COURSE DATA

Data Subject	
Code	36507
Name	Advanced Operations Research Models
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1332 - Degree in Business Intelligence and Analytics	Faculty of Economics	2	First term

Subject-matter

Degree	Subject-matter	Character
1332 - Degree in Business Intelligence and Analytics	8 - Matemáticas Avanzadas	Obligatory

Coordination

Name	Department
BALLESTIN GONZALEZ, FRANCISCO FELIPE	257 - Business Mathematics

SUMMARY

The subject of "Advanced Operations Research Models" is a compulsory semester subject taught in the second year, first semester, of the Degree in Business Intelligence and Analytics / BIA.

This course delves into mathematical optimization concepts studied in the subject "Basic Models of Operations Research" and develops concepts and basic techniques of several important areas within Operational Research that are not covered in the first-year course. The subject is divided into three large blocks. The first introduces the design of heuristic and metaheuristic algorithms, necessary to solve many operational research problems and in particular some of the problems considered in the rest of the subject. In the second block, concepts and methods for multi-objective programming are developed. In this type of optimization one works with several criteria at the same time, something very present in practice. The block begins by studying necessary basic concepts, such as the efficient solution or the Pareto set. Next, some of the existing methods to solve these type of problems are studied.

In the last block, programming with uncertainty is studied, with the aim of providing the student with the appropriate mathematical and algorithmic instruments to tackle problems where some of the data is not deterministic, but contains significant variability.

The relevance of these problems and their frequent appearance in the economics and business world makes the capacities for abstraction, synthesis, and analysis for the right evaluation of the situation and the problem statement, as well as the knowledge of the resolution and analysis methods, fundamental skills that a good graduate of Business Intelligence and Analytics must possess.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

The knowledge corresponding to the subject " Basic Models of Operations Research " is taken for granted.
This knowledge includes: the basic concepts of optimisation and modelling, as well as the use of Lingo / Gams and indexed syntax of Lingo / Gams.

OUTCOMES

1332 - Degree in Business Intelligence and Analytics

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Acquire basic training that can be used to learn new methods and technologies and to adapt to new situations in academic and professional areas.

- Be able to solve problems and to communicate and spread knowledge, skills and abilities, taking account of the ethical, egalitarian and professional responsibility of the activity of business intelligence and analytics.
- Be able to produce models, calculations and reports, and to plan tasks in the specific field of business intelligence and analytics.
- Be able to access and manage information in different formats for subsequent analysis in order to obtain knowledge through data.
- Be able to make autonomous decisions in digital environments characterised by the abundance and dynamism of data.
- Know and know how to properly use the appropriate quantitative and qualitative methods to reason analytically, evaluate results and predict economic and financial magnitudes.
- Be able to apply analytical and mathematical methods for the analysis of economic and business problems.
- Demonstrate skills for analysis and synthesis.
- Be able to analyse and search for information from diverse sources.
- Be able to learn autonomously.
- Be able to use ICT, both in academia and in professional practice.
- Be able to define, solve and present complex problems systemically.
- Be able to work in a team demonstrating commitment to quality, ethics, equality and social responsibility.
- Express situations of uncertainty and randomness using mathematical, synthetic and graphic languages.
- Make decisions under certainty and uncertainty.
- Reach strategic diagnoses in complex and uncertain environments using appropriate methodologies.
- Know the basic concepts of logic, algorithmics, computational complexity and their application to business intelligence.

LEARNING OUTCOMES

Increased ability to use logical / strategic reasoning to deal with real world economic situations.

Using advanced quantitative tools and their application in the economic environment.

Ability to select a theoretical framework for the development of the analysis.

Being able to apply different methods and analysis techniques using computer programs.

DESCRIPTION OF CONTENTS

1. Design of algorithms: heuristic algorithms.

Constructive algorithms, local searches. Use of a computer program for the implementation of heuristics.

2. Design of algorithms: metaheuristic algorithms.

Classification. Grasp, Genetic Algorithms. Other examples.

3. Multiobjective programming.

Basic concepts. Pareto-efficient solutions. Techniques for generating the efficient set: weight method and epsilon-constraint method. Techniques with a priori information: goal programming. Other techniques. Use of a computer program to solve problems.

4. Programming with uncertainty.

Introduction and basic concepts. Resolution methods. Practical applications. Introduction to fuzzy programming. Use of a computer program to solve problems.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Computer classroom practice	30,00	100
Development of group work	15,00	0
Study and independent work	15,00	0
Preparation of evaluation activities	30,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	15,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Theoretical classes:

The teacher will highlight the main aspects and those that are more difficult to understand, will make model examples and will guide the students' study through the materials available in the virtual classroom and the reference manuals. At the end of the class, the necessary materials will be indicated for the following class, so that the student can prepare the session.

Practical classes:

The practical classes will fundamentally address the aspects related to the different models and procedures studied in the theory, algorithm design, computer resolution and interpretation, applying all the relevant theory, of the results obtained. The teacher will previously solve some models and propose the realization of others for later classes. In each class the student must be able to defend the suitability of their own model and the decisions to be made in view of the results.

The theoretical and practical classes are completed with the proposal of individual and / or team exercises in which they will be modelled, solved with a computer and interpret solutions to problems similar to those studied in the subject.

EVALUATION

a) Continuous Evaluation (4 points)

Based on the participation and involvement of the student in the teaching-learning process and in the practical activities developed by the student during the course, from the preparation of individual and / or group work, with defense of the positions developed by the student. A negative behaviour of the student may reduce the continuous grade.

On a maximum of 4 points, the mathematical modeling of problems, their theoretical or computer resolution, including Lingo / Gams indexed syntax, and the interpretation and discussion ofthe results obtained will be evaluated. Theoretical-practical exercises and algorithm programming exercises can also be evaluated.

b) Synthesis Evaluation (6 points)

The synthesis test may consist of solving theoretical and practical problems, creation of algorithms and problems that require Lingo / Gams indexed syntax. In some cases, computer aid may be required for its resolution.

To pass the course it will be necessary to pass the synthesis evaluation. In this case, the final grade (out of 10) will be obtained as the sum of the summary evaluation grade plus the continuous evaluation grade. Otherwise the final grade may not exceed 4.5 points. The course will be considered approved when the final grade is at least 5 points out of 10.

The assessment tests are recoverable, except for those corresponding, where appropriate, to the group work. The student who so wishes will be able to take an exam that includes all the synthesis evaluation (6 points) and the recovery of the continuous evaluation that does not correspond to those items (minimum of 2.5 points). Students who wish to recover the continuous assessment in any of the calls must notify at least five days in advance of their desire to recover it.

REFERENCES

Basic

- Hillier, F. S. y Lieberman, G. J. (2010): Introducción a la Investigación de Operaciones (9ª Edición). México, McGraw-Hill.
- Alonso-Ayuso, A., Cerdá, E., Escudero, L.F., Sala, R. (eds.) (2004) Optimización bajo incertidumbre Tirant lo Blanch. Valencia, España.
- Lai, Y. J., Hwang, C. L. (1992): Fuzzy Mathematical Programming: Theory and applications,. Springer, Berlin

Additional

- Hillier, F. S. y Lieberman, G. J. (2002): Investigación de operaciones (7ª Edición). México, McGraw-Hill.
- Taha, H. A. (2004): Investigación de operaciones (7ª Edición). México, Pearson Education, Prentice Hall.