COURSE DATA

Data Subject	
Code	34178
Name	Models in operational research
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	4	First term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	17 - Models of statistics and operations research	Optional

Coordination

Name	Department
MARTI CUNQUERO, RAFAEL	130 - Statistics and Operational Research

SUMMARY

This course extends the contents of the course on Mathematical Programming for those students interested in Optimization and its application to real problems in Economics, Logistics, Production, etc... in order to do that, this course reviews the basic concepts on modelling and problem solving in Linear Programming and extends them to Integer Linear Programming.

The two main aspects of this course are the modelling of real problems and the development of solution procedures for Integer Linear Programming. Starting from a deep knowledge of modelling techniques and solution methods, it will be possible to introduce some of the most important problems of Operations Research, such as Production, Transportation, and Inventory models.

In the final part of the course, we will introduce the basic concepts of Simulations, as an alternative to the Optimization methods.

According to the contents and objectives of this course, its main component is the student work, individually and in groups, modelling and solving real applications. For solvins the models, the students will use available software.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Haber cursado la asignatura de Programación Matemática (segundo curso).

OUTCOMES

1107 - Degree in Mathematics

- Learn autonomously.
- Adapting to new situations.
- Apply the knowledge in the professional world.
- Argue logically in decision-making.
- Expressing mathematically in a rigorous and clear manner.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.
- Participate in the implementation of software and learn mathematical software.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.
- Visualize and interpret the solutions obtained.

LEARNING OUTCOMES

· To be able to construct Integer Linear Programming models, defining the variables and constraints adequate for each problem

· To know how to use the basic procedures for solving Integer Linear problems: Cutting Planes; Branch and Bound

· To be able to model and solve problems in Production, Scheduling, Transportations and Inventories.

· To know how to use available software for solving linear and integer problems

DESCRIPTION OF CONTENTS

1. Linear Programming

1.1 Linear Programming models: variables objectives, constraints.
1.2 The Simplex Method.
1.3 AMPL.
1.4 Sensitivity analysis.

2. Linear Programming

2.1 Using integer and binary variables.
2.2 Logic constraints.
2.3 Branch and bound algorithms.
2.4 Cutting planes algorithms.

3. Heuristic Algorithms

3.1 Introduction to algorithms.
3.2 Metaheuristics.
3.3 Artificial intelligence.

4. Models for Production Planning and Scheduling

4.1 Production planning: the production master plan.
4.2 Production programming:machine scheduling.

5. Transportation and Distribution problems

5.1 Shortest path problems.
5.2 Transportation problems.
5.3 Network flows.

6. Multi-Objective Problems

6.1 Goal Programming.
6.2 The Multi-Objective model.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	37,50	100
Computer classroom practice	15,00	100
Other activities	7,50	100
Development of group work	15,00	0
Development of individual work	30,00	0
Preparation of evaluation activities	15,00	0
Preparing lectures	15,00	0
Resolution of case studies	15,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The classes will combine the theoretical and the practical part, without separating sessions devoted to theory from those devoted to practice. All the classes will be in a computer equipped classroom.

In the theoretical part of the classes, the teacher will introduce the concepts and methods of Integer Linear Programming and the Operations Research models, with examples and exercises to be solved by the students.

In the practical part, synchronized with the theory, the students will use the available software to model and solve real problems and interpret the results.

EVALUATION

The evaluation of the knowledge and skills attained by the students will be done in a continuous way throughout the course. The evaluation will have two components:

1.- Algorithm coding: 30% of the final grade, which a 10% comes from seminars.

2.- Written final exam: 70% of the grade

In order to pass the course, it is necessary to get a minimal mark of 5 over 10 in the final exam.

The activities in part 1 are considered not-recoverable, that is, they cannot be evaluated by an exam. The marks will be kept for the whole academic year.

REFERENCES

Basic

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Referència b1: Cliff T. Ragsdale, Spreadsheet Modeling & Decision Analysis, A Practical Introduction to Business Analytics, 8th Edition, 2018. Cengage Learning.

Referència b2: Eiselt, H.A., and Sandblom, C.L. Operations Research. A model-based approach. Springer (2012), 2nd edition.

Referència b3: Sarker, R.A. and Newton, C.S., Optimization Modelling. A Practical Approach, CRC Press (2008)

Referència b4: Williams, H., Model Building in Mathematical Programming. Wiley (2013), 5th edition.

Referència b5: Eiselt, H.A., and Sandblom, C.L. Integer Programming and Network Models. Springer (2000).

Additional

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Referència c1: Winston, W.L. and Albright, W., Practical Management Science. Duxbury Press (2011), 4th edition.

Referència c2: Hillier, F.S. y Lieberman, G.J.: Introducción a la Investigación de Operaciones. McGraw-Hill (2010), 9ª edición.

Referència c3: Murty, K.G.: Linear and Combinatorial Programming. Wiley (1976).

Referència c4: Papadimitriou, C. and Steiglitz, K., Combinatorial Optimization: Algorithms and Complexity. Prentice Hall (1998)

Referència c5: Taha, H., Investigación de Operaciones. Pearson, Educación (2012), 9ª edición

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available