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By K B Hemanth Raj

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ARITIFICAL NEURAL NETWORKS

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**17EC653**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives: The objectives of this course are:

- Understand the basics of ANN and comparison with Human brain
- Provide knowledge on Generalization and function approximation and various architectures of building an ANN
- Provide knowledge of reinforcement learning using neural networks
- Provide knowledge of unsupervised learning using neural networks.

Module-1

Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – **Architecture**: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.**L1, L2**

Module-2

Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm. **L1, L2, L3**

Module-3

Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory,Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.**L1, L2, L3**

Module-4

Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.**L1, L2, L3**

Module-5
Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.**L1, L2, L3**
Course Outcomes: At the end of the course, students will be able to: 1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling. 2. Understand the concepts and techniques of neural networks through the study of important neural network models. 3. Evaluate whether neural networks are appropriate to a particular application. 4. Apply neural networks to particular application. 5. Analyze the steps needed to improve performance of the selected neural network.
Text Book: **Neural Networks A Classroom Approach**– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.
Reference Books: 1. **Introduction to Artificial Neural Systems-**J.M. Zurada, Jaico Publications 1994. 2. **Artificial Neural Networks-**B. Yegnanarayana, PHI, New Delhi 1998.