COURSE DATA

DATA SUBJECT

Code: 36498
Name: Basic Operations Research Models
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1332 - Degree in Business Intelligence and Analytics	Facultat d'Economia	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1332 - Degree in Business Intelligence and Analytics	Matemáticas	BASIC

COORDINATION

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SUMMARY

"Basic Models in Operations Research" is a six-month basic subject that is taught in the first year, second semester, of the Degree in Business Intelligence and Analytics.
In this subject the basic concepts and techniques of mathematical optimization are developed with the objective of providing the student with the appropriate mathematical tools in order to deal with the problem of assigning scarce resources to different alternative uses. Mathematical optimization techniques are needed to approach the theory of the firm, consumer theory, growth models, etc. Thus, the first topic of this subject introduces terminology and basic concepts of optimization. In the following topics, this knowledge is expanded and resolution techniques are developed so that, when faced with a practical real situation, the student knows how to formulate it, solve it, and interpret the obtained results.
Once the basic concepts have been introduced, non-linear programming is approached as the most general optimization problem, where interesting particular cases are addressed, such as unconstrained problems, problems with equality constraints (classical programming), and problems with non-negative variables, as well as the general case with constraints defined by inequalities. From topic 3, linear programming is addressed, where the fact that all the functions are linear allows the use of efficient methods different from those presented for the general case. The linearity also allows us to analyse the solution of the problem in a more complete way, by means of sensitivity analysis. The special case where the problem variables can take only integer values is studied in the penultimate topic. The last topic handles structured problems of Combinatorial Optimisation.

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 prior knowledge corresponding to the course "Mathematical Models for Management" is assumed. This includes: basic concepts of analysis (including the concept and computation of partial derivatives, gradient vector, and Hessian matrix), graphical representation of scalar functions of one variable, computation of matrix inverses, matrix multiplication, and the solving of linear and nonlinear systems.

COMPETENCES / LEARNING OUTCOMES

1332 - Degree in Business Intelligence and Analytics

Acquire basic training that can be used to learn new methods and technologies and to adapt to new situations in academic and professional areas.

Apply methods and techniques of analysis, synthesis and graphical representation by means of software tools.

Be able to access and manage information in different formats for subsequent analysis in order to obtain knowledge through data.

Be able to analyse and search for information from diverse sources.

Be able to apply analytical and mathematical methods for the analysis of economic and business problems.

Be able to define, solve and present complex problems systemically.

Be able to learn autonomously.

Be able to make autonomous decisions in digital environments characterised by the abundance and dynamism of data.

Be able to produce models, calculations and reports, and to plan tasks in the specific field of business intelligence and analytics.

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 use ICT, both in academia and in professional practice.

Be able to work in a team demonstrating commitment to quality, ethics, equality and social responsibility.

Demonstrate skills for analysis and synthesis.

Know and know how to properly use the appropriate quantitative and qualitative methods to reason analytically, evaluate results and predict economic and financial magnitudes.

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 be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

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 have developed the learning skills needed to undertake further study with a high degree of autonomy.

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.

DESCRIPTION OF CONTENTS

1. Introduction to Optimisation

Introduction: the problem and its parts. Basic concepts: feasible solution, classes of optimum and classification of problems. Convexity. Basic theorems. The modeling process. Syntax of the computer program.

2. Non-linear Programming

Introduction to convexity. Kuhn-Tucker conditions. Basic theorems of non-linear programming. Interpretation of Kuhn-Tucker multipliers. Modeling, interpretation and computer resolution of non-linear programming models: existence and globality of the solution and interpretation of the multipliers.

Basic feasible solutions. Fundamental theorems of Linear Programming. The Simplex algorithm. Sensitivity

3. Linear programming

and post-optimization analysis. Modeling, computer resolution and interpretation of linear programming models. Advanced syntax of the computer program. Applications to the business environment.

4. Integer Linear Programming

Introduction. General formulation of linear integer problems. Method of branch and bound. Modeling, computer resolution and interpretation of linear integer programming models.

5. Structured problems in combinatorial optimisation

Problem of the shortest path. Problem of the spanning tree with minimum cost. Other problems.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Computer classroom practice	30,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	30,00
Preparation of lessons	30,00
Preparation for assessment activities	30,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The classes will be given in English.

Lectures:

The teacher will highlight the main aspects and those more difficult to understand, perform exercises and the study guide students through the materials available in the virtual classroom and reference manuals.

After the class, the materials needed for the next class will be indicated, so that students can prepare for the session.
Practical classes:
Practical classes primarily will address issues related to modeling, computer resolution and interpretation, applying all relevant theory, of the results obtained. In each class, students should be able to defend the adequacy of its own model and to take decisions in the light of the results.
Theoretical and practical classes are completed with the proposed individual and/or group exercises.

EVALUATION

a) Continuous Assessment (4 points)
It is divided into two parts:
1) Group work (0.5 points)
May require defense of developed positions. It is not recoverable.
2) Individual work (3.5 points)
The study of theoretical-practical exercises will be evaluated, the mathematical modeling of practical cases, where
It is recoverable.Negative behavior can reduce the continuous evaluation mark.
b) Final Exam (6 points)
The synthesis test will consist of solving theoretical-practical problems and, where appropriate, mathematical mode
The final grade (out of 10) will be obtained as the sum of the synthesis test grade plus the group work grade plus th
The individual work part is recoverable. Whoever so wishes may —both in the first and second call— take an extra te
To pass the subject it will be necessary to meet three conditions: 1) pass the synthesis test, 2) obtain at least a 1.3
If the 3 conditions are not met, the final grade may not exceed 4.5 points.

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REFERENCES

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