Mathematical Optimization for Business

Academic Year: (2020 / 2021) **Review date: 10-07-2020**

Department assigned to the subject: Statistics Department

Coordinating teacher: NIÑO MORA, JOSE

Type: Electives ECTS Credits : 6.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students are expected to have completed courses with contents in linear algebra, multivariable differential calculus, statistics, business administration and computer programming.

OBJECTIVES

CORE COMPETENCES:

1. Formulating optimization models for decision-making in diverse application areas.
2. Analyzing and solving optimization problems of linear, integer and nonlinear types, through the formulation and solution of their optimality conditions.
3. Using software tools for formulating and solving optimization models.
4. Interpreting the numerical solutions of optimization models in decision-making terms.

TRANSVERSAL COMPETENCES:

1. Capacity for analysis and synthesis.
2. Problem solving and mathematical modeling.
3. Oral and written communication.

DESCRIPTION OF CONTENTS: PROGRAMME

Topic 1.1. Linear optimization (LO). Operations research; LO models; formulations and applications; computer-based solution.

Topic 1.2. Graphical solution; sensitivity analysis.

Topic 1.3. The fundamental theorem of LO; basic feasible solutions and vertices; the simplex method.

Topic 1.4. The two-phase simplex method; interior point methods.

Topic 1.5. Optimal network flow models.

Topic 1.6. More applications and examples.

Topic 2.1. Integer optimization models; linear relaxations; optimality gap; graphical and computer solution.

Topic 2.2. The Branch and Bound method.

Topic 2.3. Combinatorial optimization models; strengthening formulations; valid inequalities.

Topic 2.4. More applications and examples.

Topic 3.1: Unconstrained non-linear optimization (NLO). Motivation and examples; local and global optima; convexity; optimality conditions; numerical solution.

Topic 3.2. Equality-constrained NLO. Motivation and examples; Lagrange multipliers; optimality conditions; numerical solution.

Topic 3.3. Inequality-constrained NLO. Motivation and examples; Karush-Kuhn-Tucker multipliers; optimality conditions; numerical solution.

Topic 3.4. More applications and examples.

LEARNING ACTIVITIES AND METHODOLOGY

Theory (3 ECTS). Theory classes with supporting material in Aula Global.
Practice (3 ECTS). Model formulation and problem-solving classes. Computing classes.

The teaching methodology will have a practical approach, being based on the formulation and solution of problems drawn from diverse application areas, both in the practical classes and in the theory classes, as motivation and illustration of the theory.

There will be a weekly individual tutoring session.

ASSESSMENT SYSTEM

The course grade will be based on three midterm exams, with a weight of 100% of the final grade.

Students who have not followed the continuous evaluation will be allowed to take a final exam with a value of 60% of the course grade

Students who do not pass the course in the regular semester will have an extraordinary exam. If the student followed the continuous evaluation process, this exam will have the same weight that the regular exam. If the student did not follow the continuous evaluation process, the weight of the final exam will be 100% of the total grade. In any case, the final grade will be based on the more favorable weighing scheme.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- F.S. Hillier, G.J. Lieberman Introduction to operations research, McGraw-Hill.
- H.A. Taha Operations research : an introduction, Prentice Hall.