27018 - Operations Research

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	453 - Degree in Mathematics
ECTS	6.0
Year	3
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

Operations Research is compulsory within the block *Optimization* .

Operation Research is the science of decision making. It includes several mathematical techniques to aid decision makers to make good decisions. In this course, we study the fundamental of deterministic models with emphasis on linear programming.

1.2.Recommendations to take this course

It is recommended that students attend all classes. Students are expected to prepare the topics throughout the course and to do regular homework assignments to become familiar with the different concepts, some with economic implications, which are the core of the course.

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

A midterm exam will be given on November.

The final exam will be given at the end of the semester (see the final exam schedule published by the Faculty of Sciences).

Exams are closed book and closed notes.

2.Learning goals

2.1.Learning goals

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

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Understand problems from narrative statements and convert narrative statements to mathematical models.

Identify convex sets and convex functions from their definition or characterizations.

Determine extreme points and extreme directions of a polyhedron.

Apply optimality conditions to get a local/global optimal solution of a nonlinear (continuous) optimization problem.

Identify systems which can be modelled as linear problems.

Formulate and solve linear optimization problems.

Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.

Formulate and solve the dual of a linear optimization problem and understand the relationship between a linear program and its dual.

Perform sensitivity analysis.

Solve specialized linear programming problems like the transportation, thansshipment and assignment problems.

Formulate some basic models in integer programming.

Use specialized software to solve optimization problems.

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

To provide students with an introduction to optimization models, methods, and their applications. Students will develop the ability to conceptualize from real-world situations appropriate mathematical programming models. The students will model, analyze, solve, and interpret results of decision-making problems.

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

Laboratories and active participation during the classes (5%)

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Midterm exam (15%).

Final exam (80%)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

Lectures (50% classes)

Operations Research problem resolution (30% classes)

Laboratories (20% classes)

5.2.Learning tasks

Lectures, problem resolution classes and laboratories.

Lecture slides and other important materials will be posted on moodle2@unizar.es. Please check there regularly.

5.3.Syllabus

Course outline:

Topic 1: *Introduction to Operations Research.*

Topic 2: *Convex Analysis.*

Convex sets. Polyhedra. Extreme points and extreme directions of a polyhedron. Convex functions.

Topic 3: *Introduction to Nonlinear Optimization.*

Unconstrained and constrained minimization. Karush-Kuhn-Tucker optimality conditions.

Topic 4: *Linear Optimization.*

Problem formulation. Basic concepts and fundamental theorems. The simplex algorithm.

Topic 5: *Duality and Sensitivity Analysis.*

Formulation of the dual problem. Primal-dual relationships. The dual-simplex algorithm.

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Topic 6: *Special Models in Linear Optimization.*

Transportation, transshipment and assignment problems.

Topic 7: *Integer Programming.*

Problem formulation. Branch and bound algorithm.

5.4.Course planning and calendar

See the oficial scheduling in the Faculty of Sciences web page.

5.5.Bibliography and recommended resources

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