

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS & ELECTRICAL DRIVES (45)

INTELLIGENT CONTROL

SUBJECT CODE: 2724506

SEMESTER: II

Type of course: Engineering Science (Electrical)

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
		PA	ALA		ESE	OEP				
3	2#	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	UNIT I INTRODUCTION Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.	6	15
2	UNIT II ARTIFICIAL NEURAL NETWORKS Concept of Artificial Neural Networks and its basic mathematical model, McCulloch Pitts neuron model, simple perceptron, Adeline and Madeline, Feed-forward Multilayer Perceptron. Training, validation, cross-validation, testing the neural network. Data Processing: Scaling, Fourier transformation, principal component analysis and wavelet transformations. Hopfield Network, Self-organizing network and recurrent network. Neural Network based controller.	10	30
3	UNIT III GENETIC ALGORITHM Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.	6	15
4	UNIT IV FUZZY LOGIC SYSTEM Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modelling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modelling and control schemes for nonlinear systems. Adaptive neuro fuzzy inference system. Fuzzy logic control for nonlinear time-delay system.	10	20

5	UNIT V APPLICATIONS Tuning parameters of PI controller using GA. Identification and control of linear and nonlinear dynamic systems using Neural Network. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller in standard software. Stability analysis of fuzzy control system.	8	20
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Reference Books:

1. Panos J. Antsaklis and Kevin M. Passino, "An Introduction to Intelligent and Autonomous Control", Kluwer Academic Publishers, 1993.
2. Hagan, Martin T., Howard B. Demuth, and Mark H. Beale., "Neural network design", Vol. 1. Boston: Pws, 1996.
3. Jacek. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
4. Kosko,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.
5. Klir G.J. & Folger T.A. "Fuzzy sets, uncertainty and Information", Prentice-Hall of India Pvt. Ltd., 1993.
6. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
7. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.

Course Outcome:

After learning the course the students should be able to:

1. Understand concepts and philosophies of intelligent control.
2. Understands and apply different tools for intelligent control e.g. ANN, GA, Fuzzy Logic.

List of Experiments:

1. Write a program to generate the different Membership Functions of Fuzzy Logic.
2. Write a program for addition, difference, product and division of two membership functions of Fuzzy Logic Using.
3. Develop a Fuzzy Interface System for Restaurant Tipping.
4. To Perform the Fuzzy Logic Control for Two Inputs.
5. Write a program for Single Layer and Multi-Layer Feed Forward Neural Network.
6. Find optimum value of a nonlinear function by Genetic Algorithm.
7. To perform Load Forecasting using Artificial Neural Network.

Design based Problems (DP)/Open Ended Problem:

Course coordinator has to define at least 3 open ended problems related to the course.

Major Equipment:

Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.

List of Open Source Software/learning website:

Rlab, Octave, Scilab.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website