GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch : Civil (Structural Engineering)

Course/Subject Code : ME01000071

Course / Subject Name : Structural Optimization

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite:	Structural Analysis and Design, Mathematics
Rationale:	The basic requirement of structural design is safety and economy. Safety can be ensured by designing the structure by satisfying various standards of code of practice. There are many design solutions which satisfy codal provisions, out of which few gives economic solution. Thus the best solution using available resources can be achieved by using optimization techniques. The optimal design can be in terms of minimum cost, minimum weight or maximum performance or a combination of these. Thus, optimization techniques play an important role in structural design.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand optimization techniques,
02	Classify the optimization problems,
03	Derive response quantities corresponding to design variable,
04	Apply optimization techniques to trusses, beams and frames.

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	2	0	4	70	30	20	30	150

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch : Civil (Structural Engineering)

Course/Subject Code : ME01000071

Course / Subject Name : Structural Optimization

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction**: Basic theory and elements of optimization Terminology and definitions. Basic principles and procedure of optimization. Classical Methods of optimization: Trial and error method, Lagrangian Multiplier method and Kuhn-Tucker method with illustrative examples	09	20
2.	**Linear Programing**: Introduction, terminology, standard form of linear programming problem, geometrical interpretation, canonical form of equation graphical and algebraic methods of solving L.P. problems, Simplex method, illustrative examples.	09	25
3.	**Non Linear programming**: Unconstrained methods of optimization on Direct search methods, Univariate search method, Hooke and Jeeves' method, Powell's method, Steepest Descent Methods, Davidon –Fletcher-Powell (DFP) method, illustrative examples.	10	20
4.	**Structural Applications**: Optimum design using the plastic theory, Optimum design of planner structures using matrix force method and matrix displacement method.	12	30
5.	**Introduction to Specialized Optimization techniques**: Integer programming, Dynamic programming, Geometric programming and Genetic Algorithms.	05	05
	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**
20	20	20	20	15	5

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. Rao S. S., Engineering Optimization – Theory and Practice, New Age International.
2. Majid K I, Optimum Design of Structures- NEWNES – BUTTERWORTHS, London.
3. Deb, K., Optimization for Engineering Design – Algorithms and examples, Prentice Hall.
4. Kirsch U., Optimum Structural Design, McGraw Hill.
5. Arora J S. Introduction to Optimum Design, McGraw Hill

(b) Open source software and website:

1. *http://nptel.ac.in/*
2. *http://ocw.mit.edu/courses/civil-and-environmental-engineering/* …

Suggested Course Practical List: If any

List of Laboratory/Learning Resources Required:

Suggested Project List: Minimum 05 problems from each topic should covered in the tutorial work out of which half of the problems shall be also solved using self developed computer programs or readymade software.

* * * * * * *