T-810-OPTI **OPTIMIZATION METHODS** **8 ECTS**

Year of study:	First or second year MSc.
Semester:	Fall.
Level of course:	5. Second cycle, intermediate.
Type of course:	Core for MSc Engineering Management (in 1st year MSc) and MSc Financial Engineering (in 2nd year MSc).
Prerequisites:	Operation Research (T-403-ADGE).
Schedule:	Runs for 12 weeks - 6 teaching hours a week.
Supervisor:	Hlynur Stefánsson.
Lecturer:	Hlynur Stefánsson.

Learning outcome: After the completion of this course students will be capable of using basic methods of Operations Research for analyzing and solving complex decision problems. More specifically the student will be able to:

- Understand the properties of linear optimization and how it can be used to analyze and solve complex decision problems;
- Use and analyze different forms of linear optimization models;
- Understand and be capable of analyzing the geometry of linear optimization;
- Apply systematic methods and algorithms for analyzing and solving decision problems;
- Understand the importance and usefulness of linear optimization and its applications;
- Apply software to solve optimization models;
- Implement solution methods for linear optimization models and have in-depth understanding of the mechanics of the Simplex methods;
- Practice the use of sensitivity analysis and to derive formulas for sensitivity of model parameters;
- Understand integer programming and how it can used in decision making;
- Use the main solution methods for integer programming;
- Understand the special properties of network models and formulate practical problems as network models;
- Understand the nature of non-linear optimization problems and the challenges involved in solving the problems;
- Be familiar with different classes on non-linear optimization models and some of the available solution methods and algorithms;
- Understand the importance of optimization under uncertainty and be able to develop robust programming, change constraints and stochastic programming models;
- Be familiar with dynamic programming;
- Present results in a clear and organized manner.

Content:
Overview and approach: This course introduces the concepts of linear, discrete, stochastic, nonlinear and dynamic optimization. Emphasis is on methodology and the underlying mathematical structures. Topics include basic principles and techniques for implementaiton of optimization models, the theoretical foundations of LP and the Simplex method, sensitivity analysis and applications, robust optimization and chance constraints, stochastic programming (with recourse), introduction to NLP and examples, one-variable and multivariable unconstrained optimization, KKT conditions, quadratic programming and separable programming, convex and nonconvex programming.

Reading material: Hillier and Lieberman, *Introduction to Operations Research,* 10th Edition, Pearson 2014.
Teaching and learning activities: Lectures, exercises, group work, individual homework, mid-term exams, final exam.
Assessment methods: Final exam 50%, mid-term exams 20%, group work 10%, homework 10%, reports 10%.
Language of instruction: English.

All course descriptions may be subject to change. Revised information on the course schedule, reading material, teaching and learning activities, and assessment methods will be introduced in the learning management system Canvas at the beginning of the semester.