

ACADEMIC PLAN FOR VII SEMESTER

Subject: Soft Computing

Class: 7th Sem. (CSE-AIML)

Subject Code: SC-401T

Total Lecture classes available: 44

S.No.	TOPICS TO BE COVERED	No. of Lectures
1	UNIT I – Introduction to Soft Computing	
1	Introduction to Soft Computing: concept of computing systems; introduction to soft computing.	2
2	Soft Computing versus Hard Computing: differences, approaches and problem-solving philosophy.	2
3	Characteristics of Soft Computing: approximation, tolerance for imprecision, uncertainty and robustness.	2
4	Applications of Soft Computing techniques in engineering and real-life problem solving.	2
5	Overview of major soft-computing techniques: Fuzzy Logic, Genetic Algorithms and Artificial Neural Networks.	2
	Total Lectures	10
	UNIT II – Fuzzy Logic	
6	Introduction to fuzzy logic; fuzzy sets, membership functions and linguistic variables.	3
7	Operations on fuzzy sets: union, intersection, complement and related properties.	2
8	Fuzzy relations: representation, operations and composition of fuzzy relations.	2
9	Fuzzy rules and propositions; formulation and representation of linguistic rules.	2
10	Fuzzy inference: inference mechanisms and reasoning with fuzzy rules.	2
11	Defuzzification techniques; need, methods and numerical examples.	2
12	Applications of Fuzzy Logic: fuzzy inference systems and fuzzy control applications.	1
	Total Lectures – Unit II	12
	1st TERM END	
	Total Lectures – 1st Term (Unit I + Unit II)	22 hrs
	UNIT III – Genetic Algorithms	
13	Concept of genetics and evolution; biological inspiration and probabilistic search techniques.	2
14	Basic Genetic Algorithm framework and architecture: population, chromosome and fitness function.	1
15	Encoding techniques: binary, real-valued and permutation representations.	1
16	Selection operators: fitness-proportionate, tournament and rank selection.	2
17	Crossover operators: single-point, multi-point and uniform crossover.	1
18	Mutation operators; GA cycle and parameter selection.	1
19	Solving single-objective optimization problems using Genetic Algorithms; worked example.	2
	Total Lectures – Unit III	10
	UNIT IV – Artificial Neural Networks	
20	Biological neurons and their working; artificial neuron model and activation functions.	2
21	ANN architectures: single-layer, multilayer and recurrent neural networks.	2
22	Training techniques: supervised, unsupervised and reinforcement learning; learning parameters.	2
23	Perceptron learning rule and simulation of artificial neurons for problem solving.	2
24	Applications of ANN to real-life problems: classification, prediction and pattern recognition.	1
25	Fuzzy neural systems, genetic fuzzy systems and genetic neural systems.	2
26	Integrated applications and comparison of hybrid soft-computing systems.	1
	Total Lectures – Unit IV	12
	2nd TERM END	
	Total Lectures – 2nd Term (Unit III + Unit IV)	22 hrs

Textbook(s): T1 – J. S. R. Jang, C. T. Sun and E. Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004.

T2 – S. N. Sivanandam and S. N. Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2007.

References: S. Rajasekaran and G. A. V. Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003;
Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.

SWAYAM / NPTEL lecture links and other relevant online lecture/resource links of soft computing

- NPTEL – Introduction to Soft Computing (IIT Kharagpur)

Covers Fuzzy Logic, Fuzzy Sets, Fuzzy Relations, Defuzzification, Genetic Algorithms, GA operators, ANN and ANN applications

<https://archive-elearn.nptel.ac.in/shop/nptel/introduction-to-soft-computing/?v=13b5bfe96f3e>

- NPTEL – Fuzzy Logic and Neural Networks (IIT Kharagpur)

Particularly useful for Unit 2 (Fuzzy Logic) and Unit 4 (ANN). The course includes fuzzy sets, fuzzy reasoning, neural-network fundamentals, multilayer networks, RBF, SOM, recurrent networks and hybrid systems.

<https://nptel.ac.in/courses/127105006>

- MathWorks – Fuzzy Logic Toolbox

Very useful for your MATLAB practical's, especially membership functions, fuzzy inference systems, Mamdani/Sugeno systems and fuzzy controllers.

<https://in.mathworks.com/help/fuzzy/index.html>

- MathWorks – Fuzzy Logic Designer Tutorial

Useful for practically creating a fuzzy system, defining membership functions and rules, and viewing the inference result.

<https://www.mathworks.com/help/fuzzy/building-systems-with-fuzzy-logic-toolbox-software.html>

- Google – Neural Networks

A concise resource for Unit 4, covering nodes, hidden layers, activation functions and neural-Network training/backpropagation.

<https://developers.google.com/machine-learning/crash-course/neural-networks>

- Google – Machine Learning Crash Course

Helpful supplementary material for neural networks and machine-learning concepts, with videos, interactive visualizations and exercises.

<https://developers.google.com/machine-learning/crash-course>

