UAB
Universitat Autònoma de Barcelona

# Data Science in the Aeronautical Sector 2026/2027

Code: 108242
Credits: 6

| Degree programme | Type | Course |
|---|---|---|
| Aeronautical Management | OP | 4 |

## Contact lecturer

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## Teaching staff

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## Group languages

You can consult this information at the end of the document.

## Prerequisites

To successfully complete the practical work of this subject, it is essential for students to have prior programming knowledge in the Python language, equivalent to that acquired in the subjects Programming Fundamentals I and II, as well as the basic concepts addressed in the Artificial Intelligence subject.

In relation to the theoretical content, fundamental knowledge of Statistics and Algebra is required to understand and apply the quantitative methods used in data science.

Consequently, it is recommended that students who have not previously passed these subjects do not enroll in this course, as the lack of such knowledge can significantly hinder their progress and performance throughout the course.

## Objectives

1. Understand the fundamental principles, methodologies, and concepts of data science, as well as its specific application and relevance in the aeronautical sector.
2. Acquire the ability to apply advanced techniques of exploratory data analysis and machine learning to datasets originating from the aeronautical field.
3. Develop skills to identify, analyze, and interpret significant patterns, trends, and relationships in large volumes of aviation data.
4. Apply the principles of ethical, responsible, and secure data use, ensuring information privacy, protection, and integrity.

## Learning outcomes

- CM17 (Prepare opinions or reports based on optimisation models, simulation and quantitative

techniques for decision-making processes, systematising, documenting and reflecting the process and mechanisms used.) Prepare opinions or reports based on optimisation models, simulation and quantitative techniques for decision-making processes, systematising, documenting and reflecting the process and mechanisms used.

- CM18 (Propose decisions based on available and contrasted data and analysis tools in the context of the aeronautical industry that are in line with regulatory and ethical frameworks, and the objectives of the organisation. (CT04)) Propose decisions based on available and contrasted data and analysis tools in the context of the aeronautical industry that are in line with regulatory and ethical frameworks, and the objectives of the organisation. (CT04)
- CM19 (Communicate data analysis results clearly and effectively to technical and non-technical audiences.) Communicate data analysis results clearly and effectively to technical and non-technical audiences.
- KM38 (Relate the fundamental concepts of data science and its ecosystem within the aeronautical industry.) Relate the fundamental concepts of data science and its ecosystem within the aeronautical industry.
- KM39 (Identify the use of machine learning and data mining techniques in aeronautical management, analysing the technological challenges and architectures associated with Big Data for the optimisation of operations and decision-making.) Identify the use of machine learning and data mining techniques in aeronautical management, analysing the technological challenges and architectures associated with Big Data for the optimisation of operations and decision-making.
- SM28 (Analyse aeronautical data, including large volumes, to identify patterns, trends, and anomalies, and to implement and evaluate machine learning models.) Analyse aeronautical data, including large volumes, to identify patterns, trends, and anomalies, and to implement and evaluate machine learning models.

## Contents

32. Ethical principles in data usage
33. Data protection, privacy, and regulatory compliance
34. Risks and best practices in data-driven systems
35. Advanced topics and current research in aeronautical data science
36. Recent trends in machine learning and advanced analytics
37. Emerging applications in aviation and airport systems
38. Review of recent research papers and case studies

## Learning activities and methodology

| Title | Hours | ECTS | Learning outcomes |
|---|---|---|---|
| Lecture and discussion classes | 26 | 1.04 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Preparation and discussion of topics related to practical work | 25 | 1 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Preparation for lectures | 10 | 0.4 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Lab/Practical classes | 12 | 0.48 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Group study | 65 | 2.6 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Problem-solving classes | 12 | 0.48 | CM17, CM18, CM19, KM38, KM39, SM28 |

*Lecture Sessions*

Theoretical sessions will be carried out using two main methodologies:

- Participatory lecture, in which the fundamental concepts, algorithms, and methods of each topic will be presented, accompanied by short examples and exercises to facilitate immediate understanding and application of the contents.
- Flipped classroom, in which students must complete preparation tasks beforehand (watching videos, reading documents, or completing quizzes). During the session, exercises and problems will be solved and must be turned in at the end of class.

*Problem-Solving Sessions*

In these sessions, exercises will be proposed to be solved in small groups, with the aim of consolidating the knowledge acquired in the lectures. The composition of the groups will be determined by the teaching staff.

*Practical/Lab Sessions*

Practical work will be carried out in small groups. To ensure proper assimilation of the contents by all group members, mandatory control sessions will be held, during which students must demonstrate their understanding of the submitted solution.

Use of the Virtual Campus

The Virtual Campus platform (http://cv.uab.cat) will be the standard and official means of communication between the teaching staff and the students. Likewise, it will be the only valid channel for the submission of gradable activities, with the exception of in-person written exams. Submissions via email will not be accepted.

All teaching materials, notices, and relevant information for the progress of the subject will be published exclusively on this platform.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

## Continuous assessment activities

| Title | Weight | Hours | ECTS | Learning outcomes |
|---|---|---|---|---|
| Exam 1 | 25% | 0 | 0 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Theoretical Exercises | 10% | 0 | 0 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Problems | 20% | 0 | 0 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Exam 2 | 25% | 0 | 0 | CM17, CM18, CM19, KM38, KM39, SM28 |
| Practical Assignments | 20% | 0 | 0 | CM17, CM18, CM19, KM38, KM39, SM28 |

This subject is governed by a continuous assessment system and does not offer a single-comprehensive exam option.

*Grading Activities*

One or two submissions will be required for each topic, which may include multiple-choice questions, theoretical exercises, problems, and practical assignments. The set of these submissions will account for 50% of the final grade. These activities cannot be retaken/recovered.

*Exams*

Two written exams will be conducted throughout the course, each with a weight of 25% on the final grade. It is necessary to obtain a minimum score of 3.5 out of 10 on each exam to pass the course. Both exams can be retaken.

## Bibliography

For each theory session, the teaching staff will publish a presentation accompanied by bibliographic references, which may include scientific articles, press articles, reports from international organizations, or documentation produced by companies. All these materials will be open access or available through the UAB Library's electronic resources.

Consulting the following books is recommended as supplementary reading:

* Downey, A. B. (2024). *Think Python: How to Think Like a Computer Scientist* (3rd ed.). O'Reilly Media. Available at: https://allendowney.github.io/ThinkPython/

* VanderPlas, J. (2016). *Python Data Science Handbook*. O'Reilly Media. Available at: https://jakevdp.github.io/PythonDataScienceHandbook/

## Software

### Python

### Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

| Type of teaching | Group | Language | Semester | Shift |
|---|---|---|---|---|
| (TE) Theory | 1 | English | first semester | afternoon |
| (PAUL) Classroom practices | 1 | English | first semester | afternoon |
| (PLAB) Practical laboratories | 1 | English | first semester | afternoon |
| (PLAB) Practical laboratories | 2 | English | first semester | afternoon |