BHARATI VIDYAPEETH'S COLLEGE OF ENGINEERING
(Approved by AICTE, New Delhi & Affiliated to Guru Gobind Singh Indraprastha University, Delhi)
(An ISO 9001:2015 Certified Institution)
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Department of ICE

3.1.1 Course Name: Neural Network and Fuzzy logic Course Code: (ICE-322T)

At the end of the course, student will be able to

CO	Statement	Bloom Level(s)
ICE 322.1	Understand and remember the basic concepts of Artificial Neural network	Understand, Remember
ICE322.2	Analyze the supervised &unsupervised learning algorithm and apply the algorithms in solving problems.	Analyze, Apply
ICE322.3	Evaluate fuzzy logic concepts with their application to real world problem with the use of scientific tools	Evaluate
ICE322.4	Design fuzzy logic controller using fuzzy logic concept.	Design

3.1.2. CO-PO matrices

CO	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2
ICE322.1	3	3	3	3	3	2	2	2	1	1	1	3	2	2
ICE322.2	3	3	3	3	3	-	2	2	1	1	1	1	2	2
ICE322.3	3	2	2	2	1	1	2	1	2	2	-	3	2	2
ICE322.4	3	3	3	3	3	-	2	-	1	1	1	1	2	2

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

JUSTIFICATIONS FOR CO-PO MAPPING

CO1-PO1	High	Understanding ANNs requires knowledge of mathematics (linear algebra, calculus) and computer science principles.
CO1-PO2	High	Understanding how ANNs can be used to solve specific problems requires strong problem-analysis skills.
CO1-PO3	High	Designing an ANN involves creating architectures tailored to solve specific engineering problems with understanding of ANN
CO1-PO4	High	Investigating the performance of different ANN models and hyperparameters to find the best solution require understanding of basics.
CO1-PO5	High	Implementing ANNs requires proficiency in tools like TensorFlow, PyTorch, and other machine learning libraries.
CO1-PO6	Medium	While CO1 focuses more on technical aspects, understanding ANN applications requires awareness of societal impacts (e.g., ethical AI).
CO1-PO7	Medium	Applying ANNs in sustainable technologies, like renewable energy management or smart grids with understanding of ANN
CO1-PO8	Medium	Developing and using ANNs responsibly, considering biases and fairness.
CO1-PO9	Low	Collaborative projects often involve ANN development, necessitating teamwork skills.
CO1-PO10	low	Explaining complex ANN concepts and results to different stakeholders.
CO1-PO11	low	Managing ANN-based projects involves planning, resource allocation, and understanding costs.
CO1-PO12	High	ANN is a rapidly evolving field requiring continuous learning and adaptation to new advancements.
C01-PS01	Medium	The knowledge of various algorithms using modern tools is used as lifelong learning in solving various problems.
CO1-PSO2	Medium	The basic concept of design is needed in acquiring advanced knowledge pertaining to design various advanced controllers
CO2-PO1	High	Understanding and applying algorithms involves a deep knowledge of mathematics (e.g., statistics, probability) and computer science.
CO2-PO2	High	Selecting and analysing appropriate algorithms for different problem types requires strong analytical skills.
CO2-PO3	High	Designing effective models using supervised or unsupervised learning to solve real-world problems.
CO2-PO4	High	Investigating data, selecting appropriate algorithms, and evaluating their performance is critical in both types of learning.
CO2-PO5	High	Implementing algorithms requires proficiency in tools like Python, R, and machine learning libraries (e.g., Scikit-learn, TensorFlow).
CO2-PO6	-	-
CO2-PO7	Medium	Using algorithms in applications like climate modelling, resource optimization, and sustainable development.

CO2-PO8	Medium	Ensuring ethical use of data and algorithms, addressing issues like data privacy and algorithmic bias.
CO2-PO9	low	Collaborative projects often involve applying machine learning algorithms, necessitating teamwork.
CO2-PO10	low	Explaining the choice of algorithms, their functioning, and results to different stakeholders.
CO2-PO11	low	Managing projects involving machine learning applications, including budgeting for computational resources and data acquisition.
CO2-PO12	low	Machine learning is a rapidly evolving field requiring continuous learning and adaptation to new techniques and tools.
CO2-PSO1	Medium	The knowledge of design of Fuzzy Controller using modern tools is used as lifelong learning in designing various controllers
CO2-PSO2	Medium	The basic concept of design is needed in acquiring advanced knowledge pertaining to design various advanced controllers
CO3-PO1	High	Understanding fuzzy logic requires knowledge of mathematics (e.g., set theory, probability) and engineering principles.
CO3-PO2	Medium	Analyzing the suitability and effectiveness of fuzzy logic in solving specific problems requires strong analytical skills.
CO3-PO3	Medium	Designing fuzzy logic systems involves creating models that can handle uncertainty and imprecision in real-world scenarios.
CO3-PO4	Medium	Investigating the performance of fuzzy logic systems, tuning membership functions, and rules requires a systematic approach.
CO3-PO5	low	Implementing fuzzy logic solutions requires proficiency in tools like MATLAB, Simulink, and other fuzzy logic toolboxes.
CO3-PO6	low	Applying fuzzy logic in societal contexts (e.g., healthcare, autonomous vehicles) requires an understanding of its broader impacts.
CO3-PO7	Medium	Using fuzzy logic in environmental monitoring, sustainable resource management, and other applications.
CO3-PO8	low	Ensuring the ethical use of fuzzy logic, especially in decision-making systems that affect human lives and well-being.
CO3-PO9	Medium	Collaborative projects often involve the design and implementation of fuzzy logic systems, necessitating teamwork.
CO3-PO10	Medium	Explaining fuzzy logic concepts, models, and results to different stakeholders, including non-technical audiences.
CO3-PO11	-	Managing projects involving fuzzy logic applications, including resource allocation, budgeting, and time management.
CO3-PO12	High	: Fuzzy logic is an evolving field; staying updated with new methodologies and applications is crucial.
CO3-PSO1	Medium	To apply fuzzy logic concepts to real world problem the use of scientific tools is needed.

CO3-PSO2	Medium	Evaluate fuzzy logic concepts with their application to real world problem with the use of scientific tools
CO4-PO1	High	Designing a FLC involves applying mathematical concepts (e.g., set theory, control theory) and engineering principles.
CO4-PO2	High	Analyzing the system to be controlled, identifying input-output relationships, and determining control requirements.
CO4-PO3	High	Creating an effective FLC requires designing appropriate membership functions, rules, and defuzzification methods.
CO4-PO4	High	Testing and tuning the FLC, investigating its performance under various conditions.
CO4-PO5	High	Implementing the FLC using tools like MATLAB, Simulink, and other fuzzy logic toolboxes.
CO4-PO6	--	-
CO4-PO7	Medium	Designing energy-efficient control systems that contribute to environmental sustainability.
CO4-PO8	-	-
CO4-PO9	Medium	working collaboratively on the design and implementation of the FLC, requiring teamwork skills.
CO4-PO10	Medium	Explaining the design and operation of the FLC to different stakeholders, including non-technical audiences.
CO4-PO11	Medium	Managing the design project, including resource allocation, budgeting for tools and components.
CO4-PO12	Medium	Staying updated with the latest developments in fuzzy logic and control systems to continually improve the FLC design.
CO4-PSO1	Medium	Design of fuzzy controllers needs knowledge of complex engineering problems and basic concepts with the use of latest engineering tools
CO4-PSO2	Medium	Design of fuzzy controllers require advanced knowledge of various algorithms.

Lesson Plan

(Subject Name): Neural Network and Fuzzy Logic

Paper Code: ICE-322T **L T C**

Paper: Neural Network and Fuzzy Logic **3 3**

Topics to be covered		
S. No.	**Contents**	**Total Lectures+ Tutorial**
	Unit 1	
1	Basic Concepts of Neural Network	1
2	Human Brain	1
3	Model of an Artificial Neuron	1
4	Neural Network Architectures	2
5	Characteristics of Neural Network	1
	Unit II	
6	Supervised and unsupervised Learning	2
7	Reinforcement Learning Methods	1
8	Hebb Method	1
9	Delta Method	1
10	Back Propagation Method	1
11	Architecture of Back Propagation Network	2
12	The perceptron Model	1

13	Single layer Artificial Neural Network	2
14	Model for Multilayer	2
15	Back Propagation Learning, illustrations and implications	2
16	Selection of various parameters in BPN	2
	Total No of Lectures	**23**
	Midterm Exam	
	Unit III	
17	Fuzzy versus Crisp set, Crisp sets, Fuzzy sets	2
18	Crisp Relations, Membership Functions	1
19	Fuzzy Relations	1
20	Fuzzy Logic Interface	2
21	Fuzzy Rule Based system	2
22	Defuzzification Methods	3
	Unit IV	
23	Fuzzy Controller Design for washing Machine	2
24	Fuzzy Controller Design for DC motor	2
25	Fuzzy Controller Design for Power converter	2
26	Fuzzy Controller Design for air conditioning system	2
	Total Lectures	**21**

Teaching Pedagogy

1) Encourage students to actively participate in the learning process through activities such as discussions, problem-solving, case studies, role plays, and group projects.
2) Implement group-based activities where students can work together to achieve a common goal, fostering teamwork, communication, and social skills.
3) Use questioning to stimulate critical thinking and draw out ideas and underlying presumptions. This dialogue-based approach helps students develop analytical skills.
4) Combine online digital media with traditional face-to-face classroom methods, providing a more flexible and personalized learning experience.
5) Enable students to learn by doing through hands-on experiences such as labs, simulations, field trips, and internships.