Marwadi University

Master of Technology

Structural Engineering

Optimization Techniques

01ST1109 (PEC)

Objective of the Course:

- To impart knowledge about the optimization
- To study the different optimization methodologies applied to structural systems

Credit Earned: 3

Students learning outcomes:

After successful completion of the course, it is expected that student will be able to,

1. Understand structural optimization problems.
2. Apply various classical techniques for optimization.
3. Identify problem formulation form constrained and unconstrained nonlinear programming for optimization problem.
4. Apply optimization techniques to structural steel and concrete elements.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE (I)	IA (M)	Viva (V)	Term Work (TW)	
03	00	00	03	50	20	30	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Introduction** Basic Engineering Analysis and Design, Engineering application of optimization, classification of optimization, Variables, Need for optimal design, Local and global optima, Feasible and infeasible solution, Formulation of structural optimization problems.	**06**
2	**Classical Technique** Differential Calculus, Optimality criteria, Single variable optimization, Multivariable optimization with and without constrains, Lagrange Multiplier method, Kuhn -Tucker Criteria, Variation Principle	**08**

3	**Linear and Non-Linear Programming**	**14**
	Standard Form of Linear Programming, Problem formulation, Graphical solution, Analytical method, Simplex method, Two phase method, Elimination method, Constrained and Unconstrained optimization problems, Direct and indirect method, Method of feasible direction, Penalty function method	
4	**Structural Engineering Applications**	**14**
	Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory, Minimum weight design for truss members, Optimization principles to design R.C. structures such as multi-storey buildings, water tanks and bridges. Structural optimization for transient (dynamic) problems	
		42

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	5%	20%	25%	25%	20%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through presentations on power point and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

Recommended Study Material:

Reference Book:

1. Rao, S.S, "Engineering Optimization: Theory and Practice", New Age International, New
2. K. Deb, "Optimization for engineering design: Algorithms and example", PHI Pvt Ltd
3. J.S. Arora, Introduction to optimum design, McGraw Hill International editions.
4. E R.T. Hafta and Z. Gurdal, "Elements of structural optimization", Kluwer academic publishers
5. Andrej Cherkaev, Variational Methods for Structural Optimization, Vol.140, Springer Science.