 **Annexure ‘CD – 01’**

**FORMAT FOR COURSE CURRICULUM**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **L** | **T** | **P/S** | **SW/FW** | **No. of PSDA** | **TOTAL CREDIT UNITS** |
| 2 | 0 | 2 | 0 | 0 | 3 |

**Course Title: Soft Computing and Applications Credit Units: 3**

**Course Level: Minor**

**Course Code: CSE320**

**Course Objectives:**

The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities. Soft Computing is a consortium of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.

**Pre-requisites:** Basic Knowledge of artificial intelligence.

|  |  |
| --- | --- |
|  | **Weightage (%)** |
| **Module I: Introduction to Soft Computing** | **10%** |
| **Descriptors/Topics**  Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques |
| **Module II: Neural Networks (Introduction and Back Propagation Networks)** | **25%** |
| **Descriptors/Topics**  Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications. |
| **Module III: Fuzzy Systems** | **25%** |
| **Descriptors/Topics**   * Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic. |
| **Module IV: Genetic Algorithms** | **25%** |
| **Descriptors/Topics**  Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications, Multi-objective Optimization Problem Solving, Concept of multi-objective optimization problems (MOOPs) and issues of solving them.Multi-Objective Evolutionary Algorithm (MOEA).  Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs |
| **Module V: Hybrid Systems** | **15%** |
| **Descriptors/Topics**  Hybrid Systems, Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems |

**Course Learning Outcomes:**

* Learn basic concepts of soft computing and their roles in building intelligent machines.
* Design and implement neural networks classifier and apply Back Propagation algorithms.
* Apply the concepts of fuzzy logic, operations, and their properties.
* Understand the basic concepts and apply working principles of Genetic Algorithm.
* Recognize genetic algorithms for generating high quality solutions to optimization and search problems by relying on biologically inspired operators such as mutation, crossover, and selection.

**Pedagogy for Course Delivery:**

* The course would be covered under online classes using MS Team software.
* Delivery of course will be covered using e-content based on 4-quadrant approach.

**List of Professional Skill Development Activities (PSDA):**

* Minor Project/Case Study
* Group Presentation
* Quiz

**Lab/Practicals details, if applicable:**

**List of Experiments:**

* Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
* 2 Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
* 3 Train the autocorrelator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, - 1, 1). Test it using patterns: Ax = (-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
* Train the hetrocorrelator using multiple training encoding strategy for given patterns: A1=(000111001) B1=(010000111), A2=(111001110) B2=(100000001), A3=(110110101) B3(101001010). Test it using pattern A2.
* Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
* Solve Greg Viot’s fuzzy cruise controller using MATLAB Fuzzy logic toolbox.
* Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox.
* Implement TSP using GA.

**Assessment/ Examination Scheme:**

|  |  |
| --- | --- |
| **Theory L/T (%)** | **Lab/Practical/Studio (%)** |
| **67%** | **33%** |

**Theory Assessment (L&T):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Continuous Assessment/Internal Assessment 40%** | | | | | **End Term Examination 60%** |
| **Components (Drop down)** | **Attendance** | **Class Test** | **HA** | **Quiz** | **EE** |
| **Weightage (%)** | 5 | 15 | 10 | 10 | 60 |

**Lab/ Practical/ Studio Assessment:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Continuous Assessment/Internal Assessment**  **(40%)** | | | | **End Term Examination**  **(60 %)** | | |
| **Components (Drop down** | **Attendance** | **Lab Record** | **Performance** | **Viva** | **Experiment** | **Viva** | **Total** |
| **Weightage (%)** | 5 | 15 | 10 | 10 | 30 | 30 | 60 |

**Text Reading:**

* Genetic Algorithms: Search and Optimization, E. Goldberg.
* Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.

|  |
| --- |
| * Build\_Neural\_Network\_With\_MS\_Excel\_sample by Joe choong. |

* **References:**
* Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

**Additional Reading:**

* Provide E-Content