A.P. State Council of Higher Education
Semester-wise Revised Syllabus under CBCS, 2020-21
Three Year B.Sc. - Semester – V (from 2022-23)
Subject: **B.Sc -Data Science**

Course-6A: Soft Computing

(Skill Enhancement Course (Elective), 5 credits, Max Marks: 100 + 50

I. Course Objective:

The student should be made to:

- Classify the various soft computing frame works
- Be familiar with the design of neural networks, fuzzy logic and fuzzy systems
- Learn mathematical background for optimized genetic programming

II. SYLLABUS

UNIT I INTRODUCTION TO SOFT COMPUTING

Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies - applications.

UNIT II NEURAL NETWORKS

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self-organizing feature maps.

UNIT III FUZZY LOGIC-I

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals

UNIT IV FUZZY LOGIC-II

fuzzy rule base and approximate reasoning: truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT V GENETIC ALGORITHM

Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators – Encoding scheme – Fitness evaluation –

crossover - mutation - genetic programming – multilevel optimization – real life problem-advances in GA.

III. SKILL OUTCOMES FOR THE PRACTICALS

- Understand the fundamental theory and concepts of neural networks
- Illustrate the soft computing techniques like neural network and fuzzy logic and their roles in building intelligent systems.
- Illustrate and implement the various learning rules
- Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- Design and implement real life examples using fuzzy logic and genetic algorithms

IV 6A (L): SOFT COMPUTING LAB USING (PYTHON/MATLAB)

List of Experiments:

1. Introduction to MATLAB/PYTHON & its environment.
2. Introduction to MATLAB/PYTHON: Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos
3. Introduction to MATLAB/PYTHON: Neural Network (NN) Toolbox, NN Simulink Demos
4. MATLAB/PYTHON simulation: Artificial Neural Network (ANN) implementation
5. MATLAB/PYTHON simulation: NN Tool Artificial Neural Network (ANN) implementation
6. MATLAB/PYTHON simulation: Various structure of NN algorithms implementation
7. MATLAB/PYTHON simulation: Training Algorithms of ANN.
8. MATLAB/PYTHON simulation: Coding and minimizing a fitness function using GA.

V. References:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011.
3. S.Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications”, Prentice-Hall of India Pvt. Ltd., 2006.
4. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications Prentice Hall, 1997.
5. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning Pearson Education India, 2013.

6. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
7. Simon Haykin, Neural Networks Comprehensive Foundation Second Edition, Pearson Education, 2005.

VI. Co-Curricular Activities:

a) **Mandatory**: (Training of students by teacher on field related skills: 15 hrs)

1. **For Teacher**: Training of students by teacher in laboratory for a total of 15 hours on familiarity of required software tools, installation procedure, preparation of programs, maintaining of observation books.

2. **For Student**: Individual visit to a laboratory in a university/research organization/private sector and study of required technology, tools and its usage. Submission of a hand-written analysis Report not exceeding 10 pages in the given format.

3. Max marks for analysis Report: 05.

4. Suggested Format for analysis work: Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.

5. Unit tests (IE).

b) **Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.

2. Assignments (including technical assignments like identifying various software tools in used in laboratory and their applications.

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on tools and techniques in related field.

5. Collection of material/installation procedure/various operational methods related to relevant area and organizing them in a systematic way in a file.

6. Visits to local universities and research organizations etc.

7. Invited lectures and presentations on related topics by teaching professionals and industrial experts.

VII. Suggested Question Paper Pattern:

MODEL QUESTION PAPER (Sem-end. Exam)

B.Sc. DEGREE EXAMINATION

SEMESTER –V

Course 6A: SOFT COMPUTING

Max. Marks: 70 Time: 3 hrs

SECTION A (Total: 10 Marks)

Very Short Answer Questions (10 Marks : 5 x2)

1. What is soft computing?
2. Define mutation.
3. What is a neural network?
4. Draw the basic model of Adaline network.
5. What is a fuzzy relation?

SECTION B (Total: 4x5=20 Marks)

(Answer any four questions. Each answer carries 5 marks.

1.	Distinguish between supervised learning and unsupervised learning?
2.	Compare soft computing vs. hard computing.
3.	What is meant by associative memory?
4.	Explain the working of a self-organizing map
5.	Mention some applications of Fuzzy logic.
6.	Differentiate fuzzy set and crisp set?
7.	Mention the role of fitness function in GA.
8.	State the operators of Genetic Algorithm.

SECTION C(Total: 4x10 = 40 Marks)

(Answer any four questions. Each answer carries 10 marks

1.	What is artificial neural network? Define Characteristics and applications of artificial neural network.
2.	Explain with a diagram and an example radial basis function neural network.
3.	Explain the framework of a fuzzy expert system with a diagram.
4.	(i)Explain with neat block diagram the various components of a fuzzy logic system. (ii)Describe shortly on Centroid method
5.	Explain the basic concepts of genetic algorithm and steps involved in its algorithm.
6.	Elaborate on various traditional optimization and search techniques.