

**M. Tech. I Semester II**

**Subject Name:** Soft Computing Techniques in Environmental Engineering

**Subject Code:** MTEN14206

**Type of course:** PE-IV

**Prerequisite:** Basics of Environmental Engineering

**Rationale:** To develop the basic knowledge about the concept of different soft computing techniques like ANN, Fuzzy and AHP. It's application in environmental engineering field. Also develop different numerical techniques and model application for monitoring and management of environment.

**Teaching and Examination Scheme:**

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

**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.	Topics	Teaching Hrs.	Module Weightage
1.	<b>Introduction:</b> Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing ,Different soft computing techniques, Application of soft computing techniques.	4	12%
2.	<b>Linear Programming:</b> Linear Programming, Graphical and Simplex methods, Measures of central tendency, dispersion Regression and correlation, rank correlation, multiple and partial correlation, analysis of variance, one way and two way classifications, experimental design, Latin square design, Time series analysis ,AHP.	6	14%
3.	<b>Introduction to Fuzzy Logic system:</b> Fuzzy set theory and logic, Fuzzy MCDM and FRBS, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, De-fuzzification techniques, Multi Objective Optimization Using Fuzzy Linear Programming, Some applications of Fuzzy logic, simple applications in environmental engineering.	12	26%
4.	<b>Concept of Neural Networks:</b> ANN Concepts, Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures,	10	24%

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	Training techniques for ANNs, Applications of ANNs to solve some real-life problems, Modular Neural Networks.		
5	<b>Genetic Algorithm:</b> Introduction to genetic algorithm, 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.	10	24%

**Suggested Specification table with Marks (Theory/Practical):**

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	20%	10%	25%	25%	10%

**Legends: R:** Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **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 Text Books:**

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Fuzzy Logic: A Practical approach	F. Martin, Mcneill, and Ellen Thro	AP Professional	2000	-
2	Fuzzy Logic with Engineering Applications	Timothy J. Ross, Willey	-	2010	Third
3	Fundamental of Artificial Neural Network and Fuzzy Logic	Rajesh Kumar	Laxmi Publications ISBN: 9788131807101	2009	First
4	An Introduction to Genetic Algorithms	Melanie Mitchell	MIT Press, ISBN: 978-0262631853	2000	Fifth
5	Optimization for Engineering Design – Algorithms and examples.	Kalyanmoy Deb	Prentice Hall India Learning Private Limited ISBN-	2012	Second

			978-8120346789		
6	Neuro-Fuzzy and soft Computing, 2009	J.-S. R. Jang, C.-T. Sun, and E. Mizutani	PHI Learning	2009	-

**Course Outcome:**

Sr. No.	CO statement	Marks % weightage
CO-1	Comprehend soft computing techniques and its applications.( R,Ucognitive level)	20
CO-2	Understand the artificial neural networks and its applications.(E,N,Ccognitive level)	25
CO-3	Analyze the single-objective optimization problems using Gas(N,Ccognitive level)	20
CO-4	Develop the fuzzy logic sets and membership function and de-fuzzification techniques. (R,U,N,Ccognitive level)	20
CO-5	Understand the AHP and its application ( U,N,Ccognitive level)	15

**List of Practicals:**

1. Problems based on GA and its applications in Environmental engineering.
2. Problems based on Fuzzy logic and its applications in Environmental engineering
3. Problems based on ANN and its applications in Environmental engineering
4. Problems based on AHP and its application in Environmental engineering.
5. Problem based on linear programming and its application in Environmental Engineering.