Synthesis and Applications”, 1st edition, Prentice Hall of India Publication, 2009.
2. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, 1st edition, Jaico Publishing House, 2006.

**REFERENCE BOOKS:**

1. James A Freeman and Davis Skapura, “Neural Networks”, 1st edition, Pearson, 2008.
2. Simon Haykins, “Neural Networks”, 2nd edition, Pearson Education, 2009.
3. Bork Kosko, “Neural Networks and Fuzzy Logic System” 1st edition, Prentice Hall of India Publications, 2009.