

## Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
IND 501	Linear Optimization	1	3	0	0	3	6

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Compulsory
Course Level	Masters Degree
Objective	<p>This course introduces basic theoretical principles and algorithms of linear programming, which provide a foundation for the other mathematical programming concepts and techniques. Furthermore, the course also introduces several different types of mathematical models, which can be used to model real-life applications, and the softwares GAMS and CPLEX, which can be used to solve large-scale linear programming problems. The objectives of the course are determined as follows:</p> <ul style="list-style-type: none"> <li>• Introduce how to formulate mathematical models of the real-life applications</li> <li>• Enable students to apply the linear optimization algorithms efficiently</li> <li>• Enable students to use the softwares GAMS and CPLEX for large-scale linear optimization problems</li> <li>• Facilitate the understanding of the theory of the other mathematical programming techniques</li> </ul>
Content	
References	<p>Bazaraa, M.S., Jarvis, J.J., Sherali, H.D., "Linear Programming and Network Flows", 4. Edition, Wiley, New Jersey, 2010</p> <p>Bertsimas, D., Tsitsiklis, J.N., "Introduction to Linear Optimization", Athena Scientific Series in Optimization and Neural Computation, Massachusetts, 1997</p> <p>Bazaraa, M.S., Sherali, H.D., "Nonlinear Programming: Theory and Algorithm", 3. Edition, Wiley, New Jersey, 2006</p> <p>Wolsey, L.A., "Integer Programming", Wiley, New Jersey, 1998</p> <p>GAMS Manual, downloadable from <a href="http://www.gams.com/">http://www.gams.com/</a></p>

## Theory Topics

Week	Weekly Contents
1	Modeling of optimization problems (Bazaraa, Jarvis & Sherali, Chapter 1, Bertsimas & Tsitsiklis, Chapter 1)
2	Modeling of optimization problems (Bazaraa & Sherali, Chapter 1, Wolsey, Chapter 1) and solution through GAMS and MATLAB+CPLEX
3	Basic concepts in linear algebra (Bazaraa, Jarvis & Sherali, Chapter 2)
4	Basic concepts in convex analysis (Bazaraa, Jarvis & Sherali, Chapter 2)
5	The simplex and big-M algorithms (Bazaraa, Jarvis & Sherali, Chapter 3)
6	The two-phase algorithm, degeneration, cycling, and cycling prevention rules (Bazaraa, Jarvis & Sherali, Chapter 4)
7	Farkas' lemma, Karush-Kuhn-Tucker optimality conditions (Bazaraa, Jarvis & Sherali, Chapter 5)
8	Midterm I
9	Duality and sensitivity analysis (Bazaraa, Jarvis & Sherali, Chapter 6, Bertsimas & Tsitsiklis, Chapter 4)
10	Parametric analysis, the revised simplex algorithm (Bazaraa, Jarvis & Sherali, Chapter 6, Bertsimas & Tsitsiklis, Chapter 5)
11	The dual simplex and the primal-dual algorithms (Bazaraa, Jarvis & Sherali, Chapter 6)
12	Dantzig-Wolfe decomposition (Bazaraa, Jarvis & Sherali, Chapter 7, Bertsimas & Tsitsiklis, Chapter 6)

Week	Weekly Contents
13	Programming the Dantzig-Wolfe decomposition in MATLAB+CPLEX
14	Midterm II