GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (COMMUNICATION SYSTEMS ENGG) (05)
ARTIFICIAL NEURAL NETWORKS
SUBJECT CODE: 2730503
M.E. SEM-III

Type of course: Major Elective-IV

Prerequisite: Higher Engineering Mathematics e.g. linear algebra, multivariate calculus and Probability theory, Fundamental knowledge of signals and systems along with types, Mathematical representation of signals and system modeling in time as well as frequency domain. Transforms especially like Laplacian, Fourier and Z. Artificial Intelligence and Control system Engineering.

Rationale:
An Artificial neural network is an abstract simulation of real nervous system and its study corresponds to growing interdisciplinary field which consider the systems as adaptive, distributed and mostly nonlinear, three of elements found in real applications. The ANN's are used in many important engineering and scientific applications, some of these are, signal enhancement, noise cancellation, pattern classification, system identification, prediction and control. Besides they are used in many commercial products such as modems, image processing and recognition systems, speech recognition and bio medical instrumentation among others.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Contents:

Sr. No.	Contents	Total Hrs	% Weightage
1	Introduction to ANN Features , structure and working of Biological Neural Network , Trends in Computing Comparison of BNN and ANN	**4**	**10**
2	Basics of Artificial Neural Networks - History of neural network research, characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture	**6**	**15**
3	Backpropagation networks : (BPN) Architecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.	**6**	**14**
4	Activation & Synaptic Dynamics : Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.	**4**	**9**
5	Basic functional units of ANN for pattern recognition tasks: Basic feed forward, Basic feedback and basic competitive learning neural network.	**4**	**9**

	Pattern association, pattern classification and pattern mapping tasks.		
6	a) Feedforward neural networks – - Linear responsibility X-OR problem and solution. - Analysis of pattern mapping networks summary of basic gradient search methods. b) Feed back neural networks Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning	**6**	**14**
7	Competitive learning neural networks : Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.	**6**	**14**
8	Applications of ANN : Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters. NET Talk: to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation	**6**	**15**
	Total	**42**	**100**

Books:

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. S. Raj sekaran, Vijayalakshmi Pari - Neural networks, Fuzzy logic and Genetic Algorithms
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005
4. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995
5. Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press, 1990
6. Journal of Artificial neural networks, Volume 1 – Ablex Publishing corporation , 1994

Course Outcome:

By the end of this course, the student should be able to do the followings

1. To organize synaptic connectivity as the basis of neural computation and learning
2. To learn the ideological basics of artificial neural networks
3. To learn the origins of artificial neural networks
4. To know some application of artificial neural networks
5. To identify the different structures of artificial neural networks.
6. Perceptron and dynamical theories of recurrent networks including amplifiers, attractors, and hybrid computation would be studied.
7. To learn how to design and how to supervised and unsupervised artificial neural networks

List of Experiments:

Based on above contents

Design based Problems (DP)/Open Ended Problem:

1. Data fitting, clustering and pattern recognition using neural network toolbox in MATLAB.
2. Design neural network to identify and control nonlinear systems using MATLAB.

C. List of Software:

Matlab

Learning website:

www.ocw.mit.edu

www.learnartificialneuralnetworks.com

www.softcomputing.net

www.neural-forecasting.com

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.