GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code : ME02000431

Subject Name : Optimization Techniques

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective

Prerequisite:	Nil
Rationale:	Optimization techniques course teach students how to find the best solution to a problem within certain constraints. These techniques can be applied in many fields, including engineering, business, and machine learning

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Students will be able to understand basic theoretical principles for formulation of optimization models and its solution.	40
2	Students will be able to learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques.	25
3	Students should be able to apply detailed theoretical and practical aspects of intelligent modelling, optimization and control of linear and non-linear systems.	35

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction to Optimization** Historical Development, Engineering applications of Optimization, Design vector and constraints ,Constraint surface, Objective	05	12

	function, Classification Of Optimization Problems		
2.	**Classical Optimization Techniques** Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions	06	14
3.	**Linear Programming** Statement of an LPproblem, Graphical Solution of an LP problem, Simplex method, Dual simplex method	06	14
4.	**Non-linear Programming: One-dimensional minimization method**: Unimodalfunction,Unrestrictedsearch,Exhaustivesearch,Dichotomou ssearch, Interval halving method, Fibonacci method, Golden section method, Direct root methods	06	14
5.	**Non-linear Programming: Unconstrained Optimization Techniques** DirectSearchMethods:Randomsearchmethods,Gridsearchmethod,Un ivariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods:Steepestdescent method, Fletcher-Reeves method, Newton's method	08	16
6.	**Non-linear Programming: Constrained Optimization Techniques** Direct Methods: Random search method, Sequential linear programming Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method	08	16
7.	**Evolutionary Algorithms** Anoverviewofevolutionaryalgorithms,Simulatedannealingalgorithm, Genetic algorithm, Particle swarm optimization	06	14
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**30**	**30**	**10**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. EngineeringOptimizationTheoryandPractice,S.S.Rao,NewAgeInternationa

l(P)Ltd, Publishers
2. KalyanmoyDebMulti-objectiveoptimizationusingevolutionaryalgorithmsJohnWiley Publications
3. Jasbir S. Arora Introduction to Optimum Design McGrawHill Publication

(b) Open-source software and website:

1. Scilab Software

Suggested Course Practical List:

Computer programme (using Matlab / Scilab) for optimization techniques mentioned in syllabus like

1. Unrestricted Search methods
2. Golden Section Method
3. Fibonacci Method
4. Newton Methods
5. Quasi Newton and Secant methods
6. Univariate methods
7. Indirect search methods

List of Laboratory/Learning Resources Required:

Computational facility and Matlab / Scilab. List of Open Source Software/learning website:

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