

COURSE CODE	COURSE TITLE	L	T	P	C
1152CS124	SOFT COMPUTING	3	0	0	3

Course Category: Program Elective

A. . Preamble: This course introduces some new fields in soft computing with its principal components of fuzzy logic, ANN, and EA, and it is hoped that it would be quite useful to study the fundamental concepts on these topics for the pursuit of allied research.

B. Prerequisite Courses:

Sl. No	Course Code	Course Name
1	1151CS102	Data Structures

C. Related Courses:

Sl. No	Course Code	Course Name
1	1156CS601	Minor Project
2	1156CS701	Major Project

D. Course Educational Objectives:

Students undergoing this course are expected to

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing

E. Course Outcomes:

Students undergoing this course are able to

CO Nos.	COURSE OUTCOMES	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Analyse a given computational task to recognize the appropriateness through fuzzy sets	K2
CO2	Design a fuzzy based soft computing system to address the computational task	K3
CO3	Analyse a given computational task to solve it through neural network	K3
CO4	Applying Genetic Algorithm operations for solving a computational task	K3
CO5	Design and implement a soft computing system to achieve a computational solution	K3

F. Mapping Course Outcomes with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	M						M					L	L		L
CO2	M		H				M					M	L	L	L
CO3	M	H	L				M	L				M	L	M	L
CO4	M	L	L				M	L				M	L	M	L
CO5	M	L	L				M	L				M	M	L	L

G. Course Content

Unit-I **9**
 Introduction to Soft Computing, Evolution from Conventional AI to Computational intelligence and Evolutionary Search Strategies Fuzzy Sets, Fuzzy Membership Functions, Operations, Relations, Fuzzy Extension Principle Basics of Fuzzy Logic- Problem solving using Fuzzy Rules and Fuzzy Reasoning, Mamdani 's Representation, Zadeh's Representation

Unit-II **9**
 Fuzzy Inference Systems, Fuzzification, Application of Fuzzy Operators on Antecedent part of Rules, Evaluation of Fuzzy Rules, Defuzzification, Problems associated to Fuzzy controller (Cruise Controller and Air Conditioner Controller)

Unit-III **9**
 Neural Networks in Computer Science, Biological model, McCulloch-Pitts Model, The Perceptron Model, Widrow-Hoff's Delta Rule, XOR Problem, Curse of Dimensionality, Dimensionality Reduction, Activation Functions, Learning by Neural Nets;
 Pattern Classifiers- Layered Feed Forward Neural Networks- Solution for XOR Problem, Hebb's Rule; Competitive Learning Methods (Kohonen's Self Organizing Maps and Learning Vector Quantization); Pattern Associators (Hopfield nets) ;
 Back Propagation Networks: Generalized Delta Rule, Back Propagation Algorithm, Convergence of efficiency parameter, Boltzmann's Machine Learning Algorithm

Unit-IV **9**
 Advanced Search Strategies Natural Evolution – Chromosomes, Systematic approach of Elitism (Selection- Crossover- Mutation); Development of Genetic Algorithm, Fitness Function, Population, GA operators, parameters, Convergence

Unit-V **9**
 Hybrid Systems : Neuro-Fuzzy Modelling- control- Feedback control- neuro fuzzy control; Neuro-fuzzy Reinforcement Learning, Gradient Free Optimization(GA operators), Gain Scheduling; Case study: Color Recipe Prediction.

Total Hours: 45

H. Learning Resources:

i. Text Books:

1. Samir Roy and Udit Chakraborty , “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms” Pearson Education,2013
2. J.S.R. Jang, C.T.sun and E. Mizutani ,“Neuro-fuzzy and Soft Computing: A computational Approach to Learning and Machine Intelligence, Pearson Education, 2004

i. Reference Books:

1. D.E.GoldBerg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2013
 2. S.N.Sivanandam, S.N.Deepa, “Priciples of Soft Computing”, 2nd Edition, John-Wiley India,2011
 3. G.J.Klir and B.Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, Second Reprint, PHI,2000
- J.A.Freeman and D.M.Skapura, “Neural Networks: Algorithms, Applications and Programming Techniques”, Pearson Education, 2011