



GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF ENGINEERING SYLLABUS

Subject Code : 3164303

Subject Name : Nature Inspired Optimization Algorithms

WEF Academic Year :	2020-21
Semester :	6
Category of the Course :	Open Elective

Prerequisite : Algorithm Design and Analysis.

Rationale : Natural Computation is the study of computational systems that use ideas and get inspiration from a variety of natural systems. Describe different nature-inspired search and optimization methods and explain how they are applied to solve real world problems.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	P		Theory		Practical		
			University exams (ESE)	Progressive Assessment (PA) (M)	ESE (V)	PA (I)		
3	-	2	4	70	30	20	30	150

Course Content :

Unit No.	Content	No. of Hours	Weightage (%)
1	Introduction to Algorithms and Optimization Introduction to algorithm, fundamental of Optimization, Types of optimization problems, example of optimization, formulation of optimization problem and classification of optimization algorithm, applications of nature inspired optimization algorithm. Travelling salesman and Knapsack Problem	07	10%
2	Nature Inspired Algorithms Structure of NIOAS ,Traditional Vs. Nature inspired algorithm, Bio inspired algorithm, Swarm Intelligence, Metaheuristics, Diversification and Intensification, Basics of Genetic Algorithm, example of GA.	06	20%
3	Classical Optimization Algorithm Mathematical model for optimization, linear Programming : Simplex and Revised Simplex, Non-Linear Programming, Dynamic Programming, Integer Programming, Stochastic programming	07	10%



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4	Nature Inspired Optimization Algorithms - 1 Particle Swarm Optimization: swarm behavior and algorithm, Differential Evolution: Algorithm, Ant Colony Optimization: Ant colony characteristics, travelling salesman problem and algorithm, Fish School Search optimization algorithm	08	25%
5	Nature Inspired Optimization Algorithm - 2 Cuckoo Search optimization algorithm, Binary Cuckoo Search algorithm, Discrete Cuckoo algorithm, Firefly algorithm, Bat algorithm, Crow search algorithm, Flower Pollination algorithm.	10	25%
6	Combinatorial Optimization Travelling Salesman Problem (TSP), Graph Coloring Problem, Job Scheduling problem, Network Routing Problem.	04	10%
Total Hours :		42	

Textbook :

1. Nature-Inspired Optimization Algorithms By Vasuki A.

Reference Books :

1. Evolutionary Optimization Algorithms by Dan Simon Latest Edition, Wiley
2. Nature Inspired Optimization Algorithm by Xin-She Yang First Edition, Elsevier
3. Swarm Intelligence and Bio-Inspired Computing by Yang , Cui, Xiao, Gandomi, Karamanoglu First Edition, Elsevier.

Course Outcomes :

After Completion of the course, students will be able to :

No.	Course Outcomes	RBT Level*
01	Understand the need of optimization and its different types.	UN
02	Understand the working of Nature inspired algorithm.	UN
03	Understand and implement classic and nature inspired optimization algorithms.	UN+AP
04	Apply algorithms to solve combinatorial problems.	AN
05	Evaluate the performance of algorithm by implementing it.	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create



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Suggested Course Practical List : (The list is suggestive in nature)

Implement below mentioned algorithm (s):

1. Travelling salesman problem algorithm.
2. Simplex method algorithm .
3. 0-1 knapsack problem using dynamic programming.
4. Particle Swarm optimization algorithm.
5. Differential Evolution algorithm.
6. The Firefly Algorithm.
7. Cuckoo search algorithm.
8. Cuckoo binary search algorithm.
9. Bat optimization algorithm.
10. Flower Pollination algorithm.

List of Laboratory/Learning Resources Required :

1. List of Hardware :

- Computer System with latest configuration

2. Suggested Software :

- Any High level programming language like python, R or Java
- Python IDLE, R studio, MATLAB
