COURSE DATA

Data Subject	
Code	44863
Name	Optimisation
Cycle	Master's degree
ECTS Credits	12.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2237 - M.U. en Planificación y Gestión de Procesos Empresariales	Faculty of Economics	1	First term

Subject-matter

Degree	Subject-matter	Character
2237 - M.U. en Planificación y Gestión de Procesos Empresariales	1 - Optimisation	Obligatory

Coordination

Name	Department
LIERN CARRION, VICENTE	257 - Business Mathematics

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

OUTCOMES

2237 - M.U. en Planificación y Gestión de Procesos Empresariales

- 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.
- Know how to communicate conclusions and the knowledge and rationale underpinning these, to specialist and non-specialist audiences, clearly and unambiguously.
- 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.
- 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.
- Use different presentation formats (oral, written, slide presentations, boards, etc.) to communicate knowledge, proposals and positions.
- 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.
- 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.
- 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.

- Develop the ability to manage information, with special emphasis on quantitative information. Adequately design the process of data collection and processing.
- Carry out and coordinate projects for technological improvement and innovation in management.
- Be able to model real situations as mathematical formulations, especially those involving decision making in complex scenarios.
- 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.
- Be able to synthesise and communicate the results, the conclusions of models and the solutions proposed in a rigorous and clear manner.
- 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.
- Be accustomed to analyse reality from a multidisciplinary approach, typical of social sciences in general and economics in particular.
- 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.
- 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.
- 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.

LEARNING OUTCOMES

At the end of the teaching-learning process the student will have learned to:

1: Know formally correct definitions of the basic concepts in optimization.

2: Be able to model real situations as mathematical formulations.

3: Know the optimization tools available in the market, their possible adaptation to the problems of the business environment and consider the development of new applications.

4: Solve optimization problems with Solver software for Excel.

5: Interpret optimization results and evaluate alternatives.

6: Develop simulation models and analyze the results.

DESCRIPTION OF CONTENTS

1. Introduction to Mathematical Programming Models

2. Linear Programming: Simplex Algorithm

3. Duality in Linear Programming

4. Sensitivity analysis

5. Modeling with integer variables

6. Integer Linear Programming: branch and bound algorithms

7. Heuristic algorithms

8. Metaheuristic algorithms: GRASP, Genetic Algorithms

9. Nonlinear Programming

10. Decision making under uncertainty

11. Introduction to fuzzy logic and modeling

12. Fuzzy optimization. Location, investment and human resources models

13. Comparison between optimization methods. Application to economics and business models

WORKLOAD

ACTIVITY	Hours	% To be attended
Computer classroom practice	90,00	100
Seminars	9,00	100
Development of individual work	120,00	0
Study and independent work	30,00	0
Preparation of evaluation activities	51,00	0
TOTAL	**300,00**	

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.

EVALUATION

The course is divided into 3 parts, each of which is taught by a professor. The first part covers Modeling and Linear Programming, the second part covers Integer Linear and Nonlinear Programming. Finally the third part deals with Optimization with uncertainty and Simulation is introduced. The 3 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 the three parts equal or higher than 5 points to pass the course.

In the first two parts, 60% of the evaluation will correspond to the grade obtained in the course work. This work will consist of the resolution of a set of exercises, related to the matter explained in the classes, that the professors will be proposing 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 get at least a 4 (out of 10) in each part of the exam.

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

The exercises proposed in the three parts of the course are considered not recoverable, that is to say, their grade will be kept for the two calls of the course, but they cannot be recovered by means of an exam.

REFERENCES

Basic

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