Neural Networks

Course Name: Neural Networks.
Course Code: ITF309
Credit hours: 3
Knowledge Domain: IT foundations.
Prerequisite(s): Automata Models (CAS205)- System and Operations Research (GEN211)

Learning Objectives

Upon completion of this course, the student will be able to:

1. Grasp the neural networks for pattern classification and association.
2. Acquire the basic concepts of competition-based neural nets.
3. Comprehend architecture& algorithms for Adaptive Resonance Theory.
4. Apply back propagation for multilayer neural nets.

Learning Outcomes

1. Grasping the use of neural nets for pattern recognition problems.
2. Acquaintance with Kohonen self-organizing maps, Adaptive Resonance Theory and back propagation in multilayer neural nets.

Overview and Syllabus

Introduction. Neural nets for pattern classification. Pattern association neural nets. Competitive-based neural nets. Adaptive resonance theory. Back propagation neural nets.

Course Outline

	Topic
1	**Module 01: Introduction to Neural Networks** Introduction Objectives **Lesson 01:** Overview of Neural Networks **Lesson 02:** Biological and Artificial Neuron Model **Lesson 03:** Artificial Neuron Structures **Lesson 04:** Types of Activation Function **Lesson 05:** Properties and Applications of Neural Networks Summary Assessment

2	**Module 02: Neural Network Structures** Introduction Objectives **Lesson 01:** Network Architecture **Lesson 02:** Threshold Logic Units (TLU) **Lesson 03:** Decision Surface Summary Assessment
3	**Module 03: Learning Process And Rosenblatt's Perceptron** Introduction Objectives **Lesson 01:** Learning Process in Neural Networks **Lesson 02:** Rosenblatt's Perceptron Learning Rule **Lesson 03:** ILLustrative Example 1 **Lesson 04:** ILLustrative Example 2 - And Problem **Lesson 05:** Perceptron Limitations Summary Assessment
4	**Module 04: Associative Memory** Introduction Objectives **Lesson 01:** Introduction To Associative Memory **Lesson 02:** Hebbian learning rule **Lesson 03:** Linear Associative Memory Network **Lesson 04:** Storage Capacity Summary Assessment
5	**Module 05: LMS Algorithm For Single Layer Network** Introduction Objectives **Lesson 01:** Introduction **Lesson 02:** Adaline(Adaptive Linear Neuron) Networks **Lesson 03:** Derivation of LMS Algorithm. **Lesson 04:** Example of LMS Algorithm **Lesson 05:** Limitation Of Adaline **Lesson 06:** Madaline Multilayer Net Summary Assessment
6	**Module 06: Multilayer Perceptron And Back-Propagation Algorithm – Part I** Introduction Objectives **Lesson 01:** Multilayer Perceptrons Networks **Lesson 02:** Back-Propagation Algorithm **Lesson 03:** Derivative of the Back-Propagation Algorithm **Lesson 04:** Activation Functions **Lesson 05:** Graphical Description of the Bp Algorithm

	Summary Assessment
7	**Module 07: Multilayer Perception And Back-Propagation Algorithm - Part II** Introduction Objectives **Lesson 01:** XOR Problem **Lesson 02:** Local Minima Problem **Lesson 03:** Overtraining Problem **Lesson 04:** Backpropagation Improvement **Lesson 05:** Practical Considerations Summary Assessment
8	**Module 08: Unsupervised learning Neural Nets** Introduction Objectives **Lesson 01:** Fixed-Weight Competitive Nets **Lesson 02:** Competitive Learning **Lesson 03:** Self-Organizing Map **Lesson 04:** Kohonen Self-Organizing Map **Lesson 05:** Illustrative Example For SOM Summary Assessment
9	**Module 09: Adaptive Resonance Theory (ART)** Introduction Objectives **Lesson 01:** Adaptive Resonance Theory **Lesson 02:** ART1 Network **Lesson 03:** Illustrative Example **Lesson 04:** ART Extensions And ART2 Summary Assessment