

Subject Code: 1ET2130301	Subject Title: Elective:III- Artificial Intelligence Applications to Power System
Pre-requisite Subject	Basic concepts and principles of Power Systems Analysis.

Course Objective: After learning the course, the students should be able to:

- This course provides detailed concepts of various soft computing techniques which can be useful in solving the problems of power systems engineering. Applications related to function approximation; control of frequency/voltage and power system optimization will be covered.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	-	2	6	24	60	16	40	12	30	08	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction: Introduction, definition of AI difference between soft computing techniques and hard computing systems, expert systems brief history of ANN, Fuzzy and GA.	04	10%
2	Artificial Neural Networks: Introduction, History of neural network research, Basic concepts of Neural Networks, Human brain, Model of Artificial Neuron, Neural Network architectures, Single layer feed forward Network, Multi-layer feed forward network, recurrent networks, characteristics of NN, Learning Methods Perceptron. Architecture of Back propagation Network, Nonlinear activation operators, single and multilayer ANN, learning methods like Back propagation etc. training and testing of ANN.	10	25%
3	Fuzzy Logic: Introduction, Comparison between Fuzzy and crisp logic, Fuzzy sets, Membership function, Basic fuzzy set operations, properties of Fuzzy set, fuzzy relations, Fuzzy inference system, Mamdani, Sugeno, Fuzzy rule based system, defuzzification methods.	08	20%
4	Genetic Algorithm: Working principles, difference between GA and traditional methods, Different types of coding methods, fitness function, different types GA operators 1. Roulette wheel selection 2. Stochastic remainder Roulette wheel selection, Rank selection, Tournament selection and stochastic universal sampling, different types of cross over methods in GA, Mutation, Schema theorem, elite preserving operator, GA's for constrained optimization, understating of working of GA using flow chart.	10	25%
5	Applications of ANN, Fuzzy logic and GA in power systems operation and control: for solving problems of load forecasting, voltage control, voltage stability, security assessment, feeder load balancing, AGC, Economic load dispatch, Unit commitment, Condition monitoring.	10	20%

Course Outcome:

After learning the course, the students should be able to:

1. Understand how the soft computing techniques can be used for solving the problems of power systems operation and control.
2. Design of ANN based systems for function approximation used in load forecasting.
3. Design of Fuzzy based systems for load frequency control in power systems
4. Solve problem of Optimization in power systems.

List of Text Books:

1. Artificial intelligence techniques in power systems by KEVIN WARWICK, ARTHUR EKWUE RAJ AGRAWAL
2. Multi-objective Optimization using Evolutionary Algorithms By Kalyanmoy Deb Willey Publication

List of Reference Books:

1. Neural Networks, Fuzzy logic and Genetic algorithms By S. Rajasekaran, G. A. Vijayalakshmi Pai PHI publication,
2. Optimization for Engineering Design by Kalyanmoy Deb PHI publication

List of Experiments:

1. Introduction to MATLAB and various tool boxes.
2. USE of MATLAB tool box for ANN.
3. USE of MATLAB tool box for Fuzzy Logic.
4. USE of MATLAB tool box for Optimization.
5. Use of MATLAB Programming for implementing NN.
6. Use of MATLAB Programming for generating different types of activation functions in ANN
7. Use of MATLAB Programming for training and testing of ANN.
8. Use of MATLAB for load forecasting using ANN
9. MATLAB program for generating different types of Fuzzy membership functions.
10. Use of MATLAB for feeder load balancing problem by fuzzy logic.
11. MATLAB program for solving standard benchmark functions using Genetic algorithm.
12. MATLAB program for solving economic load dispatch problem using GA.

Students may use other software's such as C, C++ etc in lieu of MATLAB

List of Open Source Software/learning website:

MATLAB Software. C, C++, SCILAB

NPTEL courses related to power system analysis and Soft Computing.