GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: ELECTRICAL ENGINEERING
SUBJECT NAME: AI TECHNIQUE
SUBJECT CODE: 3710721
M.E. 1st SEMESTER

Type of course: Program Elective I

Prerequisite: Knowledge of computer programming

Rationale:
This course provides detailed concepts of various Artificial Intelligence Techniques which can be useful in solving the problems of Electrical Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction** • The AI Problems, The Underlying Assumption, What is An AI Techniques? • Difference between soft computing techniques and hard computing systems • Expert systems brief history of ANN, Fuzzy and GA	4	10
2	**Artificial Neural Networks** Transient system model • Introduction, • History of neural network research, • Basic concepts of Neural Networks, Human brain, • Model of Artificial Neuron, • Neural Network architectures, Perceptron, Single layer feed forward Network, Multi layer feed forward network, recurrent networks, Feedback networks and Radial Basis Function Networks • Characteristics of NN, Learning Methods, LMS and Back Propagation Algorithm, training Examples of models • Advances in Neural networks	**10**	20
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 interference system, Mamdani, Sugeno, Fuzzy rule based system, • Defuzzification methods, Fuzzy Neural Networks	**8**	18

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	20
5	**Applications** • Applications of Above Techniques in power systems operation and control for solving problem of Load forecasting, voltage control, voltage stability, security assessment, feeder load balancing, AGC, Economic load dispatch, Unit commitment. Condition monitoring	14	32

Reference Books:

1. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall,
2. Neural Networks, Fuzzy logic and Genetic algorithms By S. Rajasekaran, G. A. Vijayalakshmi Pai PHI publication,
3. J M Zurada , "An Introduction to ANN",Jaico Publishing House
4. Simon Haykins, "Neural Networks", Prentice Hall
5. Artificial intelligence techniques in power systems by KEVIN WARWICK, ARTHUR EKWUE RAJ AGRAWAL
6. Timothy Ross, "Fuzzy Logic with Engg. Applications", McGraw. Hill
7. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication 5. Golding, "Genetic Algorithms", Addison-Wesley Publishing Com
8. Optimization for Engineering Design by Kalyanmoy Deb PHI publication
9. Multi-objective Optimization using Evolutionary Algorithms By Kalyanmoy Deb Willey Publication
10. Students are encouraged to read various research papers of peer reviewed journals for application related topics and
11. The Help Available in the MATLAB

Course Outcome:

Students will be able to:

1 Analyze how Different 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

Suggested 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 softwares such as C, C++ etc in lieu of MATLAB

Major Equipment:

List of Open Source Software/learning website:

MATLAB (Trial version): Software is useful for simulation and analysis

https://onlinecourses.nptel.ac.in/noc18_cs13