Bharatiya Vidya Bhavan's
Sardar Patel Institute of Technology
(Autonomous Institute Affiliated to University of Mumbai) Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058

Artificial Intelligence and Soft Computing

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Artificial Intelligence and Soft Computing	3	0	2	5	10	2	0	1	4

Examination Scheme				
Component	ISE	MSE	ESE	Total
Theory	13	14	40	67
Laboratory	26	--	7	33

CE303

Pre-requisite Course Codes, if any. Mathematics

Course Objective: The objective of this course is to introduce students to the foundational concepts of Artificial Intelligence (AI) and Soft Computing, which are essential components of modern intelligent systems. The course aims to provide students with both a solid theoretical background and practical understanding necessary to design, analyze, and implement intelligent systems. Emphasis is placed on key AI paradigms and soft computing techniques, including neural networks and fuzzy logic, enabling students to develop systems that can learn, adapt, and make decisions in complex and uncertain environments.

Course Outcomes (CO): ***At the End of the course students will be able to***

CS303.1	Identify the various characteristics of Artificial Intelligence and soft computing techniques in building intelligent machines
CS303.2	Apply the supervised and unsupervised Neural Network Learning algorithm to solve real world engineering problems.
CS303.3	Design an associative memory network for real world problems
CS303.4	Design Fuzzy Logic Controller System
CS303.5	Analysis Working of NN-FL Hybrid System

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS303.1	2	2	--	2	--	--	--	--	--	--	--	--
CS303.2	2	2	2	2	2	--	--	--	1	1	--	--
CS303.3	2	2	2	2	2	--	--	--	1	1	--	--
CS303.4		2	2	2	2	--	--	--	--	--	--	--
CS303.5		2	2	2								

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
CS303.1	2	2	--	--	--	--
CS303.2	3	2	--	--	2	--
CS303.3	3	2	--	--	2	--
CS303.4	3	2	3	--	--	--
CS303.5	3	2	--	--	--	--

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to AI and Soft computing technique**	T1,T2, R3	**06**
	1.1	Definition of AI, History and Future of AI. Intelligent Agents, Agents and Environments ,Rationality, Nature of Environment, Structure of Agent, Problem solving Approach to Typical AI problem, Introduction to Expert System Design		
	1.2	Soft computing Constituents, Difference between Hard Computing and Soft Computing.		
2	**Title**	**Neural Networks**	T1,T2 T3,R1	**12**
	2.1	**Basics of Neural Networks:** Introduction to Neural Networks, Biological Neural Networks, Models of ANN, terminologies in ANN, Activation functions and its types, McCulloch Pitt model, Linear separability, Hebb Network		
	2.2	**Supervised Learning algorithms:** Perceptron (Single Layer, Multi layer),, Adaline, Delta learning rule, Back Propagation algorithm.		

	2.3	**Un-Supervised Learning algorithms:** Hebbian Learning, Winner take all, Self-Organizing Maps KSOFMN , Learning Vector Quantization.		
3	**Title**	**Associative Memory Networks**	T2, T3,T4	**4**
	3.1	Auto associative and Hetero associative Memory Network, BAM, Hopfield network.		
4	**Title**	**Fuzzy Logic, Classical Set and Fuzzy Relations**	T2,T3, T4,R1, R3	**12**
	4.1	Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Functions, Classical and Fuzzy set operations, and properties of classical and Fuzzy sets.		
	4.2	Classical and Fuzzy Relations**:** Cartesian product of relation, Fuzzy Max-Min and Max-Product Composition, Fuzzy extension principle		
5	**Title**	**Fuzzy control system design and Hybrid Model**	T2, T3 T4, R2	**8**
	5.1	Fuzzy Inference System (FIS), Types of FIS, fuzzification, defuzzification methods, and design of fuzzy controllers. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro-Fuzzy Networks(ANFIS)		
	Self Study	Adaptive Resonance Theory, Genetic Algorithms, CNN, Transfer Learning,	**-**	**5**
			Total	**42**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No	**Title of the Experiment**
1	To study and write a program using Prolog for simple real time problems like temperature conversion, Monkey banana problem, Fibonacci series etc
2	Implement a simple intelligent agent using Python
3	To implement Transfer/Activation Functions for a given problem statement and design ANN for a given problem statement.
4	To design and implement SLP for a given problem statement. 1. Design a perceptron using Joone Editor. 2. Write a program using Single Layer perceptron
5	To implement the Supervised Learning algorithm.
6	To implement the Unsupervised Learning algorithm
7	To implement Associative Memory Network for a given problem statement
8	To implement Fuzzy Sets and Fuzzy Relations for a given problem statement
9	To design and implement Fuzzy Logic controller for a given problem statement
10	To design and implement ANFIS model for a given problem statement

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
T1	Introduction to Artificial Neural Systems	1st	Jacek M. Zurada	Jaico Publisher	1994
T2	Principles of Soft Computing	3rd	Sivanandan and Deepa	Pearson Edition	2019
T3	Fuzzy logic with engineering applications	3rd	Ross, Timothy J	John Wiley & Sons	2011
T4	Neural Networks, Fuzzy Logic and Genetic Algorithms	Kindle	S.Rajasekaran and G.A.VijayalakshmiPai	PHI Learning	2013

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
R1	Neural Network Design	2nd	Hagan, Demuth, Beale	CENGAGE Learning	2014
R2	Neuro-Fuzzy and Soft Computing	1st	J.-S.R.Jang .	Pearson	1996
R3	Introduction to Soft Computing	1st	Sameer Roy	Pearson	2013