

Branch Name:	Artificial Intelligence & Data Science
Program Code	ET108
Semester/Year:	Semester V/ Third Year
Course Name:	Optimization Algorithm (Professional Elective –II)
Course Code:	2ET1080505T
Pre-requisite:	Derivative, and integral calculus; applied/intro linear algebra; basic computer programming; probability/statistics.

Course Objective:

This course will enable students:

1. Understand the principles and applications of operations research in the context of artificial intelligence and data analysis.
2. Apply mathematical modeling techniques to formulate AI and DA problems as optimization problems.
3. Implement and analyze various OR techniques such as linear programming, integer programming, and dynamic programming for AI and DA applications.
4. Evaluate and compare different OR methods based on their effectiveness and suitability for solving specific AI and DA problems.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction to Operations Research (OR): Definition, scope, and importance of OR in AI and DA. Formulation of Mathematical modeling(LPP Model) Linear Programming (LP): Introduction and formulation of LP Model, Standard form of Linear Programming Problem(LPP), simplex method, simplex method using artificial variables, degeneracy in simplex method, duality, dual simplex method and sensitivity analysis-change in coefficients of objective function.	12	27
2	Transportation Problem: Introduction to Transportation Problem, Mathematical Model of Transportation Problem, Vogel's approximation method, Modified Distribution Method (MODI - Method). Assignment Problem: Introduction to Assignment Problem, Mathematical Model of Assignment Problem, Hungarian Method for solution of Assignment Problem.	10	22

3	Non-linear Programming: Unconstrained problems of maxima and minima and Constrained problems of maxima and minima, Lagrangian Method and Kuhn Tucker conditions.	09	20
4	Applications of Dynamic Programming: Dynamic Programming Terminology, Optimal Policy, Shortest Route Problem, Dynamic Programming Approach for Solving LPP.	06	14
5	Decision Theory: Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, Hurwicz criterion, Decision tree, case study.	08	17

List of Reference Books:

1. K.V.Mittal, C. Mohan, "Optimization Methods in Operations Research and Systems Analysis", New Age International, 1st edition, 1996.
2. H.A.Taha, "Operations Research: An introduction", Prentice Hall of India Learning Pvt. Ltd., 10th edition, 2019.
3. D.P.Kothari, J.S.Dhillon, "Power System Optimization", Prentice Hall of India Learning Pvt. Ltd., 2nd edition, 2011.
4. Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

e-resources:

1. <https://nptel.ac.in/courses/111105039>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand basics and theoretical concepts of optimization techniques.	2 Understand
CLO2	Apply mathematical principles to formulate optimization problems.	3 Apply
CLO3	Investigate the different classical methods to solve linear, non-linear programming problems and transportation & Assignment problems.	2 Understand 4 Analyze
CLO4	Solve Linear Programming Problem using dynamic programming.	2 Understand 3 Applying,
CLO5	Analyze the performance of allocation methods to solve optimization problems. (L4)	2 Understand 4 Analyze

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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CLO1	M	H	H	L	M								H		L	L
CLO2	H		L	H				H		M	M	M	H	M		L
CLO3	H	H	H	M		L			L			M	H	H	M	L
CLO4		M	H	H	L	M	H					L	M	H	H	L
CLO5		H	L	H	M	H	H	L			M	M	L	M	H	L

H: High, M: Medium, L: Low