**B.Tech III Year I Semester**
### JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA
### 19AEE54c- AI TECHNIQUES IN ELECTRICAL ENGINEERING
**(Professional Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**
- To get exposed to a few Intelligent Control Techniques
- To learn about Artificial Neural Network based Estimators
- To learn about Fuzzy Logic Control System as one of the ICT
- To learn about a few evolutionary algorithms
- To implement the various ICTs for linear and non

### UNIT – I: Fundamentals of AI                                                      10 Hrs
AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- To get exposed to fundamentals of AI                                               **L1**
- To understand about architecture of Intelligent Control                            **L2**

### UNIT – II: ANN based Controllers and Estimators                                  10 Hrs
Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; Training the neural network- Supervised and unsupervised learning concepts; Hopfield network; Self- organizing map (SOM), Neural Network based controllers and estimators design

**Learning Outcomes:**
At the end of this unit, the student will be able to
- To learn about basic concepts of ANN                                               **L1**
- To develop mathematical models for various controllers of single and multilayer Perceptrons      **L2**

### UNIT – III: Fuzzy Logic Control System                                           10 Hrs
Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule bases; defuzzification, Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- To learn about fundamentals of Fuzzy Logic Control systems                         **L1**
- To be able to understand knowledge and rule bases in Fuzzy Logic Systems           **L2**

### UNIT – IV: Evolutionary Algorithms                                               10 Hrs
Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS). Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures

**Learning Outcomes:**
At the end of this unit, the student will be able to
- To learn about basic concepts of evolutionary algorithms                          **L1**
- To learn about ANFIS                                                               **L2**

**UNIT – V Case Studies**                                                                                          **10 Hrs**

ANN Applications to Load Flow Studies, Applications of Fuzzy Controller for Load Frequency Control – Single Area System , Applications of ANFIS Controller for Water Tank Control, Applications of Evolutionary Algorithms for Economic Load Dispatch.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To identify case studies related to linear and non-linear dynamic systems                **L1**
- To be able to implement control strategies with Neural Networks for the identified        **L2**

**Text Books:**

1. Padhy.N.P.; "Artificial Intelligence and Intelligent Systems"; Oxford University Press, 2005
2. Jacek. M. Zurada; "Introduction to Artificial Neural Systems", JaicoPublishing House, 1 st Edition, 1994
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3 rd Edition, WILEY Publications, 2011
4. S.N. Sivanandam and S.N. Deepa, Introduction to Genetic Algorithms, Springer Publications, 2008

**Reference Books:**

1. J.S.R. Jang, C.T.Sun and E. Mizutami, "Neuro-Fuzzy & Soft Computing", Pearson India Education Services Pvt. Ltd.
2. LaurereFauselt, "Fundamentals of Neural Networks", Pearson India Education Services Pvt. Ltd..

**Course Outcomes:**

At the end of this Course the student will be able to

- To get familiarity of various Intelligent Control Techniques                              **L1**
- To be able to design the controllers and estimators using ANN                            **L2**
- To be able to model and develop control schemes with Fuzzy Logic rule bases              **L3**
- To be able to implement an evolutionary algorithm suitable to optimize and design a given system specifications                                                                **L4**
- To be able to use MATLAB tool boxes for implementation of various ICTs for system modeling, control schemes and to design estimators                                          **L5**