GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: CIVIL (Structural Engineering)
SUBJECT NAME: Structural Optimization
SUBJECT CODE: 3712018
ME 1st Semester

Type of course: Program Elective-II

Prerequisite:

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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% 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.	08	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.	08	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.	04	05

Reference 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

Course Outcome:

After learning the course the students should be able to:

  (a) understand optimization techniques,

  (b) classify the optimization problems,

  (c) derive response quantities corresponding to design variable,

  (d) apply optimization techniques to trusses, beams and frames.

List of Experiments/Tutorials:

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.

List of Open Source Software/learning website:

http://nptel.ac.in/

http://ocw.mit.edu/courses/civil-and-environmental-engineering/