COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC363	Optimization Techniques	3-0-0-3	2015

Prerequisite: NIL

Course objectives:

The purpose of this course is:

1. To understand the need and origin of the optimization methods.
2. To get a broad picture of the various applications of optimization methods used in engineering.
3. To define optimization problem and its various components

Syllabus: Engineering applications of optimization, Formulation of design problems as mathematical programming problems, objective function, constraints, classification of optimization problems/techniques, necessary and sufficient conditions for optimality, uni-modality, convexity, Mathematical formulation of LP Problems, Reduction of a LPP to the standard form. Feasible solutions, Graphical solution methods, optimality conditions, degeneracy, Simplex algorithm, Duality in linear programming, Transportation Problem, Game theory, Network path models, Nonlinear unconstrained optimization, Modern methods of optimization, Genetic algorithm. Introduction to optimization tools and software.

Expected outcome:

1. On completion of this course, the students will have a thorough understanding of optimization techniques
2. Students will be able to formulate and solving the engineering optimization problems

Text Books:

1. Singiresu S Rao, "Engineering optimization Theory and Practice", New Age International, 2009
2. H.A. Taha, " Operations Research", 5/e, Macmillan Publishing Company, 1992.
3. Kalynamoy Deb. "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi

References:

1. Hadley, G. "Linear programming", Narosa Publishing House, New Delhi
2. Ashok D Belegundu, Tirupathi R Chandrupatla, "Optimization concepts and Application in Engineering", Pearson Education.
3. Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand and Sons
4. J. S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company.
5. A. Ravindran, D. T. Phillips, J. J. Solberg, Operations Research – Principles and Practice, John Wiley and Sons.
6. Papalambros & Wilde, Principles of Optimal Design, Cambridge University Press, 2008

Course Plan			
Module	**Course content**	**Hours**	**Sem. Exam Marks**
I	Introduction: Engineering applications of optimization, Formulation of design problems as mathematical programming problems, objective function, constraints, classification of optimization problems/techniques.	2	**15**
	Optimization techniques: Classical optimization, unconstrained single and multivariable minimization-necessary and sufficient conditions for optimality, uni-modality, convexity.	5	
II	Linear programming problems-I: Mathematical formulation of LP Problems, slack, surplus and artificial variables. Reduction of a LPP to the standard form, feasible solutions. Graphical solution method, simplex algorithm and solution using tabular method, optimality conditions and degeneracy. Duality in linear programming	7	**15**
FIRST INTERNAL EXAM			
III	Transportation Problem: Formulation of transportation problem, Basic feasible solution using different methods-East West corner method, Vogel approximation method, Optimality methods, MODI method, Unbalanced transportation problem	7	**15**
IV	Game Theory: Introduction, 2- person zero – sum game; Saddle point; Mini-Max and Maxi-Min Theorems (statement only); Graphical solution (2x n, m x 2 game), dominance property. Network path Models: Tree Networks – Minimal Spanning Tree - Prim's Algorithm. Shortest path problems- solution methods – Dijkstra's Method.	7	**15**
SECOND INTERNAL EXAM			
V	Nonlinear unconstrained optimization: Single variable optimization methods- Fibonacci search method, Newton-Raphson method. Multi-variable methods- Hook-Jeeves pattern search method, Cauchy's (steepest descent) method.	7	**20**
VI	Modern methods of optimization: Introduction to Genetic algorithm, Cross over, Mutation, Reproduction, Simple examples of applications in electronics engineering	5	**20**
	Introduction to optimization tools and softwares. Solution of optimization Problems using MATLAB.	2	**0**
END SEMESTER EXAM			

Question Paper

The question paper shall consist of three parts. Part A covers I and II module, Part B covers III and IV module, Part C covers V and VI module. Each part has three questions, which may have maximum four subdivisions. Among the three questions, one will be a compulsory question covering both modules and the remaining from each module, of which one to be answered. Mark patterns are as per the syllabus with 30 % for theory and 70% for logical/numerical problems, derivation and proof.