1. BASIC INFORMATION

Course	MODELS FOR DECISION-MAKING
Degree program	DATA SCIENCE
School	SCHOOL OF SCIENCE, ENGINEERING AND DESIGN
Year	3
ECTS	9
Credit type	MANDATORY
Language(s)	ENGLISH
Delivery mode	IN-PERSON
Semester	6

2. INTRODUCTION

Data-driven decision-making is defined as the use of facts, metrics, and data to guide strategic business decisions that align with an organization's goals, objectives, and initiatives. When an organization takes full advantage of the value of its data, everyone working there, from the business analyst to the sales manager and human resources specialist, has the ability to make better decisions, every day. However, this is not achieved simply by choosing the right analysis technology to identify the next strategic opportunity.

3. SKILLS AND LEARNING OUTCOMES

Core competencies:

- CB1 - That students have proven to possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, includes also some aspects that involve knowledge coming from the forefront of his field of study.
- CB3 - That students have the ability to collect and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.
- CB4 - That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences.

Cross-curricular competencies:

- CT01 - Ethical values: Ability to think and act according to universal principles based on the value of the person that are directed to its full development and that entails commitment to certain social values.
- CT02 - Autonomous learning: A set of skills to select strategies for searching, analysing, evaluating and managing information from diverse sources, as well as to learn and implement independently what has been learned.
- CT05 - Analysis and problem solving: Be able to critically evaluate information, break down complex situations into their constituent parts, recognize patterns, and consider other alternatives, approaches and prospects for finding optimal solutions and efficient negotiations.

Specific competencies:

- CE2 - Ability to apply statistical techniques and models in data analysis and processing, decision support systems, finding relationships between variables and making predictions.

Learning outcomes:

- RA1 - Use mathematical and statistical language to formulate a problem.
- RA2 - Search, select and process appropriate data for carrying out the subsequent analysis.
- RA3 - Use programming languages and computer packages to apply statistical and optimization techniques to carry out data processing, use decision aid systems, find relationships between variables and make predictions.
- RA4 - Generate reports containing the results of statistical studies including ethical criteria.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB1, CT02, CT05, CE2	RA1
CB3, CT01, CT02, CT05, CE2	RA2
CB1, CB3, CT02, CT05, CE2	RA3
CB3, CB4, CT01, CT02, CT05, CE2	RA4

4. CONTENTS

- Linear regression models.
- Analysis of variance.
- Model adjustment and validation techniques.
- Panel data and time series.
- Descriptive techniques and inferential procedures of multivariate analysis.
- Bayesian data analysis.

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Master classes
- Case method
- Cooperative learning
- Learning based on problems
- Project-based learning
- Learning based on laboratory teachings (laboratory practices, workshop practices, simulation environments)
- Gamification

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Master classes and practical seminars	50
Problem solving	26
Case studies and field studies	15
Laboratory practice	18
Debate and colloquium	7
Apprenticeship contract (definition of interests, needs and objectives)	3
Autonomous study	88
Tutoring	13
Face-to-face tests of knowledge	3
TOTAL	**173**

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Face-to-face tests to evaluate theoretical/practical content objectives	60%
Non-face tests to evaluate theoretical/practical content objectives	25%
Tests to evaluate attitudes	5%
Self-assessment and co-evaluation tests	5%
Laboratory, workshop or simulation practice tests	5%

When you access the course on *Campus Virtual*, you'll find a description of the assessment activities you must complete, as well as the delivery deadline and assessment procedure for each one. Please note that the evaluation procedures for each of the different activities may be specific, two activities need not be weighted with the same weight, and/or the evaluation criteria/headings may be different.

For each of the activities, the evaluation criteria and their weighting will be specified within the block of training activities.

The evaluation process is based on the personal work of each student and presupposes the authenticity of the authorship and originality of the exercises performed. Lack of authenticity in authorship or originality of evaluation tests; copying or plagiarism are irregular behaviors that can have academic and disciplinary consequences. Students who are identified by a teacher as cheating or suspect that they have cheated on any knowledge test or assessable activity. If such students cannot demonstrate otherwise, or alternatively, that they possess the knowledge and skills associated with the test or activity, the test or activity will be evaluated with a grade of 0. Higher sanctions may be considered according to the University's General Coexistence Regulations.

This subject can only be passed based on continuous assessment. The weighted average of each of the continuous assessment marks of each of the blocks of training actions becomes the final grade of the subject. Late deliveries will not be accepted.

To ensure this continuous assessment, you must attend at least 50% of the classes in person to be able to apply for the ordinary call. Virtual attendance (hyflex) to the sessions is allowed exclusively for justified cases typified by the University. Otherwise, it will be recorded as non-attendance. Cases where the student is 15 minutes late will be recorded in the Canvas Attendance system as "Late Assistance" (the system will automatically compute 80% attendance). On the other hand, it will be recorded in the system as "Absence" when the student arrives or leaves more than 15 minutes after/before the start/end of the class (the system will automatically compute a 0% attendance).

After a student is reprimanded three consecutive times for behaviors that are not conducive to a favorable environment for class learning or involve disrespect to the teacher or other peers, the student will be invited to leave the classroom to preserve an appropriate learning environment. Depending on the offense, higher sanctions may be considered according to the University's General Coexistence Regulations.

7.1. First exam period

To pass the course in the Ordinary Call, you must obtain a final course grade of at least 5 out of 10 (weighted average).

In any case, you will need to obtain a grade of 5 out of 10 in each exam to count towards the final grade, along with all the grades corresponding to the other activities.

The assessable activities (deliveries, assignments, projects, challenges, tasks, presentations, etc.) will also have a minimum grade of 4 out of 10 to average and a minimum average grade of 5 out of 10 to pass the subject.

7.2. Second exam period

The activities not passed in the Ordinary Call must be delivered after receiving the corrections corresponding to them by the teacher or those not delivered. Activities that have been passed cannot be delivered. In the case of activities done in groups in Ordinary Call, new working groups could be generated in Extraordinary or done individually.

All the marks obtained in the Extraordinary Call, except the exam, will be multiplied by a coefficient of 0.7. Those that remain approved from the Ordinary Call are not altered.

Once multiplied by 0.7, the following points should be considered:

- To pass the subject, you must obtain a grade greater than or equal to 5 out of 10 in the final grade (weighted average) of the subject.

- In any case, it will be necessary that you obtain a grade greater than or equal to 5 out of 10 on each partial part of the exam so that it can average with the rest of the activities.
- If you have passed one of the partial exams, you will do only the partial exam you haven't passed. If you have passed all the partial exams, you won't need to do the exam.
- The assessable activities (deliveries, assignments, projects, challenges, tasks, presentations, etc.) will also have a minimum grade of 4 out of 10 to average and a minimum average grade of 5 out of 10 to pass the subject.

8. BIBLIOGRAPHY

The main reference work for this subject is:

- Alpaydin, E (2020). Introduction to machine learning, The MIT Press, 2020:
- Theodoridis (2015). Machine Learning: a Bayesian and Optimization perspective. Elsevier
- D. Haroon (2017). Python Machine Learning Case Studies: Five Case Studies for the Data Scientist. Apress
- Bishop C.M, (2006). Pattern recognition and machine learning, Springer
- Cherkassky, V.; Mulier, F. (2007). Learning from data: concepts, theory, and methods, John Wiley, 2007.
- T.; Tibshirani, R.; Friedman, J,. (2009). The elements of statistical learning: data mining, inference, and prediction. Hastie

The recommended Bibliography is:

- R. O. Duda, P. E. Hart, D. G. Stark (2016). Pattern classification, Third Edition, John Wiley & Sons Inc.
- C. M. Bishop (2016). Pattern Recognition and Machine Learning, Springer
- Géron, A, (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: concepts, tools, and techniques to build intelligent systems - O'Reilly Media, Inc.
- K. P. Murphy (2020). Machine Learning: a probabilistic perspective, Second Edition, The MIT Press.
- Hastie, R. Tibshirani, J. Friedman (2011) The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer (Series in Statistics)