

Uka Tarsadia University



B. Tech.
Semester V

NEURAL NETWORKS
AI5013

EFFECTIVE FROM June-2023

Syllabus version: 1.00

Subject Code	Subject Title	Teaching Scheme			
		Hours		Credits	
		Theory	Practical	Theory	Practical
AI5013	Neural Networks	3	2	3	1

Subject Code	Subject Title	Theory Examination Marks		Practical Examination Marks	Total Marks
		Internal	External	CIE	
AI5013	Neural Networks	40	60	50	150

Objectives of the course:

- To deliver the basic proficiency in fundamentals of neural networks.
- To deliver a design and development paradigms of artificial neural networks and expose students with architectures and applications of artificial neural networks.

Course outcomes:

Upon completion of the course, the student shall be able to,

CO1: Understand the fundamentals of neural networks.

CO2: Apply the basics design of neural networks for classification and understand the use of neural networks for pattern association.

CO3: Gain the need of back-propagation mechanism of neural net along with its application in real world.

CO4: Understand the requirements of self-organizing map and competition based networks.

CO5: Get the understanding for using neural networks for constrains optimization.

CO6: Student will get the fundamentals of advanced neural network based on recurrent learning.

Sr. No.	Topics	Hours
Unit – I		
1	Fundamentals of Neural Networks: Functioning of human brain, Artificial and Biological neural networks, History of neural networks, Applications of neural networks, Neural network architectures, Use of neural networks, McCulloch-Pitt neuron.	5

Unit – II		
2	Neural Network for Pattern Classification and Pattern Association: Neural network for pattern classification – Introduction, HebbNet, Perceptron, ADALINE, Neural network for pattern association – Training algorithms for pattern associations, Hetero-associative memory neural network, Auto-associative network, Iterative Auto-associative network, Bidirectional associative memory.	6
Unit – III		
3	Neural Networks based on Competition: Fixed weight competitive networks, Kohonen self-organizing maps, Learning vector quantization, Counter propagation.	7
Unit – IV		
4	Adaptive Resonance Theory: Introduction, Motivation, Basic architecture, Basic operation, ART1, ART2.	5
Unit – V		
5	Back Propagation Neural Network: Standard back propagation – Architecture, Algorithm and Applications, Variations, Theoretical results – Derivation of learning rules, Multilayer neural networks as universal approximators.	6
Unit – VI		
6	Other Neural Networks: Fixed weight networks for constrained optimization – Boltzmann machine, Continuous Hopfield networks, Gaussian machine, and Cauchy machine, Recurrent neural network – Architecture, Learning algorithms, Back propagation through time, Real time recurrent learning, Applications of RNN.	7

Text book:

1. Laurene Fausett - “Fundamentals of Neural Networks” – Pearson Education.

Reference books:

1. Rajasekaran, G.A. Vijayalakshmi Pai – “Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications”, Prentice Hall of India.
2. S. Haykin - "Neural Networks - A comprehensive foundation", Pearson Education.

Course objectives and Course outcomes mapping:

- To deliver the basic proficiency in fundamentals of neural networks: CO1, CO2, and CO5.
- To deliver a design and development paradigms of artificial neural networks and expose students with architectures and applications of artificial neural networks: CO3, CO4, CO5, and CO6.

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Fundamentals of neural networks	✓					
2	Neural network for pattern classification and pattern association		✓				
3	Neural network based on competition			✓			
4	Adaptive resonance theory				✓		
5	Back propagation neural network					✓	
6	Other neural networks						✓

Programme outcomes:

- PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.
- PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.
- PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.
- PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.
- PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.
- PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

- PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.
- PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
- PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.
- PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12: Life-long learning: recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	C01	C02	C03	C04	C05	C06
P01	✓					
P02						
P03			✓	✓	✓	
P04			✓	✓	✓	
P05			✓	✓	✓	
P06						
P07						
P08						
P09						
P010						
P011						
P012						✓