CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Engineering (Information Technology)**

Semester: **VI**

Course Code: **102060622**

Course Title: **Soft Computing Techniques**

Course Group: **Open Elective - II**

Course Objectives: This course introduces an insight for Soft Computing concepts and algorithms to develop an intelligent system. Further, to give students knowledge about non-traditional techniques and fundamentals of artificial neural networks, fuzzy logic and genetic algorithms. To provide students hands-on experience on recent soft computing tool (i.e., MATLAB, Python, etc.) to implement various strategies and real-life problems. To gain experience of doing independent study and research.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
2	0	2	3	40/14	60/21	20/7	30/10	150/52

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to soft computing:** Introduction, Importance of Soft Computing, Main Components of Soft Computing – Fuzzy Logic, Artificial Neural Networks, Support Vector machine, Evolutionary Algorithms, Hybrid Intelligent Systems and applications of soft computing.	04
2	**Fuzzy Logic Systems:** Introduction to Fuzzy logic, classical sets *vs* fuzzy sets, Membership functions and its features, Properties and operations on Fuzzy sets, classical relations *vs* Fuzzy relation, Operations of Fuzzy relation, Defuzzification, Fuzzy rule base and approximate reasoning, Fuzzy Inference Systems, Design a fuzzy logic controller: Mamdani & Sugeno Architecture.	10

3	**Neural Network Systems:** Introduction to Artificial Neural Network, Biological neurons *vs* artificial neural network, Neuron models: McCulloch-Pitts Neuron, Hebb Network, learning in neural networks: **Supervised Learning Network** – Perceptron, ADALINE, MADALINE, Back propagation network, **Unsupervised Learning Network** – Self organizing Map, Learning Vector Quantization, Adaptive resonance theory.	**10**
4	**Genetic Algorithms:** Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.	**04**
5	**Hybrid Systems and Applications:** Hybrid Soft computing Techniques – Fuzzy-Neural, Neuro-Fuzzy, Genetic-Fuzzy, Genetic-Neuro, Applications in various domain.	**02**
	Total	**30**

List of Practicals / Tutorials:

1	Introduction to MATLAB / Python Tool for Soft Computing Applications.
2	Introduction: Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos.
3	MATLAB simulation: Fuzzy Logic Controller (FLC) implementation.
4	MATLAB simulation: Simulink Fuzzy Logic Controller (FLC) implementation.
5	MATLAB simulation: Implement any one application using FLC.
6	Introduction: Neural Network (NN) Toolbox, NN Simulink Demos
7	MATLAB simulation: Artificial Neural Network (ANN) implementation.
8	MATLAB simulation: NN Tool Artificial Neural Network (ANN) implementation.
9	MATLAB simulation: Various structure of NN algorithms implementation
10	Introduction: Genetic Algorithm (GA), Simulation Demos.
11	Simulation Assignment: Application Development using Fuzzy / NN /GA.

Reference Books:

1	S. N. Sivanandam and S.N.Deepa, Principles of Soft Computing, Wiley India Pvt. Limited.
2	R. Rajasekaran, and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India.
3	T. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill
4	L. Fausett, Fundamentals of Neural Networks, Prentice Hall
5	Suran Goonatilake, and Sukhdev Khebbal (Eds), Intelligent hybrid systems, John Wiley & Sons.
6	D. E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley.

Supplementary learning Material:	
1	MATLAB: Signal Processing Toolbox, Image Processing Toolbox, Neural Network Toolbox, Fuzzy Logic Toolbox, Optimization Toolbox.
2	Python Programming and Application Development

3	NPTEL / Coursera courses on Soft Computing, Neural Network, Fuzzy Logic and Genetic Algorithm.
4	Python based Application Development

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10%	20%	20%	20%	20%	10%	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Identify and describe soft computing techniques and their roles in building intelligent systems.	**15**
CO-2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.	**25**
CO-3	Integrate and develop learning mechanism using Neural Network for intelligent applications.	**25**
CO-4	Solved Optimization problem using genetic algorithms.	**10**
CO-5	Judge the role played by engineers to automate the process by integrating the knowledge of soft-computing tools and techniques.	**25**

Curriculum Revision:	
Version:	1.0
Drafted on (Month-Year):	June-2020
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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