King Fahd University of Petroleum and Minerals
Department of Mathematics
SYLLABUS, Semester II, 2024-2025(242)
(Dr. Izhar Ahmad)

Course #: Math 581
Title: Advanced Linear Programming
Textbook: Robert J. Vanderbei, **Linear Programming Foundations and Extensions**, Fifth Edition **Springer Science + Business Media New York 2020** ISBN 978-3-030-39415-8 (eBook)
Course description: Theory of linear programming and its duality. Simplex method revised simplex method, dual simplex method. Interior point method. Sensitivity analysis. Integer and mixed integer programming (cutting plane, and branch and bound methods). Implementation and current solvers. Applications selected from transportation problems, assignment problems, game theory, goal programming, multiobjective programming, linear fractional programming, regression, classification and finance.

Main Objectives:
The main objectives of the course are to

1. Build students' computational background and skills in programming.
2. Develop students' competence in the applications of advanced linear programming.

Course Learning Outcomes:
Upon completion of the course, students should be able to:

1. Explain theory of linear programming and its duality.
2. Discuss simplex, revised simplex, dual simplex, and interior point methods
3. Apply sensitivity analysis to solutions of linear programs.
4. Use Cutting plane and branch and bound methods for integer and mixed integer problems.
5. Apply algorithms for solving linear programming problems.
6. Use software for solving linear problems

Topics to be Covered

Weeks	List of Topics	Contact hours
1-2	Theory of linear programming (linear inequalities, convex polyhedral, duality)	6.00
3-8	Geometry, theory and algorithms of the simplex, Revised simplex, dual simplex, and interior point method	18.00
9-10	Sensitivity analysis,	6.00
10-13	Integer and mixed integer programming problems	9.00
13-15	Applications of linear programming problems.	6.00
Total		45.00

Evaluation Policy: Midterm Exam: 35%, Project + Assignments: 20%, Final Exam: 45%.

References:

1. David G. Luenberger and Y. Ye**, Linear and Nonlinear Programming, 5th Edition, 2021, Springer.**
2. Dimitris Bertsimas and John Tsitsiklis, **Introduction to Linear Optimization**. Athena Scientic, 1997, 608 pp., ISBN 1-886529-19-1.
3. Hamdy A. Taha, **Operations Research - An Introduction, 10th Edition, 2017, Pearson.**