Course Title	Optimization Techniques
Course Code	EE5304
No. of Credit Hrs (Lecture + Tutorial + Lab)	3 (2+0+1)
No. of Contact Hrs (Lecture + Tutorial + Lab)	4 (2+0+2)
Level-Year	9-5
Prerequisite (if any)	MATH 3301

1) Course Objectives:

To understand the key concepts involved in optimization techniques. The course is designed to:

- Impart the knowledge of basic concepts involved in optimization techniques and acquire a systematic understanding of it.
- Apply the theory of optimization methods and algorithms for solving various types of optimization problems in electrical engineering allied fields.

2) Expected Learning Outcomes:

After completing this course, the students should be able to:

1. **Define and explain** the fundamental concepts and theoretical foundations of modern electrical engineering topics. **KLO1 [1]**
2. **Analyze and design** solutions to industrial-related problems using appropriate engineering principles. **KLO2 [2]**
3. **Utilize and apply** modern techniques, skills, and engineering tools necessary for advanced engineering practice. **KLO3 [6]**
4. **Formulate and solve** complex engineering problems by applying suitable models and methods. **KLO1 [1]**
5. **Design and test** components or subsystems of advanced electrical engineering systems under practical constraints. **KLO2 [2]**
6. **Communicate** technical findings and recent trends in electrical engineering effectively through structured technical reports. **KLO8 [3]**

3) Course Contents:

1. Basic concepts: Scope and motivation of studying optimization techniques with a focus on electrical engineering problems, basic mathematical formulation of an optimization problems. classification of optimization problem.
2. Classical optimization techniques: Single and multivariable optimization, multivariable optimization with equality and inequality constraints (Lagrange multipliers), Kuhn-Tucker conditions, convex programming
3. Linear programming: Problem formulation, graphical method for optimization of two variable problem, simplex algorithm (minimization vs maximization), duality, primal-dual relations, dual simplex method.
4. Transportation problem, Quadratic programming.

5. Non-linear programming -Unconstrained optimization: Line search methods, method of multidimensional search, steepest descent methods, Newton's method, modifications to Newton's method.
6. Applications of optimization techniques in problems related to electrical engineering, use of software's (eg.Matlab/Scilab/Octave) for solving engineering optimization problems.

7. Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Tutorial sheets

8. Mode of Evaluation: Course Assessment Methods

- Quizzes and assignments
- Major Exams
- Final Exam

Evaluation

- **Semester Work**

Major Exams	30%
Quizzes and Homework	10%
Assignments	10%
Tutorial (Homework, Mini-project, Report, Long essay ....)	10%

- **Final**

Paper work	40%

9. Textbook(s):

– Singiresu Rao, "Engineering Optimization-Theory and Practice", John Wiley & Sons, Inc., New York, 3rd Edition, 2000.

10. References:

– Mohammad Fathi and Hassan Bevrani, "Optimization in Electrical Engineering", Springer, Boston, 2019, https://doi.org/10.1007/978-3-030-05309-3.
– L. R. Foulds, "Optimization Techniques - An Introduction", Springer-Verlag, Berlin, 3rd Edition, 2012.
– Achille Messac, "Optimization in Practice with MATLAB®: For Engineering Students and Professionals", Cambridge University Press, 2015.
– MathWorks: Optimization toolbox, Online: https://www.mathworks.com/help/optim/