M.E Semester: 1
Electrical Engineering (Electrical Power System)
Subject Name: Introduction to Optimization (Major Elective-I)

A. Course Objective:

- To review the traditional methods of optimization so that they can be implemented in power system operation.
- To study new technologies in optimization which would find application in load dispatch and optimal power flow problems.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEEPS-105A	Introduction to Optimization	4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus

SR No.	Unit No	Topic	No. of Hours	Weighatage In Exam
1	**Unit:1**	**Concepts from geometry**: Line segments, Hyper planes and linear varieties, Convex set, Neighborhoods, Polyhedra and polytopes, Exercises.	06	10%
2	**Unit: 2**	**Unconstrained Optimization Methods:** Introduction, Basics of set-constrained and unconstrained optimization, conditions for local minimizers, Newton's method: Introduction, Analysis of Newton method; Line search method; Gradient methods: Introduction, Method of steepest descent, Analysis of gradient method, Convergence, Convergence rate, Exercises	20	30%
3	**Unit: 3**	**Conventional methods:** Linear Programming: Brief history of linear programming, Simple examples of linear programs, two dimensional linear programs, Convex polyhedral and linear programming; Quadratic programming.	12	15%

4	**Unit: 4**	**Constrained Optimization Methods:** Constrained optimization methods with Equality Constraints: Introduction, Problem Formulation, Tangent and Normal Spaces, Lagrange Condition, Second order conditions, minimizing quadratics subject to linear constraints, Exercises. Constrained Optimization Methods with Inequality Constraints: Karush Kuhn Tucker Conditions, Second order Conditions, exercises.	12	25%
5	**Unit: 5**	**Application of Optimization in Power System:** Optimal Power Flow using Newton method: Neglecting line security constraints, considering line security constraints; Economic Dispatch using Gradient method, Security constrained economic dispatch using linear programming and quadratic programming, Interior point method for VAR optimization.	10	20%

D. Instructional Methods

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

E. Students Learning Outcomes

- Students would understand the application of algorithm in different areas of power system including optimal power flow, economic dispatch, load scheduling and sensitivity calculation..

F. Recommended Study Materials

- **Text & Reference Books:**

1. An Introduction to Optimization: Edwin K. P. Chong and S. H. Zak, Wiley Publication.
2. Optimization of Power system Operation: Jizhong Zhu, Wiley Publication.
3. Computer Analysis Methods for Power systems: G.T. Heydt, Stars in a Circle Publication.

