

Branch Name:	Artificial Intelligence & Data Science
Program Code:	108
Course Name:	Optimization Algorithm
Course Code:	1ET1080604
Pre-requisite Course:	Derivative, and integral calculus; applied/intro linear algebra; basic computer programming; probability/statistics.

Course Objective:

1. To understand basic concepts of Optimization.
2. To understand role of linear programming and non-linear programming.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	-	03	70	30	-	-	100

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.	3	5
2	Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions	9	20
3	Linear Programming: Statement of an LP problem, Simplex method, Dual simplex method	5	10
4	Non-linear Programming: One-dimensional minimization: Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods: Newton-Raphson and Quasi Newton methods	9	25
6	Non-linear Programming: Unconstrained Optimization Techniques: Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method	8	15
5	Modern Methods of Optimization: Genetic algorithms, simulated annealing, fuzzy optimization, neural-network-based methods.	8	25

Course Outcome:

After learning the course the students should be able to:

1. Formulate a problem for determining optimum state of the Mechanical system.
2. Apply optimization techniques to simple and moderate systems to determine magnitude of variables for optimum performance of system.
3. Use modern methods of optimization.

List of Reference Books:

1. Engineering Optimization Theory and Practice, S.S.Rao, New Age International (P) Ltd, Publishers
2. Kalyanmoy Deb Multi-objective optimization using evolutionary algorithms John Wiley Publications
3. Jasbir S. Arora Introduction to Optimum Design McGraw Hill Publication

List of Suggested titles of Experiments (If Any):

1. Exercise on mathematical modelling and problem formulation for optimization of various mechanical system.
2. Write a program to implement single variable optimization technique.
3. Write a program to implement multivariable optimization techniques.
4. Write a program to implement LP techniques.
5. Write programs to implement Non-linear programming methods.
6. Write program to implement GA.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the basic principles for formulation of optimization models and its solution	1 Remembering 2 Understanding
CLO2	Apply optimization techniques to simple and moderate systems to for optimum performance of system.	2 Understanding
CLO3	Understand various algorithms with their comparative study for the utilization of Optimization problem solution	4 Analyze
CLO4	Develop the ability to apply the concepts of linear and Non-Linear programming	2 Understanding
CLO5	Learn depth understanding of Genetic algorithms and fuzzy optimizations	2 Understanding 3 Applying

Mapping of CLOs with POs & PSOs

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	L	L	M	M	L	M			L				H	L		
CLO2		L	M	H	L	L					L	L	M	L		
CLO3	L	M	M	L	L	H		M		L			L	M		
CLO4	M	M	L	L	M	H		M	L				M	L		
CLO5	L	L	H	L	M	H		M		L			L	M		

H: High, M: Medium, L: Low