

Course title:

Introduction to Python

Duration [number of hours]: **12**

PhD Program [MERC/MPS/SPACE]: **MERC**

Name and Contact details of unit organizer(s):

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Course Description [max 150 words]:

This Unit provides an introduction to the fundamentals of Python programming. The course starts with the core concepts of procedural programming and gradually advances toward the use of complex libraries for machine learning. After presenting the basic syntax and structure of Python as well as the main ideas of procedural programming, students will move to object-oriented programming, gaining a clear understanding of classes, inheritance, and polymorphism. Building on these foundations, the course will introduce essential Python libraries such as NumPy, pandas, and scikit-learn, with practical examples showing their most relevant functions and applications. The unit will conclude with a practical project in which students will integrate the concepts learned throughout the course to solve a case study.

Syllabus [itemized list of course topics]:

• **Introduction to Python**

- Installing and setting up the environment (Python, IDE, Jupyter)
- Basic syntax, variables, data types, input/output

• **Control Structures and Functions**

- Conditionals (if, else, elif)
- Loops (for, while)
- Defining and using functions, parameters, scope, recursion

• **Data Structures**

- Lists, tuples, dictionaries, sets
- Basic operations and string manipulation

• **Files and Modules**

- Reading and writing text and CSV files
- Creating and importing modules
- Organizing code into packages

• **Object-Oriented Programming (OOP)**

- Classes, attributes, methods, constructors

- Inheritance and polymorphism

- **Scientific Libraries**

- **NumPy**: arrays, slicing, vectorized operations, broadcasting
- **pandas**: DataFrames, indexing, filtering, aggregation, merging datasets

- **Introduction to Machine Learning with scikit-learn**

- Datasets and preprocessing
- Training and validating supervised models (regression, classification)
- Model evaluation metrics

- **Final Project**

- Integration of OOP, data analysis, and machine learning in a practical case study

Assessment [form of assessment, e.g., final written/oral exam, solutions of problems during the course, final project to be handed-in, etc.]:

Final project to be handed-in

Suggested reading and online resources:

“Learning Python” – Mark Lutz (O’Reilly)