FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102320104

Course Title: Optimization Methods

Type of Course:Program Elective I

Course Objectives: This subject is designed for giving exposure of classical optimization techniques, conventional single variable, multi varaible and modern optimization techniques to Mechnaical Engineering Applications.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	2	0	4	40/16	20/08	60/24	30/12	150/60

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	INTRODUCTION TO OPTIMIZATION: Introduction and Historical Development, Formulation of Optimization Problem, Classification of Optimization Problems, Engineering Applications of Optimization.	4
2	CLASSICAL OPTIMIZATION TECHNIQUES: Single Variable Optimization & Multivariable Optimization with No Constraints. Multivariable Optimization with Equality Constraints: Solution by Direct Substitution, Solution by the Method of Constrained Variation, Solution by the Method of Lagrange Multipliers Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Conditions	8
3	SINGLE VARIABLE OPTIMIZATION Introduction, Unimodal Functions Elimination Methods: Unrestricted search, Exhaustive Search, Dichotomous Search, Interval Halving Method, Fibonacci Method, Golden Section Method, Comparison of Elimination Methods Interpolation Methods: Quadratic & Cubic Interpolation methods, Direct root Methods	10

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4	MULTI VARAIBLE OPTIMIZATION Unconstrained Optimization Techniques Direct Search Methods: Random Search Methods, Grid Search Method, Univariate method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method. Constrained Optimization Techniques Direct Methods: Random search Methods, Complex Method, Sequential Linear Programming, Indirect Method: Basic Approach of the Penalty Function Method, Interior Penalty Function Method, Exterior Penalty Function Method	**14**
5	MODERN OPTIMIZATION METHODS Genetic Algorithms, Simulated Annealing, Particle Swarm Optimization, Neural Network based Optimization	**3**
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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
15	20	20	20	15	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1	Engineering Optimization: Theory and Practice, S. S. Rao, 4th Edition, John Wiley & Sons.
2	Nonlinear Programming, Theory and Algorithms, Mokhtar S. Bazaaraa, Hanif D. Shirali and M.C.Shetty, John Wiley & Sons.
3	Modern heuristic optimization techniques: theory and applications, Kwang Y. Lee, Mohamed A. El-Sharkawi, Kluwer.
4	Operations Research: An Introduction, Hamdy A. Taha, 8th Edition, Pearson Education.
5	Engineering Optimization: Methods and Applications, V. Reklaitis, A. Ravindran, K. M. Ragsdell, Wiley.
6	Nonlinear optimization with engineering applications, Michael C. Bartholomew-Biggs, Springer.
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Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Students will enhance power of programming and development of models for solving optimization problems	**50 %**
CO-2	Understand how modern techniques and algorithms are evolving for solving complex problems	**50 %**
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CO-4	Click or tap here to enter text.	Click
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CO-6	Click or tap here to enter text.	Click
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CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click

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List of Practicals / Tutorials:

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1	To understand structure of optimization problem and various applications of optimization problems.
2	To identify and decide different types of optimization techniques.
3	To solve and understand Single variation optimization problems.
4	To solve and understand Multivariable Optimization problems with no constraints.
5	To solve and understand Multivariable Optimization problems with equality constraints.
6	To solve and understand Multivariable Optimization problems with inequality constraints.
7	To apply Elimination methods in problems for single variable optimization.
8	To apply Interpolation methods in problems for single variable optimization.
9	To study and apply various Multi variable Optimization techniques.
10	Understand and selection modern optimization methods with case studies.
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Supplementary learning Material:	
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Curriculum Revision:	
Version:	**1**
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22

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