GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Biomedical Engineering
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2024-25	Effective for the batch Admitted in	July 2022
Course Code	2BM6108	Course Name	Neural Networks & Fuzzy Logic

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	-	1	-	4	Theory	40	60	100
Hours	3	-	2	-	5	Practical	30	20	50

Pre-requisites

Basic knowledge of mathematics and central nervous system.

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	**Understand** the fundamentals and architecture of neural networks.
CO2	**Demonstrate** proficiency in designing and training the neural networks for various applications.
CO3	**Analyze** and **apply** fuzzy logic concepts to model uncertainty in real-world problems.
CO4	**Implement** and **optimize** fuzzy logic systems for decision-making.

Theory syllabus

Unit	Content	Hrs.
1	INTRODUCTION TO NEURAL NETWORKS Biological inspiration and history of neural networks, Biological neuron, Artificial neuron, Basic concepts: Neurons, activation functions, weights, and biases. Comparison of ANN and BNN, Objective of neural networks, Advantages and applications of artificial neural network.	6
2	FUNDAMENTAL OF ARTIFICIAL NEURAL NETWORKS Artificial neuron model, McCulloch-Pitts model, Types of neuron, Activation function, ANN architectures. Types of learning: Supervised and unsupervised learning, Error correction learning, Habbian learning, Competitive learning, Perceptron learning, Adaptive linear neuron with applications, Back propagation network, Introduction to Weka software.	11
3	DESIGN ISSUES Input data types, structure of networks, implication of network structures, Choice of learning algorithms, Comparative analysis: Input data considerations, Interpretation of results, Data checking, validation of learning algorithm, Evaluation of performance.	7
4	INTRODUCTION TO FUZZY LOGIC Partial truth &fuzziness, Foundation of fuzzy systems, Fuzzy systems at work, Design steps. Classical set and fuzzy set: Operations on classical sets, Properties of classical sets, Fuzzy set operations, Properties of fuzzy sets, Fuzzy arithmetic, Principles of fuzzy set theory. Membership function and linguistic variable.	9
5	FUZZY SYSTEMS DESIGN Structure of fuzzy rules, Decomposition of rules, Fuzzy inference system: Input data processing, Evaluation of antecedent of fuzzy variable, Defuzzification techniques, Fuzzy c-means clustering, Type 1 and type 2 fuzzy system, Application of fuzzy logic in health care.	12

Practical Contents

Term work and practical shall be based on the above syllabus.

Text Books

1	Neural Networks by Simon Haykin Pub.: Pearson Education

2	Fuzzy Systems Design Principles by Riza C. Berkan and Sheldon L. Trubateh. Pub.: Wiley
Reference Books	
1	Neural Networks and Artificial Intelligence for Biomedical Engineering by Donna L. Hudson and Maurice E. Cohen Pub.: Prentice Hall
2	Fuzzy Logic with Engineering Applications by Timothy J. Ross Pub.: John Wiley and Sons
3	Neuro-Fuzzy and Soft computing by: J. S. R Jang, C.T.Sun and E. Mizutani. Pub.: Prentice Hall
ICT references	
1	https://nptel.ac.in/courses/127105006/
2	https://nptel.ac.in/courses/108104157
3	https://nptel.ac.in/courses/117105084

Mapping of CO with PO and PSO:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	0	2	1	1	0	0	1	0	0	1	1	0	1
CO2	1	3	3	1	2	1	0	1	1	1	1	2	2	3	2
CO3	1	2	0	1	0	0	0	0	1	2	0	1	0	1	0
CO4	1	2	2	2	2	2	1	0	2	2	2	1	2	2	2