



TEACHING GUIDE - 2026-2027

Intermediate Python programming & a glimpse into AI applications

UGRA_015141

Departments	Data, Analytics, Technology and Artificial Intelligence (DATA), Dept. of Operations, Innovation & Data Sciences
Teaching Languages	English
ECTS	2
Teacher responsible	Carles Roger Riera Molina - carles.riera1@esade.edu

Course Goals

Organisations rarely work with perfectly clean and connected data. Useful information is often distributed across spreadsheets, exports and text fields that require substantial manual work before they can support a decision.

This hands-on course helps students move beyond introductory Python and use it to solve realistic data problems. Across the course, students will build a complete workflow that takes raw data, cleans and combines it, produces a clear analysis and enriches it using an existing artificial intelligence service.

By the end of the course, students should be able to:

1. Load, inspect and transform structured data using pandas.
2. Identify and resolve common data-quality problems, including missing values, duplicated observations, inconsistent text, invalid dates and incorrect data types.
3. Combine related datasets while checking join keys and table cardinality.
4. Summarise data using grouped operations, aggregations and pivot tables.
5. Organise repeated transformations into small, reusable Python functions.
6. Create a clear visualisation that supports a specific analytical conclusion.
7. Use a Python client to send data to an AI service and interpret its structured response.
8. Integrate AI-generated results into a DataFrame and validate them critically.
9. Recognise practical limitations involving reliability, privacy, cost

and human oversight.

The course focuses on producing useful and defensible results rather than memorising syntax. Students will leave with an end-to-end workflow that connects data analysis with a tangible AI-enabled application.

Previous knowledge

Students are expected to be comfortable reading and modifying simple Python programs, including:

1. Basic data types, such as strings, numbers, lists and dictionaries.
2. Conditional statements and loops.
3. Defining and calling simple functions.
4. Importing and using Python libraries.
5. Working in a Jupyter notebook.

Previous experience with machine learning is not required. The necessary concepts will be introduced during the course.

Prerequisites

Introductory Python programming experience is required.

Algorithmic Thinking & Programming, or an equivalent introductory programming course, is recommended.

Teaching methodology

The course follows an active, case-based and practice-oriented approach. Students will work with a common business-oriented dataset across the teaching sessions and progressively develop it into a complete analysis.

The course follows a clear practical sequence:

- inspect clean transform combine communicate enrich with AI

Each session combines:

1. A short introduction to the problem.
2. A focused conceptual explanation.
3. A live coding demonstration.
4. A guided practical activity.
5. An applied challenge.
6. A checkpoint in which students compare results and discuss analytical decisions.

Most class time will be spent working directly with Python. Concepts will be introduced when they are needed to solve the case rather than as isolated technical topics.

The AI component will use one selected service and a prepared Python client. Students will focus on the transferable workflow: preparing inputs, sending a request, interpreting structured output, integrating the result and checking

whether it is credible. Saved responses will be provided so that the activity remains reproducible even if the external service is temporarily unavailable.

Lectures and in-class exercises will represent approximately 50% of the student workload. Session preparation, assignments and preparation for the final examination will represent the remaining workload.

Course materials, notebooks, datasets, instructions and supporting resources will be available through Moodle.

Description

Course contribution to program

Professionals in management, consulting, finance, marketing, operations and public policy increasingly work with data that are too fragmented, repetitive or unstructured to analyse reliably by hand.

This course gives students a practical bridge between introductory programming and real analytical work. It develops the ability to:

- turn messy files into analysis-ready data;
- combine information from different sources;
- replace repetitive spreadsheet operations with reusable Python workflows;
- communicate evidence through concise numerical and visual outputs;
- incorporate an existing AI capability into an analytical process;
- evaluate the reliability and limitations of automated results.

The subject complements courses focused on business decision-making and artificial intelligence. It concentrates on the data and programming skills needed to make analytical and AI-enabled applications useful in practice, without duplicating the training and evaluation of machine-learning models covered elsewhere.

Short description

Real-world data do not arrive as a clean spreadsheet. They arrive as disconnected files, inconsistent categories, missing values, awkward dates and text that cannot be summarised with a pivot table alone.

In this hands-on course, students will use Python to turn those raw inputs into a useful analysis. They will clean and combine data, automate repeated transformations, create clear visual evidence and use an AI API to enrich a dataset with structured information.

By the end of the course, students will have completed a full workflow from messy data to an AI-enhanced analytical output, while learning how to check the reliability, privacy and limitations of the results.

Bibliography

VanderPlas, J., Python Data Science Handbook: Essential Tools for Working with Data (2nd ed.), O'Reilly Media.

Wes McKinney, Python for Data Analysis, 3rd Edition, O'Reilly Media, Inc. (Book)

Content

#	Topic
1	Working with Real-World Data in Python. Students will learn to use pandas to load, inspect, clean, and transform data from common formats such as CSV and Excel. They will work with realistic data-quality problems, including missing values, duplicated observations, inconsistent text, invalid dates, and incorrect data types.
2	Combining and Summarising Information. Students will learn to combine related datasets safely, identify the appropriate join keys, and detect unmatched or unexpectedly duplicated observations. They will use grouped operations, aggregations, and pivot tables to answer practical business questions.
3	Visualising and Communicating Findings. Students will learn to create clear visualisations that reveal relevant comparisons, distributions, and trends. They will use analytical and visual evidence to formulate concise conclusions and recommendations while recognising what the data do and do not support.
4	Building an AI-Enabled Data Workflow. Students will learn to use Python to connect a data analysis to an existing artificial intelligence service. They will prepare inputs, interpret structured responses, integrate AI-generated information into a DataFrame, and critically assess the reliability, privacy, and limitations of the resulting outputs.

Assessment

Tool	Assessment tool	Category	Weight %
Attendance and punctuality	Class participation	Ordinary round	10.00%
Individual or team exercises	Sessions preparation	Ordinary round	10.00%
Individual or team exercises	Assignment 1	Ordinary round	20.00%
Individual or team exercises	Assignment 2	Ordinary round	30.00%
Written and/or oral exams	Final exam	Ordinary round	30.00%
Written and/or oral exams	Retake exam	Retake	100.00%

PROGRAMS

BBA20-Bachelor of Business Administration (BBA) (Undergraduates: Business)

BBA20 Year 3 (Optative)

BBA20 Year 4 (Optative)

BBA23-Bachelor of Business Administration (BBA) (Undergraduates: Business)

BBA23 Year 3 (Optative)

BBA23 Year 4 (Optative)

BBA25-Bachelor of Business Administration (BBA) (Undergraduates: Business)

BBA25 Year 1 (Optative)

BBA25 Year 3 (Optative)

GBD20-Double Degree in Business Administration and Law (Undergraduates: Law)

GBD20 Year 1 (Optative)

GBD20 Year 4 (Optative)

GBD20 Year 2 (Optative)

GBD20 Year 5 (Optative)

GBD20 Year 3 (Optative)

GBD23-Double Degree in Business Administration and Law (Undergraduates: Law)

GBD23 Year 1 (Optative)

GBD23 Year 4 (Optative)

GBD23 Year 2 (Optative)

GBD23 Year 5 (Optative)

GBD23 Year 3 (Optative)

GBD25-Double Degree in Business Administration and Law (Undergraduates: Law)

GBD25 Year 5 (Optative)

GBD25 Year 3 (Optative)

GBD25 Year 1 (Optative)

GBD25 Year 4 (Optative)

GBD25 Year 2 (Optative)

GDL20-Double Degree in Law and Global Governance, Economics and Legal Order (Undergraduates: Law)

GDL20 Year 1 (Optative)

GDL20 Year 4 (Optative)

GDL20 Year 2 (Optative)

GDL20 Year 5 (Optative)

GDL20 Year 3 (Optative)

GDL23-Double Degree in Law and Global Governance, Economics and Legal Order (Undergraduates: Law)

GDL23 Year 3 (Optative)

GDL23 Year 1 (Optative)

GDL23 Year 4 (Optative)

GDL23 Year 2 (Optative)

GDL23 Year 5 (Optative)

GDL25-Double Degree in Law and Global Governance, Economics and Legal Order (Undergraduates: Law)

GDL25 Year 5 (Optative)

GDL25 Year 3 (Optative)

GDL25 Year 1 (Optative)

GDL25 Year 4 (Optative)

GDL25 Year 2 (Optative)

GED20-Bachelor in Law (Undergraduates: Law)

GED20 Year 3 (Optative)

GED20 Year 1 (Optative)

GED20 Year 4 (Optative)

GED20 Year 2 (Optative)

GED25-Bachelor in Law (Undergraduates: Law)

GED25 Year 1 (Optative)

GED25 Year 4 (Optative)

GED25 Year 2 (Optative)

GED25 Year 3 (Optative)

GEL19-Bachelor in Global Governance, Economics and Legal Order (Undergraduates: Law)

GEL19 Year 3 (Optative)

GEL19 Year 1 (Optative)

GEL19 Year 4 (Optative)

GEL19 Year 2 (Optative)

GEL23-Bachelor in Global Governance, Economics and Legal Order (Undergraduates: Law)

GEL23 Year 4 (Optative)

GEL23 Year 2 (Optative)

GEL23 Year 3 (Optative)

GEL23 Year 1 (Optative)

GEL25-Bachelor in Global Governance, Economics and Legal Order (Undergraduates: Law)

GEL25 Year 4 (Optative)

GEL25 Year 2 (Optative)

GEL25 Year 3 (Optative)

GEL25 Year 1 (Optative)