COURSECODE 1154ME104	OPTIMIZATION TECHNIQUES	L	T	P	C
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1. Preamble

To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

2. Pre-Requisite

NIL

3. Links to Other Courses

Advanced Operations Research,
Total Quality Management and Reliability Engineering,
Project work

4. Course Educational Objectives

Students undergoing this course are expected to

- Understand the nonlinear problem and multi-objective problem
- Effectively use Optimization Techniques for solving complex Mechanical engineering Problems.
- Prepare base for understanding engineering analysis software.
- Develop logical sequencing for solution procedure and skills in soft computing.
- Optimize the solution for different real life problems with available constraints.
- Build the foundation for engineering research
- Serve as a prerequisite for post graduate and specialized studies in research.

5. Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Demonstrate the knowledge about types of optimization problems. Solve problems by MCDM AHP, Markov Decision processes.	K3
CO2	Solve Nonlinear programming problems.	K3
CO3	Solve convex and non-convex set of problems.	K3
CO4	Solve problems by Genetic Algorithms, Simulated annealing, Tabu search, Ant Colony Optimization Techniques	K3
CO5	Apply the techniques of Neural networks and Fuzzy system in the real-world applications.	K3

6. Correlation of Cos with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	L	L	L						L	M	L
CO2	H	M	L	L	L	L						L	M	L
CO3	H	M	L	L	L	L						L	M	L
CO4	H	M	L	L	L	L			L		L	L	M	L
CO5	H	M	L	L	L	L						L	M	L

H-High; M-Medium: L-Low

7. COURSE CONTENT

UNIT I INTRODUCTION AND DECISION ANALYSIS **L - 9**

Classification of optimization problems, concepts of design vector, Design constraints, constrains surface, objective function surface and multi-level optimization, parametric linear programming, Decision Trees, MCDM –, AHP and Markov Decision processes

UNIT II NON-LINEAR OPTIMIZATION – I **L - 9**

Types of Non-linear programming problems, unconstrained optimization, KKT conditions for constrained optimization, Quadratic programming- Dichotomous search – Fibonacci method - Golden section - Interpolation methods. Quadratic and cubic interpolation

UNIT III NON-LINEAR OPTIMIZATION- II **L - 9**

Separable programming, convex programming, Non-convex programming, Geometric programming, Stochastic programming- - Direct search methods: Random search – Hooke and Jeeve's – Simplex method Descent methods – Cauchy method- Newtons method

UNIT IV NON-TRADITIONAL OPTIMIZATION- I **L - 9**

Evolutionary Optimization Techniques Genetic algorithms, Simulated Annealing techniques, Particle swarm optimization, Ant colony algorithm, Differential evolution - Implementation of algorithm using Software- MATLAB –GA, SA Program.

UNIT V NON-TRADITIONAL OPTIMIZATION- II **L - 9**

Neural network based optimization, Optimization of Fuzzy systems

TOTAL: 45 PERIODS

8. Text Books

1. Singiresu S Rao, "Engineering Optimization", Wiley, 1998.
2. Kalyanmoy Deb, "Optimization for Engineering Design", PHI, 2000.

9. References

1. Johnson Ray, C., "Optimum Design of Mechanical Elements", Wiley, John & Sons, 1990.
2. Goldberg, D.E., "Genetic Algorithms in Search, Optimization and Machine", Barnen, Addison -Wesley, New York, 1989.
3. Chong, E.K.P.and Zak, S. H.."An Introduction to Optimization", John Wiley & Sons, N.Y.
4. Peressimi A.L., Sullivan F.E., Vhl, J.J. "Mathematics of Non-linear Programming", Springer – Verlag.
5. Christos H. Papadimitriou, Kenneth Steiglitz, "Combinatorial Optimization", PHI 2006