# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering (Part Time)**
**Subject Code:** 2950604
**Semester – V**
**Subject Name: Soft Computing Techniques**

**Type of course:** Open Elective

**Prerequisite:** A strong mathematical background, Programming skill in C, C++, Proficiency with algorithm

**Rationale:**

1. To apply the soft computing techniques for solving the problem of civil engineering.
2. To learn fuzzy logic and applications in civil engineering
3. To solve single-objective optimization and its applications using GAs.
4. To understand the Artificial neural network and its applications.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 2 | 0 | 2 | 3 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Introduction to Soft Computing:** Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques | 2 |
| 2 | **Fuzzy logic**: Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Some applications of Fuzzy logic. | 12 |
| 3 | **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. | 12 |
| 4 | **Artificial Neural Networks:** Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems. | 10 |

| | | |
|---|---|---|
| **5** | **Hybrid Systems:** Fuzzy Neural systems, Genetic Fuzzy systems, Genetic Neural system | **6** |

**Suggested Specification table with Marks (Theory): (For PDDC only)**

| **Distribution of Theory Marks** | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 10% | 40% | 30% | 5% | 5% | 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:**


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

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**Bachelor of Engineering (Part Time)**
**Subject Code:** 2950604

**Course Outcomes:** Students should able to

| Sr. No. | CO statement | weightage |
|---|---|---|
| CO-1 | Comprehend soft computing techniques and its applications. | 15% |
| CO-2 | Understand the artificial neural networks and its applications. | 30% |
| CO-3 | Analyze the single-objective optimization problems using GAs. | 15% |
| CO-4 | Develop the fuzzy logic sets and membership function and defuzzification techniques. | 30% |
| CO-5 | Design the hybrid system for solving the real-life problem of civil engineering | 10% |

**List of Experiments: (Work in Computation lab.)**

1. Problems based on GA and its applications in civil engineering.
2. Problems based on Fuzzy logic and its applications in civil engineering
3. Problems based on ANN and its applications in civil engineering
4. Problems based on hybrid systems and its application in civil engineering.

**List of Open Source Software/learning website:**

1. Student can refer Open source Code and material available for example
2. http://www.iitk.ac.in/kangal/codes.shtml
3. http://lancet.mit.edu/ga/dist/galibdoc.pdf
4. https://books.google.co.in/books?hl=en&lr=&id=W5SAhUqBVYoC&oi=fnd&pg=PR11&d=SOft+computing+course+&ots=et_2Nvjy_4&sig=jDXLrGIeD3zc4QUxvcEvC5FrFY#v=onepage&q=SOft%20computing%20course&f=false