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17MD008OPTIMIZATION TECHNIQUES

COURSE CODE	COURSE TITLE	L	P	T	C
17MD008	OPTIMIZATION TECHNIQUES				

Course Description and Objectives:

Optimization is the process of obtaining the best result under given circumstances. In design, construction and maintenance of any engineering system, engineers have to take many technological and managerial decisions at several stages. The ultimate goal of all such decisions is either to minimize the effort required or to maximize the desired benefit. A number of optimization methods have been developed for solving different types of optimization problems. This course is designed tofamiliarize thestudentswiththemodelingofmechanical engineering systemsandobtainingthe optimumsolution.

Course Outcomes:

Upon successful completion of this course student should be able to:

- formulate optimization problems;
- understand and apply the concept of optimality criteria for various type of optimization problems;
- solve various constrained and unconstrained problems in single variable as well as multivariable;
- apply the methods of optimization in real life situation

SKILLS ACQUIRED: Students get

- to identify and resolve real life optimization problem
- the knowledge about various optimization techniques
- to know about various non traditional optimization techniques like Genetic algorithm, Fuzzy Logic, ANN.

PRE REQUISITE: Before opting for this subject the student should have sound knowledge on

- Linear Algebra
- Solution of systems of Linear equation
- Calculus

UNIT-I **L-1**

Introduction &LinearProgramming Problem:

Introduction: Terminology, Design Variables, Constraints, Objective Function, Problem Formulation.Engineering applicationsof optimization, classificationofoptimizationproblems.

Linear Programming Problem: **:**Standard formof linear programming (LP) problem, Canonical form of LP problem, Elementary operations, Graphical method for two variable optimization problem, Simplexmethod,Applications oflinearprogramming, Two-phasesofsimplex method,Big-Mmethod.

UNIT-II **L-10**

Application of LPP

Transportation Problems: Definition, Formulation, IBFS of TP, Optimality test for transportation Problem

Assignment Problem: Definition,Formulation, mathematical Modelling of AP, Hungarian method to solve AP, Special Cases in AP- Restricted Assignment, Maximization type, Travelling Salesman Problem.

UNIT-III **L-13**

Non-Linear Programming Problem

Single Variable objective function with or without constraints: Optimality Criterion, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method

UNIT-IV **L-13**

Non-Linear Programming Problem

Multi Variable objective function with or without constraints: Solution bymethodofconstrainedvariationmethodofLagrangemultipliers,Kuhn–Tuckerconditions, Univariate method Pattern Direction**,** Gradient of a function, Steepest descent method, Newton's method.

UNIT-V **L-12**

Non – traditional optimization algorithms: Genetic algorithms (GA) – working principle, reproduction, crossover, mutation, advanced GAoperators. GAforconstrained optimization, multi- modalfunctionoptimization, Simulatedannealing,workingprinciple,Metropolisalgorithm,differencesand similaritiesbetween conventional andnon-conventional algorithms, introduction toNeuralnetworksandfuzzylogicasan optimizationtool.

Activities:

1. Find the dimension of a beam of rectangular CS to be cut from a log having a circular cross-section of diameter a. The beam has to be used as a cantilever beam to carry a concentrated load at the free end. Find the dimension of the beam that corresponds to the maximum bending stress carrying capacity.
2. A traveling saleswoman has to cover n towns. She plans to start from a particular town numbered 1, visit each of the other n-1 towns before returning to 1. The

distance between towns I and j given by d_{ij}. Formulate the problem of selecting sequence in which the towns are to be visited to minimize the total distance traveled.

TEXTBOOKS:

1. S.S.Rao,"EngineeringOptimization",3rd Edition,NewAgePublishers,2008.

2. KalyanmoyDeb,"OptimizationforEngineeringDesign",1st Edition,PHIPublishers,2009.

REFERENCEBOOKS:

1. JasbirArora,"OptimalDesign",McGrawHill(International)Publishers.

2. D.E.Goldberg, "GeneticalgorithmsinSearch,OptimizationandMachineLearning",1st Edition, JohnWileyPublishers,2009.