

**COURSE DATA****Data Subject**

Code	36497
Name	Mathematical Modelling for Management
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

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

Subject-matter

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

Coordination

Name	Department
JUAN MARTINEZ, MARIA DEL CARMEN	257 - Business Mathematics

SUMMARY

"Mathematical Models for management" is a one semester foundation course in basic mathematics for business placed in the first term of the first year of the Degree in Business Intelligence and Analytics and has a total of 6 credits.

This course is concerned with the essential mathematics for the quantitative description, analysis and comprehension of economic environment and for making business decisions. Moreover, it provides the basic concepts, techniques and mathematical tools for dealing with the other courses of this Degree.

Contents include matrix algebra, functions of one and several variables: tendency, continuity and marginal analysis, and an introduction to integral calculus.



PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Prior knowledge assumed is that corresponding to first and second year in high school in the field of humanities and social sciences.

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 the observation of economic reality.
- Management of basic quantitative tools and their application to economic environment.
- Ability to select a theoretical framework for the development of analysis.
- Being able to apply different methods and analysis techniques using computer programs.

DESCRIPTION OF CONTENTS

1. Algebra

Systems of linear and nonlinear equations. Matrices, determinants and calculation of the inverse. Matrix operations and system resolution with a computer program. Eigenvalues and eigenvectors. Diagonalization. Matrix factoring. Application to machine learning algorithms.

2. Concept of function

Concept of function of one and several variables. Contour lines. Concepts of limit and continuity. Examples of functions used in Economy: production, demand and utility functions. Examples of functions used in Machine Learning: error functions and learning functions.

3. Derivability of functions

Definition and economic interpretation of the derivative of a real function. Calculation of derivatives. Definition and economic interpretation of partial derivatives of scalar and vector valued functions. Higher-order derivatives of functions of one or more variables. Gradient, Jacobian and Hessian. Derivatives with a computer program.

**4. Differentiability of functions**

Differentiability of functions Derivative of the compound function. Derivative of the implicit function. Increase directions of a function. Gradient descent algorithms. Applications to machine learning.

5. Introduction to integral calculus

Techniques of integration. Riemann Integral: existence of the definite integral and Barrows rule. Improper integrals. Integration with a computer program.

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

The learning methodology consists of lectures and practice sessions, where the teacher encourages students in the use of mathematical and symbolic language and logic and systematic thinking and he/she promote the individual and team private study learning.

In the lectures the lecturer explains the major topics, illustrate and clarifies definitions and theorems using completely worked out examples, and assists students in their self-study learning and use of the bibliography. The lecturer's explanations will be combined with the students' participation in class through small questions and exercises designed for the discussion of frequent doubts. At the end of the class, the lecturer will give guidelines and homework to prepare next class at home. The aim is that the student develops his/her capacity for self-study and self-learning and for expressing formally using mathematical and symbolic language.

In the practice sessions the lecturer shows the main economic and business applications of the topics developed in the lectures and encourages students in the definition, solution and formal discussion of complex problems. The lecturer will solve worked out problems and he/she will propose the preparation of new ones for the next classes. Thus, each student will be able to formulate problems and propose and justify his/her method of resolution.

In some practical classes the computer will be used to learn to solve some of the problems that arise in class through some computer program.



The study and/or posterior development of lectures and practice sessions will generate written assignments and class and homework tasks which can will be taken into consideration in the continuous assessment of student.

EVALUATION

The evaluation of the course is based on a system consisting of the following parts:

1. Written exam in the day officially announced. In this exam, the estudent will be evaluated on the specific competencies over the course content and application (maximum mark 7 points).
2. Continuous evaluation of the student which will assess the achievement of general competencies and the degree of participation of the student in the process of teaching and learning by doing exercises (maximum mark 3 points). Part of the continuous evaluation may consist of solving exercises by computer. All these activities can be retaken.

To pass the course the written exam must be overcome. The final mark is the sum of the written exam plus the continuous evaluation mark. Logically, to pass the course you must obtain a final mark greater than or equal to five (5). If the written exam is not overcome , the maximum final grade will be of 4.5 points.

REFERENCES

Basic

- Calvo, C. e Ivorra, C. (2012). Las Matemáticas en la Economía a través de ejemplos en contextos económicos. Ed. Tirant lo Blanch. Valencia.
- Canós, M. J., Ivorra, C. y Liern, V. (2002). Matemáticas para la Economía y la Empresa. Ed. Tirant lo Blanch. Valencia.
- Ivorra, C. (2007). Matemáticas Económico-Empresariales. Laboratori de Materials, 2. PUV.
- Ivorra, C. y Juan, C. (2007). Matemáticas Empresariales. Laboratori de Materials, 7 . PUV.
- Deisenroth, M.P., Faisal, A.A. y Ong, C.S. (2020) Mathematics for Machine Learning. Ed. Cambridge University Press. Reino Unido.

Additional

- Alegre, P. et al. (1995). Matemáticas Empresariales. Colección Plan Nuevo. Ed. AC.
- Alegre, P. et al. (1991). Ejercicios Resueltos de Matemáticas Empresariales. Ed. AC. Vol. 1 y 2.
- Casasús, T. et al. (1991). Matemáticas Empresariales. Ed. La Nau Llibres.



- Muñoz, F., Guerra, C. et al. (1988). Manual de Álgebra Lineal. Ed. Ariel.
- Sydsaeter, K. y Hammond, P. J. (2002). Matemáticas Esenciales para el Análisis Económico. Ed. Prentice Hall.
- Aggarwal, C.C. (2020) Linear Algebra and Optimization for Machine Learning. Ed. Springer. Suiza.

