

Branch Name:	Computer Engineering (Software Engineering)
Program Code:	ET203
Course Title:	Intelligent Systems & Machine Learning
Course Code:	2ET2030102T
Pre-requisite Course:	-

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 and Examination Scheme:

t	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
	2	-	-	2	24	60	16	40	-	-	-	-	100

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	3	10
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	6	20
3	Supervise and Unsupervised Learning Neural Network Neural Network Types, Supervised Learning Rules, Functioning of Hidden Units, Ensemble Neural Networks, Hebbian Learning Rule, Principal Component Learning Rule, Self-Organizing Feature Maps, Introduction of Reinforcement Learning	6	20
4	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	5	15
5	Swarm Intelligence Introduction, Particle Swarm Optimization, Honeybee Optimization, Ant Colony Optimization: Principle, Convergence and Application, Other Swarm Technique.	4	10
6	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	5	15

7	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	10
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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.

Program 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. Handbook on Swarm Intelligence: Concepts, Principales and Applications by Bijaya Ketan Panigrahi, Yuhui Shi, and Meng-Hiot Lim (Eds.), Springer
4. Eberhart, Russell C., and Yuhui Shi. *Computational intelligence: concepts to implementations*. Elsevier, 2011
5. Tom M. Mitchell Machine Learning

Course Outcomes:

At the end of the course, students will be able to:

Course Outcomes	Description	Bloom's Taxonomy Level
CO1	Implementation of Machine Learning Algorithms	Applying (3)
CO2	Understanding the Artificial Neural Networks	Understanding (2)
CO3	Understanding Supervised Machine, Unsupervised Learning	Understanding (2)
CO4	Understanding of Artificial Immune System	Understanding (2)
CO5	Applying Fuzzy Logic System	Applying (3)

Mapping of CLO with PO and PSO:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	M	L	L	-	-	-	-	-	-	-	-	-	H	M	-	-
CLO2	M	L	L	-	-	-	-	-	-	-	-	-	H	M	-	-
CLO3	M	L	L	-	-	-	-	-	-	-	-	-	H	M	-	-
CLO4	M	L	L	-	-	-	-	-	-	-	-	-	M	M	-	-
CLO5	H	M	M	-	-	-	-	-	-	-	-	-	M	-	M	-
CLO6	H	M	M	-	-	-	-	-	-	L	-	M	-	M	-	-

H: High, M: Medium, L: Low