Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
SE408: Swarm and Evolutionary Computing	3	1	0	Discrete Mathematics, Artificial Intelligence

Course Objective: The course explores a variety of evolutionary algorithms and their application for problem solving. The student should be able to understand the bio-inspired algorithms and apply them to optimize parameters in real-world problems.

S. NO	Course Outcomes (CO)
CO1	Understand and apply evolutionary computing and swarm intelligence techniques to solve optimization problems.
CO2	Analyze and apply genetic algorithms to solve optimization problems by utilizing concepts of selection, crossover, mutation, and fitness evaluation.
CO3	Analyze and develop hybrid multi-objective optimization algorithms.
CO4	Apply and understand nature-inspired evolutionary algorithms such as Cuckoo Search, Artificial Bee Colony, and Ant Colony Optimization.
CO5	Apply optimization techniques to real-world problems in machine learning, robotics, image processing, etc.

S.No.	Contents	Contact Hours
UNIT 1	**Introduction to Evolutionary Computing:** Global Optimization, Components of an evolutionary algorithm, Evolution strategies, Fitness Functions, Learning Classifier systems, Parameter Control, Multi-modal Problems.	8
UNIT 2	**Swarm Intelligence:** Introduction to Swarm Intelligence and its application to optimization problems, Particle Swarm Optimization algorithm, position and velocity updation.	8
UNIT 3	**Genetic Algorithm:** Genetic algorithm basics: Population and generation of chromosomes, Fitness function, survival of the fittest, reproduction, cross-over and mutation, Genetic algorithm convergence, Genetic programming.	8
UNIT 4	**Hybrid Methods and Multi-objective Evolutionary Algorithms:** Variants of Particle Swarm optimization and Genetic Algorithm, Hybridization of Particle Swarm and Genetic based optimizations, Hybrid Multi-objective Optimization algorithms.	6
UNIT 5	**Recent nature-inspired evolutionary algorithms:** Cuckoo search algorithm, Artificial Bee Colony Optimization, Ant Colony Optimization, Fire-fly algorithm, Bacterial Foraging, Application to the travelling salesman problem.	6
UNIT 6	**Application to real world optimization problems:** Optimization examples from Machine Learning, Robotics, Image Processing and Computer Vision, Web and data mining, network traffic routing.	6
	TOTAL	42

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1.	Andries P. Engelbrech, "Computational Intelligence: An Introduction", John	2008

	Wiley & Sons, 2nd Edition.	
2.	Melanie Mitchell, "An Introduction to Genetic Algorithm", MIT Press.	**1996**
3.	David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Addison-Wesley.	**1989**
4.	A.E Eiben, J.E. Smith, "Introduction to Evolutionary Computing", Springer Nature, 2nd Edition.	**2007**
5.	D. Dumitrescu, B. Lazzerini, L. C. Jain, A. Dumitrescu, "Evolutionary Computation", CRC Press.	**2000**
6.	Kenneth A. De Jong, "Evolutionary Computation: A Unified Approach", MIT Press.	**2006**
7.	D. Dasgupta, Z. Michalewicz, "Evolutionary Algorithms in Engineering Applications", Springer Science & Business Media.	**2013**