

FACULTY OF **ENGINEERING**

DEGREE COURSE: **COMPUTER AND CONTROL ENGINEERING
BS**

SUBJECT: OPERATIONS RESEARCH

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OBJECTIVES

The course is aimed at:

- 1) providing students with the foundations of Operations Research introducing optimization models and the related algorithms.
- 2) providing students with the theory and the algorithms for linear programming and on a selection of network optimization problems. During the course, some applications will be also illustrated.

CONTENTS

Introduction to Operations Research. The origins, the nature and the impacts of Operations Research. The Operations Research modeling approach and its main steps. Basic review of linear algebra and topological concepts.

The Linear Programming (LP) Model. The graphical solution method for LP models.

The Simplex Method. The standard form of a LP problem. Transformation of a LP problem in its standard form. Basic solutions, feasible basic solutions and degenerate basic feasible solutions. Fundamental properties of LP. The canonical form. The simplex method in tabular form. The two phase simplex method. The matrix form of the simplex method.

Duality Theory. The dual linear programs. The primal-dual relationships. The weak duality theorem, the strong duality theorem, the complementary slackness, the economic interpretation of duality. The dual simplex method.

Sensitivity Analysis. Changes in the objective function coefficients and in the right-hand side coefficients. Adding a new constraint.

Special LP cases. The Transportation problem. The Assignment problem.

Network optimization. Introduction and basic concepts. A selection of network optimization problems. Introduction to the project management.

Introduction to Integer Linear Programming. Integer Linear Programming models. The linear relaxation.

Some formulation examples: a selection of optimization models.

LEARNING OUTCOMES

At the end of the course, students will be able to:

- model optimization problems;
 - apply the appropriate methods for their solution;
 - properly interpret the obtained results;
 - investigate the sensitivity of the solutions.
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ASSESSMENT

Written exam: multiple choice and open questions

RECOMMENDED TEXTBOOKS

F.S. Hillier, G.J. Lieberman, *Introduction to Operations Research*, Eighth Edition, McGraw-Hill International Edition, 2005.

Recommended Reading

D. Bertsimas, J. N. Tsitsiklis, *Introduction to Linear Optimization*, Athena Scientific, 1997.
