Course Code CSA4002	Artificial Neural Networks	Course Type	LTP
		Credits	4

Course Objectives:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.
- It deals with Associate Memories and introduces single and multi-layer perception networks.

Course Outcomes:

At the end of the course, students should able to

- Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
- Perform learning process models.
- Develop different single layer Perception learning algorithms
- Develop different multiple layer Perception learning algorithms
- Develop associative memory model.

Student Outcomes (SO): a, b, c, l

a. An ability to apply the knowledge of mathematics, science and computing appropriate to the discipline.

b. An ability to analyze a problem, identify and define the computing requirements appropriate to its solution.

c. An ability to design, implement and evaluate a system / computer-based system, process, component or program to meet desired needs.

l. An ability to apply mathematical foundations, algorithmic principles and computer science theory in the modelling and design of computer-based systems (CS).

Module No.	Module Description	No.of Hours	SO
1	**Introduction:** Introduction to Neural Networks: Neural Network, Human Brain, Models of Neuron, Neural networks viewed as directed graphs, Biological Neural Network, Artificial neuron, Artificial Neural Network architecture, ANN learning, analysis and applications, Historical notes.	7	a, b, c
2	**Learning Processes:** Learning Processes: Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	9	a, b, c
3	**Single layer Perception:** Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	9	a,b, c
4	**Multi-Layer Perceptron Networks:** Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm.	9	a,b,c
5	**Associative Memories:** Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. **Architecture of Hopfield Network:** Discrete and Continuous	9	a, b, c

	versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Processidentification, control, faultdiagnosis.		
5	**Guest Lecture on Contemporary Topics**	**2**	
	Total Hours:	**45**	

Mode of Teaching and Learning: *Flipped Class Room, Activity Based Teaching/Learning, Digital/Computer based models, wherever possible to augment lecture for practice/tutorial and minimum 2 hours lectures by industry experts on contemporary topics*

Mode of Evaluation and assessment:
The assessment and evaluation components may consist of unannounced open book examinations, quizzes, student's portfolio generation and assessment, and any other innovative assessment practices followed by faculty, in addition to the Continuous Assessment Tests and Term End Examinations.

Text Book(s):

1.	Simon Haykins, "Neural Network- A Comprehensive Foundation", Pearson Prentice Hall, 2nd Edition, 1999.
2.	Zurada and Jacek M, "Introduction to Artificial Neural Systems", West Publishing Company, 1992.

Reference Book(s):

1.	Vojislav Kecman,"Learning & Soft Computing", Pearson Education, 1st Edition, 2004.
2.	M T Hagan, H B Demoth, M Beale, "Neural Networks Design", Thomson Learning, 2002.
3	Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004.
4	Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
5	S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.

Indicative List of Experiments

No.	Description of Experiment	SO
1	Study of Artificial Neural Network	**a,b,c**
2	Write a Program for Matrix Addition	**a,b,c**
3	Write a Program for Matrix Multiplication	**a,b,c**
4	Write a Program for Matrix Transpose	**a,b,c**
5	Write a Program using Perceptron Neural Network to recognize even and odd numbers. Given numbers are in ASSCI form 0 to 9	**a,b,c**
6	Write a Program for Delta rule	**a,b,c**
7	Write a Program for pattern reorganization	**a,b,c**
8	Write a Program for Bidirectional Associative Memory with two pairs of vector	**a,b,c**
9	Write a Program for Hopfield Neural Network	**a,b,c**
10	Write a Program to Match the Input Pattern	**a,b,c**
11	Write a prolog program to implement back propagation algorithm.	**a,b,c**
12	Implementation of multilayer perceptron	**a,b,c**

Recommendation by the Board of Studies on	**17.01.2020**
Approval by Academic council on	**20.01.2020**
Compiled by	**Dr M Ashwin**