AEROSPACE OPTIMIZATION TECHNIQUES

III Semester: AE

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAEC29	Elective	3	-	-	3	30	70	100
ContactClasses:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:45		

I. COURSE OVERVIEW:

This course emphasizes on application of various mathematical techniques for obtaining the best outputs (minima or maxima) for an engineering problem. Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems along with classical optimization techniques and numerical methods of optimization. Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The theory of optimization methods and algorithms developed for solving various types of optimization problems.
II. Research interest in applying optimization techniques in problems of Engineering and Technology.
III. The mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1	**Apply** the concept of optimization dealing with singe variables for deterring the best output to a given engineering problem.	**Apply**
CO 2	**Analyze** the behavior of nonlinear systems using Local minima and Global minima for designing the system for better outputs.	**Analyze**
CO 3	**Apply** the numerical methods to a nonlinear problem for determining the solutions in absence for analytical methods.	**Apply**
CO 4	**Apply** the Gradient methods to an engineering problem involving multiple variables for designing a system with optimized performance.	**Apply**
CO 5	**Understanding** the Multivariable constrained problems involved in engineering systems for better designs	**Understand**
CO 6	**Illustrate** the constraints involved in engineering systems for optimized solutions.	**Apply**

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO OPTIMIZATION (09)

Introduction: Optimal problem formulation, design variables, constraints, objective function, variable bounds; engineering optimization problems: Classification and Some examples (just theory and discussion): truss structure, ammonia structure, transit schedule and car suspension.

MODULE-II: SINGLE VARIABLE OPTIMIZATION (09)

Single variable non-linear optimization problems: Local minimum global minimum and inflection point, necessary and sufficient conditions theorems, some problems based on this; Numerical methods: Exhaustive search methods, Fibonacci method, golden section method and comparison, interpolation methods: quadratic.

MODULE-III: MULTI VARIABLE UNCONSTRAINED OPTIMIZATION (09)

Multivariable unconstrained non-linear optimization problems: Numerical methods direct search methods:

Univariate method, Pattern Search methods: Powell, Hook-Jeeve's, Rosen Brock's search and Simplex methods, multivariable unconstrained non-linear optimization problems.

Gradient methods: Gradient of a function, importance, gradient direction search based methods: Steepest descent/ascent method, conjugate gradient method and variable meteric method.

MODULE-IV: MULTI VARIABLE CONSTRAINED OPTIMIZATION (09)
Multivariable constrained non-linear optimization problems classical optimization techniques: Constraints equations, Lagrangian method, inequalities-Kuhn-Tucker necessary and sufficient conditions, quadratic problem, Statement, Wolfe's and Beale's methods.

MODULE-V: GEOMETRIC AND INTEGER PROGRAMMING (09)
Geometric programming: polynomials, arithmetic, geometric inequality, unconstrained G.P, constrained G.P(≤ type only) integer Programming; Introduction, formulation, Gomory cutting plane algorithm, branch and bound method.

V. TEXT BOOKS:

1. Kalyanmoy Deb, "Optimization for Engineering Design", Prentice-Hall of India (Pvt) Ltd, New Delhi, 1st Edition, 2005.
2. S.S.Rao, "Engineering Optimization: Theory & Practice", New Age International Publications, 3rd Edition, 2003..

VI. REFERENCE BOOKS:

1. S. D. Sharma, "Operations Research", Kedar Nath & Ran Nath Co., New Delhi, 1st Edition, 2013.
2. Beveridge, Schechter, "Optimization Theory & Practice", McGraw-Hill, 1st Edition, 2010.
3. Mohan C. Joshi, K.M Moudgalya, "Optimization Theory & Practice", Narosa Publishing House, 1st Edition, 2013.

VII. WEB REFERENCES:

1. http://www.sandia.gov/~ktcarlb/opt_class/OPT_Lecture1.pdf
2. http://www.ifp.illinois.edu/~angelia/optimization_one.pdf
3. http://www3.imperial.ac.uk/pls/portallive/docs/1/7288263.PDF

VIII. E-TEXTBOOKS:

1. https://pws.yazd.ac.ir/honarvar/Optimizatio-Books/Engineering%20Optimization-Rao.pdf
2. http://www.iitg.ernet.in/rkbc/CE602/CE602/Introduction.pdf