

**The Joint Graduate School of Energy and Environment  
King Mongkut's University of Technology Thonburi**

**Course Outline and References**

**Course Code/Title** JEE 607: Optimization Techniques: 3 credits  
**Division:** ENERGY **Semester: 2**  
**Prerequisite:** None  
**Lecturer:** Assoc. Prof. Dr. PrungchanWongwises  
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**Course description:**

Introduction to optimization, engineering applications of optimization, statement of an optimization problem, constraint surface, objective function, classical optimization, multivariable optimization with no constraint, multivariable optimization with equality constraints, Lagrange multiplier method, multivariable optimization with inequality constraints, Linear Programming, simplex method, Two phases of the simplex method, Dual simplex method, Nonlinear programming, steepest descent method, algorithm, conjugate gradient method, Newton method, algorithm, Geometric programming.

**Commence Date:** 10 August 2022

**Subject outlines:**

	<b>Hrs.</b>
1. Introduction to optimization, engineering applications of optimization, statement of an optimization problem, constraint surface, objective function, classical optimization, single variable optimization.	3
2. Multivariable optimization with no constraint, Taylor's series expansion, Hessian matrix, positive definite matrix, negative definite matrix, semi definite case, saddle point.	3
3. Multivariable optimization with equality constraints, method of direct substitution, method of Lagrange multiplier, Hancock's condition.	3
4. Multivariable optimization with inequality constraints, Kuhn-Tucker condition.	3
5. Linear Programming, standard form of linear programming problem, geometry of linear programming problem, solution of a system of linear simultaneous equations, algorithm, pivotal reduction of a general system of linear equations.	3
6. Simplex method, simplex algorithm. Two phases of the simplex method.	3
7. Duality in linear programming. Dual simplex method.	3
8. Nonlinear programming, one-dimension minimum search, bracketing a local minimum, golden section search, parabolic interpolation.	3
9. Multi-dimension minimum search, gradient of a function, steepest ascent method, descent direction, steepest descent method, algorithm.	3
10. Newton method, algorithm, Conjugate gradient method, algorithm	3
11. Geometric programming, introduction, polynomial, unconstrained problem	3

12.	Solution of an unconstrained geometric programming problem using Differential calculus, degree of difficulty.	3
13.	Arithmetic-geometric inequality	3
14.	Solution of an unconstrained geometric programming problem using arithmetic-geometric inequality. Primal dual relationship and sufficiency conditions in the unconstrained case	3
15	Solution of a constrained geometric programming problem	3
<b>Total</b>		<b>45 hours</b>

**Text:**

1. S.S. Rao: Optimization Techniques Theory and Application. JOHN WILEY&SONs, INC 1996.

**References**

1. Edwin K.P. Chong and Stanislaw H. Zak: An introduction to Optimization. JOHN WILEY&SONs, INC 1996.(QA 402.5, C548. 1996).
2. Jorge Nocedal, Stephen J. Wright: Numeriacal Optimization. Springer 1999. (QA 402.5, N 756,1999).
3. Morton I. Kamien, Nancy L. Schwartz: Dynamic Optimization. North-Holland Elsevier 1991. (QA 402.5, KIS ,1991).
4. Ronald E. Miller: Optimization Foundations and Applications. JOHN WILEY&SONs, INC 2000. (QA 402.5, M644,2000).
5. Raymond L. Zahradni: Theory and Techniques of Optimization for Practicing Engineers.Barnes & Noble.(QA 402.5, Z19, 1971).
6. Wilfred Kaplan: Maxima and Minima with Applications Practical Optimization And Duality.JOHN WILEY & SONs, INC 1999. (QA 306, K17,1999).

Approved by.

(Assoc. Prof. Dr. PrungchanWongwises)

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