

**Year: B. Tech IV (Semester VII)**

**Subject Name:** Soft Computing

**Subject Code:** BTCO14707

**Type of course:** Professional Elective - V

**Prerequisite (if any):** Artificial Intelligence fundamentals and searching techniques

**List of Courses where this course will be prerequisite:**

**Rationale:** The rationale behind this course is to provide precise approximation and quick solutions for complex real-life problems. Soft computing is an important branch of Artificial Intelligence, where Swarm Intelligence, Fuzzy logic, Probability theory, Neural Networks, and Genetic Algorithms are synergistically used to mimic the reasoning and decision making of a human.

**Teaching and Examination Scheme:**

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	0	3	60	25	15	0	0	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

**Content:**

Sr. No.	Content	Total Hrs
1	Introduction to Soft Computing and Fuzzy Logic: Soft Computing definition, soft computing Vs hard computing, Brief descriptions of different components of soft computing including Artificial intelligence systems Neural networks, fuzzy logic, genetic algorithm, swarm intelligence, Applications of soft computing Techniques.  Fuzzy Logic, Crisp logic, Fuzzy set, Fuzzy relation. Operation on Fuzzy set, fuzzy membership function, Fuzzification, Defuzzification, fuzzy proposition, Fuzzy relations. Fuzzy Inference System. Fuzzy logic controller. Problem solving using fuzzy logic.	10

2	Genetic Algorithm: Heuristic search and need of soft computing algorithm, Basic Concepts of Evolutionary algorithm and Genetic Algorithms (GA), Working Principle, Encoding schemes, Fitness function, Crossover, Mutation, Parent selection methods, Convergence of GA, Problem solving using GA.	12
3	Swarm Intelligence: Ant Colony Optimization, Particle Swarm Optimization. Artificial Bee Colony. Problem solving using swarm intelligence.	8
4	Artificial Neural Network: The Hopfield network, Supervised Learning: Introduction and how the brain works, Neuron as a simple computing element, The perceptron, Multilayer perceptron, Loss function, Gradient descent algorithm, Back propagation learning, Weight setting, Activation function. Application of ANN.	10
5	Applications based on GA/Fuzzy/ANN/PSO/ACO	5

**Suggested Specification table with Marks (Theory): (For B.Tech only)**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	15	15	15	10	---

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Reference Books:**

Sr No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Principles of Soft Computing	S.N. Sivanandam and S.N. Deepa	Wiley	Latest Edition	

2	Genetic algorithm in search, optimization and machine learning	Goldberg, D. E	Addison-Wesley, Reading Mass	Latest Edition	
3	Fuzzy Logic with Engineering Applications	Timothy J. Ross	McGraw-Hill	Latest Edition	
4	Introduction to Evolutionary Computing	Eiben A. E. and Smith J. E	Second Edition, Springer, Natural Computing Series	Latest Edition	
5	Fundamentals of Computational Swarm Intelligence	Engelbrecht A. P.	John Wiley & Sons,	Latest Edition	
6	Neural Networks, Fuzzy Logic, and Genetic Algorithms synthesis and application	S. Rajasekaran & GA Vijayalakshmi Pai	PHI		
7	Swarm Intelligence Algorithms Modifications and Applications	Adam Slowik	CRC Press, ISBN 9780367528881		

**Course Outcomes:**

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and describe Soft computing and Fuzzy logic techniques and their roles in building intelligent machine	22
CO-2	Apply evolutionary algorithms to combinatorial optimization problems	28
CO-3	Inspect different Swarm Intelligence techniques for solving real life problems	18

CO-4	Demonstrate Artificial Neural Network in order to solve basic classification problems	22
CO-5	Develop application on different soft computing techniques like Fuzzy, Swarm Intelligence and Neural network	10

**List of Open learning website:**

1. NOC:Introduction to Soft Computing, Prof. Debasis Samanta, IIT Kharagpur  
<https://archive.nptel.ac.in/courses/106/105/106105173/>