FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF

CIVIL ENGINEERING

Marwadi University
Marwadi Chandarana Group

Soft Computing Techniques

01CI0617

Objective of the Course:

- To Develop an understanding to soft computing techniques and its application.
- To Understand the use of Fuzzy Logic for the problems related to civil engineering.
- To Understand the use of Genetic Algorithms in optimization problems related to civil engineering.
- To Understand the artificial neural network and its application.

Credit Earned: 03

Prerequisite: Mathematics, Algebra, Differential Equations.

Students learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Recognize the use of soft computing techniques in civil engineering field.
2. Apply the fuzzy logic for the solving problems related to civil engineering.
3. Apply the Artificial Neural Network for civil engineering problems.
4. Analyse the single-objective optimization problems using Genetic Algorithms.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	00	03	50	30	20	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Soft Computing**	**03**
	1.1 Introduction of soft computing, Concept of a computing system, Difference between soft and hard computing, Characteristics of soft computing, Application of soft computing.	

2	**Fuzzy Logic**	**12**
	2.1 Introduction to Fuzzy logic, Fuzzy Set theory, Fuzzy set operations, Fuzzy relationships, rules, propositions, implications, interferences, Defuzzification techniques,	06
	2.2 Application of Fuzzy logic in classifications, patterns recognitions. Application of Fuzzy logic to civil engineering problems.	06
3	**Artificial Neural Network**	**16**
	3.1 Introduction of Artificial Neural Network, Biological neuron and its working, Model of artificial neuron,	04
	3.2 ANN Architectures, Multi-Layer Feed Forward Network (MLFFN), Radial Basis Function Network (RBFN), Recurring Neural Network (RNN)	04
	3.3 Training Techniques, Supervised and Unsupervised learning methods, Error correction learning, Hebbian learning; Single layer perceptron – Multilayer perceptron	04
	3.4 Least mean square algorithm, Back propagation algorithm. Applications Application of ANN to solve some civil engineering problems.	04
4	**Genetic Algorithm**	**11**
	4.1 Concept of Genetic Algorithm, Use of GA, comparison of GA and traditional methods in optimization,	03
	4.2 Basic GA framework, Different architecture of GA, Terminology in GA, GA operators: Encoding, Crossover, selection, Mutation, etc.	04
	4.3 Application of GA in optimization problems related to civil engineering.	04
	Total	**42**

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	20%	30%	25%	10%	10%

Instructional Method and Pedagogy:

1. At the start of the course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lectures will be taken in class room with the use of multi-media presentations, white board– mix of both.

3. Attendance is compulsory in lectures and laboratory which carries a 5% component of the overall evaluation.
4. Minimum two internal exams will be conducted and average of two will be considered as a part of continuous evaluation
5. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.
6. Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.
7. The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

Recommended Study Material

1. Fuzzy Logic: A Practical approach, F. Martin, McNeil, and Ellen Thro, AP Professional, 2000.
2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
3. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
4. Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elsevier Press, 2004.
5. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
6. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson
7. Education, 2002.
8. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.
9. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.
10. Soft Computing, D. K. Pratihar, Narosa, 2008.
11. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
12. Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011.
13. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill
14. Simon Haykin, Neural Networks, Prentice Hall
15. J.M. Zurada, Introduction to artificial neural systems., Jaico Publishers
16. H.J. Zimmermann, Fuzzy set theory and its applications., III Edition, Kluwer Academic Publishers, London.
17. Suran Goonatilake, Sukhdev Khebbal (Eds), Intelligent hybrid systems., John Wiley & Sons, New York, 1995
18. Goldberg, D. E, Genetic algorithm in search, optimization and machine learning, Addison-Wesley, Reading Mass.
19. Kalyanmoy Deb, Optimization for Engineering Design – Algorithms and examples, PHI, New Delhi, ISBN-81-203-0943-x.