

Branch Name:	Mechanical Engineering (Production Technology)
Program Code:	ET209
Subject Title:	Engineering Optimization
Subject Code:	1ET2010203
Pre-requisite Subject:	Zeal to learn the subject with UG level material science course knowledge

Course Objective: The objective of the course to introduce conventional and modern optimization techniques and their application to mechanical engineering problems.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
02	02	00	04	60	40	30	20	150

Subject Contents				
Sr. No	Topic	Total Hours	Weight (%)	
01	Introduction to Optimization: Engineering applications of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.	03	12	
02	Classical Optimization Techniques: Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers, Karush – Kuhn - Tucker conditions.	05	20	
03	Non-linear Programming: One - dimensional minimization: Uni-modal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods: Newton -Raphson and Quasi Newton methods.	05	20	
04	Non-linear Programming: Unconstrained Optimization Techniques: Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher - Reeves method, Newton's method.	06	24	
05	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.	06	24	
		25	100	

Review Presentation: The student is expected to spend minimum 2 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same. Recommended sites for journal papers are (1) asmedigitalcollection.asme.org (2) springer.com (3) sciencedirect.com (5) ieeexplore.ieee.org (6) scholar.google.co.in or others of similar repute.

Course Outcome: After learning the course the students should be able to:

1. Modeling of constrained decision making for an optimization problem.
2. Solve practical problems using suitable optimization technique.

Tutorials: tutorial component of the course may consist of following syllabus topics

1. Classical Optimization Techniques.
2. Non-linear Programming: : One - dimensional minimization.
3. Non-linear Programming: Unconstrained Optimization Techniques.
4. Constrained Optimization Techniques.

List of References:

1. Singeresu S. Rao, "Engineering Optimization -Theory and Practice" New Age.
2. Johnson Ray C., "Optimum Design of Mechanical elements" Wiley, John & Sons.
3. Goldberg D. E., "Genetic Algorithms in search, Optimization and Machine", Addison- Wesley, New York.
4. Kalyanamoy Deb, "Optimization for Engineering Design Algorithms and Examples" Prentice Hall of India.
5. Structural Optimization, Raphael T. Haftka and Zafer Gurdal, Kluwer Academic Publishers
6. Multi - objective optimization using evolutionary algorithms , K Deb John Wiley Publications
7. Introduction to Optimum Design , J S Arora, Mc -Graw Hill.



Sankalchand Patel University
Faculty of Engineering and Technology
**First Year Master of Technology - Mechanical Engineering (Production
Technology) In Effect from Academic Year 2021-22**