COURSE DATA

Data Subject	
Code	36498
Name	Basic Operations Research Models
Cycle	Grade
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1332 - Degree in Business Intelligence and Analytics	Faculty of Economics	1	Second term

Subject-matter

Degree	Subject-matter	Character
1332 - Degree in Business Intelligence and Analytics	2 - Matemáticas	Basic Training

Coordination

Name	Department
BALLESTIN GONZALEZ, FRANCISCO FELIPE	257 - Business Mathematics

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 knowledge corresponding to the subject "Mathematical models for management" is taken for granted. This knowledge includes: basic concepts of analysis (among them, partial derivatives calculation, gradient vector and Hessian matrix), graphical representation of scalar functions with one variable, and calculation of an inverse matrix.

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

LEARNING OUTCOMES

• Ability to recognize an economic problem from observing economic reality.
• Using basic 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. 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. 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.

3. Introduction to linear programming

The linear problem: Types of solutions. Basic feasible solutions. Fundamental theorems of Linear Programming. Modeling, computer resolution and interpretation of linear programming models. Advanced syntax of the computer program.

4. Simplex method, sensitivity and post-optimización analysis

Introduction to the Simplex algorithm. Sensitivity and post-optimization objective function coefficients and right hand sides. Introducing new variables. Modeling, computer resolution and interpretation of linear programming models: type of solution, interpretation of the reduced cost and sensitivity analysis.

5. 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.

6. Structured problems in combinatorial optimisation

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

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Computer classroom practice	30,00	100
Study and independent work	30,00	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

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. Professor will solve some previously proposed models and will perform other for subsequent classes. 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 which shall be modeled, will solve with a computer and they will interpret solutions to practical problems.

EVALUATION

a) Continuous assessment (4 points)It is based on the practical activities carried out by the student during the course, including individual and/orgroup work, and the defense of the positions developed by the student.On a maximum of 4 points, the following items may be evaluated: theoretical-practical problems, mathematical modelling problems, its resolution with a computer and the interpretation and discussion of the results obtained.
b) Synthesis evaluation (6 points)The synthesis test will consists of of solving theoretical-practical problems. It may also contain modelling problems, with or without summations.To pass the course it will be necessary to pass the synthesis evaluation. In this case the final note(out of 10) will be obtained as the sum of the grade of the synthesis evaluation plus the continuousassessment grade. Otherwise the final grade can not exceed 4.5 points. The subject will be consideredas passed when the final mark is at least 5 points out of 10.All the evaluation tests are recoverable. The student who so wishes may — both in first and secondcall - take an exam that includes the entire synthesis assessment (6 points) and therecovery of continuous evaluation (4 points).Students who wish to make up the continuous assessment in any of the calls mustnotify at least five days in advance of their wish to retrieve it.

REFERENCES

Basic

- Font, B (2009): Programación matemática para la economía y la empresa. 2ª Edición. Laboratori de Materials, 1. Valencia, PUV.
- Ivorra, C. (2009): Programación matemática. (http://www.uv.es/~ivorra).

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- Meneu, R. (2013): Apunts de teoria de Matemàtiques II (http://roderic.uv.es/handle/10550/25760).
- Meneu, R. (2013): Material de pràctiques de Matemàtiques II. http://roderic.uv.es/handle/10550/25759)
- Mocholí, M. y Sala, R. (1999): Decisiones de optimización (2ª Edición). Valencia, Tirant lo Blanch.
- Vídeos docents de Matemàtiques II (2018). Projecte dInnovació Docent Preferències en l'aprenentatge de l'assignatura Matemàtiques II: Docència inversa i presencial amb aprenentatge cooperatiu.

Additional

- Arévalo, M. T., Camacho, E., Mármol, A. y Monroy, L. (2004): Programación matemática para la economía. Madrid, Delta Publicaciones.
- Barbolla, R., Cerdá, E. y Sanz, P. (2001): Optimización: Cuestiones, ejercicios y aplicaciones a la economía. Madrid, Pearson Education, Prentice Hall.
- Hillier, F. S. y Lieberman, G. J. (2002): Investigación de operaciones (7ª Edición). México, McGraw-Hill.
- Mocholí, M y Sala R (1993): Programación Lineal: Metodología y problemas. Madrid, Tebar Flores
- Taha, H. A. (2004): Investigación de operaciones (7ª Edición). México, Pearson Education, Prentice Hall.

ADDENDUM COVID-19

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

1. 1. Subject contents

No changes are made to the teaching guide.

1. 2. Workload and time planning of teaching

No changes are made to the teaching guide.

1. 3. Teaching methodology

The modality of classes for students will depend on the social and health conditions and the restrictions established by the competent authorities.

In the case of **online teaching**, classes will be given by videoconference, preferably synchronous, using Blackboard Collaborate, Teams, Skype or the tool that the lecturer considers appropriate to optimize the student's teaching-learning process during the scheduled program sessions, **which remain the same days and times.**

In the case of **blended teaching**, the students will have to access the classroom in alternate weeks according to the initial of their last name (A-M or L-Z). The classes will be broadcast so that the students will have face-to-face teaching one week, and the next week they will follow the classes in streaming.

In the case of **face-to-face teaching**, students shall attend classes during the established timetable, in classrooms where attendance does not exceed 50% of their capacity.

1. 4. Evaluation

The continuous activities that will be carried out during the all course will have a value of 4 points, all recoverable, while the synthesis evaluation will be 6 points. The continuous activities will be based in practical activities developed during the all course, from the elaboration of individual and/or group work, in defence of the presentation developed by the student.

1. 5. References

No changes are made to the teaching guide.