FACULTY OF ENGINEERING AND TECHNOLOGY

First Year Master of Technology (Computer Engineering)

In Effect from Academic Year 2016-17

Subject Code: 1ET2030205	**Subject Title:** COMPUTATIONAL INTELLIGENCE (ELECTIVE – II)
Pre-requisite	-

Course Objective:

Computational Intelligence is the successor to Artificial intelligence, offering special benefits in its applications in certain areas like classification, Regression, Robotics, etc. Examples of Computational Intelligence are nature-inspired methods, fuzzy systems, as well as various probabilistic methods under uncertainty. After the course the students will be able to conceptually understand the important terms and algorithms of Computational Intelligence, such that they would be able to choose appropriate methods for a given task.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	-	2	4	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Computational Intelligence** Computational Intelligence Paradigms – Artificial Neurons, Fuzzy Logic, Genetic Algorithm, Learning Theory; Difference between Computational and Artificial Intelligence	2	5
2	**Artificial Neural Networks** Basic Concept of Neural Network, Overview of Learning rules and activation functions, Single layer Perceptrons and Learning, Multi-layer Feed forward Networks, Back Propagation Networks, Introduction to Associative Memory, Adaptive Resonance Theory and Self Organizing Map, Recent Applications	5	20
3	**Evolutionary Computation** Generic Evolutionary Algorithm, Chromosome, Initial Population, Fitness Function, Selection, Reproduction Operators, Stopping Conditions, Evolutionary Computation versus Classical Optimization, Canonical Generic Algorithm, Crossover, Mutation, Applications	4	15
4	**Swarm Intelligence** Introduction, Ant Colony Optimization, Particle Swarm Optimization, Applications	4	15
5	**Artificial Immune System** Natural immune System – Antibodies and Antigens, The White Cells, Immunity Types, Learning the Antigen Structure, the Network Theory, Artificial Immune Models – Artificial Immune System Algorithm, Classical View Models	4	15
6	**Fuzzy Systems** Fuzzy Set theory, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification, Fuzzy Logic, Fuzzy Rule based systems, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification	4	15
7	**Bayesian Reasoning** Bayes Theorem, A priori, class conditional and posterior probabilities, using Bayes theorem as a Classifier, Bayesian belief Networks	3	15

Review Presentation: The student is expected to spend minimum 2 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same.
Recommended sites for journal papers are (1) dl.acm.org (2) springer.com (3) sciencedirect.com (4) elsevier.com (5) ieeexplore.ieee.org (6) scholar.google.co.in (7) scopus.com or others of similar repute.

Course Outcome:
On the completion of this course, the student would be able to:

- Understand fundamental computational intelligence and machine learning models
- Implement neural networks, genetic algorithms, and other computational intelligence and machine learning algorithms
- Apply computational intelligence and machine learning techniques to classification, prediction, pattern recognition and optimization problems.

List of References:

1. Engelbrecht, Andries P. Computational intelligence: an introduction. John Wiley & Sons, 2007
2. Rajasekaran, Sanguthevar, and GA Vijayalakshmi Pai. Neural networks, fuzzy logic and genetic algorithm: synthesis and applications. PHI Learning Pvt. Ltd., 2003
3. Eberhart, Russell C., and Yuhui Shi. *Computational intelligence: concepts to implementations*. Elsevier, 2011
4. Tom M. Mitchell Machine Learning

List of Experiments:
(Note: The experiment list provided beneath is for reference only. The course teacher may change/formulate it as per his/her methodology and requirement.)

1. Write a program to solve logical AND function using Perceptron network
2. Write a program for BPN network for XOR function using bipolar inputs and binary targets.
3. Write a program for Kohonen Self-Organizing map.
4. Write a program to minimize $F(x) = x^2$ using Genetic Algorithm.
5. Write a program to implement the properties of fuzzy sets.
6. Design a problem with help of Fuzzy toolbox, Neural Network toolbox and Genetic programming toolbox in MATLAB.
7. Solve printed character recognition using neural networks.
8. Solve Travelling Salesmen Problem using Ant Colony Optimization.
9. Solve Travelling Salesmen Problem using Particle Swarm Optimization.
10. Solve Travelling Salesmen Problem using Genetic Algorithm.
11. Solve Spam Filtering using Naive Bayes Classifier.