COURSE DATA

DATA SUBJECT

Code: 44863
Name: Optimisation
Cycle: Master's Degree
ECTS Credits: 12
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2237 - Master's Degree in Business Process Planning and Management	Facultat d'Economia	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2237 - Master's Degree in Business Process Planning and Management	Optimisation	COMPULSORY

COORDINATION

PARREÑO TORRES CONSUELO

SUMMARY

The main objective of this course is to introduce the student to optimization as a tool in the decision making process. The course is self-contained and the required background knowledge is reduced to user-level computer science and basic mathematics. However, students with advanced knowledge in computer science will also find techniques and strategies for the development of business optimization applications.

The student will be provided with the knowledge to model, formulate and solve optimization problems in business and industry. The course has a dual focus, at the user level and at the technician level, in order to meet the needs of different professionals in the field of decision making.

The course reviews numerous case studies taken from different business environments to illustrate the complete optimization process, from the determination of the model to the analysis of the solution obtained using the software studied.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

COMPETENCES / LEARNING OUTCOMES

2237 - Master's Degree in Business Process Planning and Management

Analyse and solve management problems by creating and validating models appropriate to the various fields of the company's activity, such as production planning and control, inventory management, distribution and logistics or project management. Work with available or possible data.

Be able to accept change as something connatural to economic activity and develop an attitude of alertness to the dynamism and uncertainty of the business environment.

Be able to integrate into teams, both as managers or coordinators and for specific and limited functions and in support of the team or of others.

Be able to integrate knowledge and handle the complexity of formulating judgments based on information that, while being incomplete or limited, includes reflection on social and ethical responsibilities linked to the application of knowledge and judgments.

Be able to model real situations as mathematical formulations, especially those involving decision making in complex scenarios.

Be able to synthesise and communicate the results, the conclusions of models and the solutions proposed in a rigorous and clear manner.

Be accustomed to analyse reality from a multidisciplinary approach, typical of social sciences in general and economics in particular.

Be familiar with the optimisation and simulation tools available in the market and their possible adaptation to business problems. Consider the development of new applications.

Carry out and coordinate projects for technological improvement and innovation in management.

Develop a systemic perspective for problem solving and decision making in the business environment. Be able to break the whole down into parts, without losing the global view and taking into account the interrelationships between the parts.

Develop the ability to manage information, with special emphasis on quantitative information. Adequately design the process of data collection and processing.

Develop the technical and analytical skills needed for decision making based on complex and incomplete information, which is the central element of the managerial activity.

Know how to communicate conclusions and the knowledge and rationale underpinning these, to specialist and non-specialist audiences, clearly and unambiguously.

Know how to work in multidisciplinary teams reproducing real contexts and contributing and coordinating

their own knowledge with that of other branches and participants.

Participate in, lead and coordinate debates and discussions, be able to summarize them and extract the most relevant conclusions accepted by the majority.

Show creativity when facing the resolution of complex problems and be able to evaluate the implications that the alternatives designed may have on the different agents involved.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

To know how to apply acquired knowledge and solve problems in new or unfamiliar situations within wider contexts (or multidisciplinary) related with their field of study.

Use different presentation formats (oral, written, slide presentations, boards, etc.) to communicate knowledge, proposals and positions.

DESCRIPTION OF CONTENTS

1.Introduction to Mathematical Programming Models

2. Linear Programming
2.1. Introduction and Modelling.
2.2. Simplex Algorithm.
2.3. Duality in Linear Programming.
2.4. Sensitivity Analysis.
2.5. Modelling, Resolution and Interpretation of Results.

3. Nonlinear Programming

3.1. Introduction and Modelling.

4. Integer Linear Programming

4.1. Modelling with Integer Variables.

4.2. Introduction to solving techniques in Integer Linear Programming
4.3. Exact Algorithms.
4.4. Heuristic Algorithms.
4.5. Metaheuristic Algorithms.

5. Multi-objective programming
5.1. Basic concepts.
5.2. Resolution methods.
5.3. Applications.

6. Decision-making under uncertainty
6.1. Multi-criteria analysis.
6.2. Introduction to fuzzy logic and fuzzy modelling. Fuzzy optimisation.
6.3. Applications.

Seminars:
1. Generative AI.
2. ODS optimisation.
3. Simulation.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Seminar	9,00
Computer classroom practice	90,00
Total hours	**99,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	120,00
Independent study and work	30,00
Preparation of lessons	0,00
Preparation for assessment activities	51,00
Resolution of case studies	0,00
Total hours	**201,00**

TEACHING METHODOLOGY

The classes, which will be held in the computer lab, have an applied nature. The practical orientation of the

subject promotes teacher-student interaction, limiting the one-way development from the teacher to the student, and stimulating participation. The teacher will introduce topics through real-life cases and demonstrate the need to develop the proposed theme in order to successfully solve the problems presented. The student will use the described tools to independently solve the problems.

In the theory classes, the method of lecture-style teaching will be combined with other sessions in which students have a more prominent role and can discuss the progress of their work. In the practical classes, problems, exercises, and examples related to all the concepts studied in theory will be solved.

In addition, the subject includes several sessions in seminar format. These sessions allow students to broaden their perspectives, deepen their knowledge of applied content and learn about professional experiences in areas related to the subject.

EVALUATION

The course is divided into 3 main parts taught by three different professors. The first covers Modelling, Linear Programming and Nonlinear Programming, the second covers Integer Linear Programming and the third covers Multiobjective Programming and Decision Making with Uncertainty. In addition, the contents are completed with seminars.

These three parts count equally in the final evaluation of the course.

It is necessary to obtain a minimum of 4 points (out of 10) in each part and an average of 5 points or more to pass the course.

In the first two parts, 60% of the evaluation will correspond to the mark obtained in the course work. This work will consist of the resolution of a set of exercises, related to the subject matter explained in the classes, which the teachers will propose throughout the semester. The remaining 40% will correspond to the grade obtained in a final exam. In order to pass the course, it is essential to obtain at least a 4 (out of 10) in each part of the exam.

In the third part, 100% of the grade will be obtained by solving exercises and homework and there will be no final exam.

Attendance is compulsory. Therefore, the student must attend at least 75% of the classes and seminars associated with the subject. If this is not the case, the student will have to take a final exam corresponding to 100% of the grade (both in first and second call).

In the case of not having passed the subject (having obtained less than 4 points in one of the parts or not exceeding an average of 5) the student will be able to opt in the second call for exams of the parts that will constitute 100% of the mark.

REFERENCES

- Carlsson, C. , Fullér, R. (2002): Fuzzy Reasoning in Decision Making and Optimization, Ed. Springer-Verlag, Berlin.
- Carlsson, C. , Fullér, R. (2011): Possibility for Decision, Ed. Springer-Verlag, Berlin.
- Gendreau, M. and Potvin, J. Y. (Eds.) Handbook of Metaheuristics. Springer, International Series in Operations Research & Management Science, Vol. 146, 2ª ed., 2010 .
- Kaufmann, A., Gil Aluja, J. (1987): Técnicas Operativas de Gestión para el Tratamiento de la Incertidumbre. Hispano Europea, Barcelona. (libre en PDF).
- Morales-Luna, G. (2002): Introducción a la lógica difusa. Obtenido de http://delta.cs.cinvestav.mx/~gmorales/ldifll/ldifll.html
- Osman, I.H., Kelly, J.P. (2011): Metaheuristics. Theory and Applications. Kluwer.
- Powell S.G., Baker, K.R. (2013): Management Science: The Art of Modelling with Spreadsheets. Wiley, 4ª ed..
- Ragsdale C. T. (2014): Spreadsheet Modelling & Decision Analysis. Cengage Learning, 7ª ed.
- Russell, R.S., Taylor, B. W. (2011): Operations Management creating value along the supply chain. Prentice Hall, 7ª ed..
- Taha, H. A. (2012): Investigación de operaciones. Pearson, 9ª ed.
- Vanderbei, R. (2013): Linear Programming: Foundations and Extensions. Springer, 4ª ed.
- Verdegay, J. L (2003): Fuzzy Sets Based Heuristics for Optimization, Ed. Springer-Verlag, Berlin.
- Winston, W.L., Albright, S. C. (2013): Practical Management Science. South Western Cengage Learning, 5ª ed.
- Winston, W.L., Venkataramanan, M. (2002): Introduction to Mathematical Programming. Thomson, 4ª ed.