



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Informatics

2223-3-E3201Q109

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#### Aims

The course has two main objectives:

1. To provide the basic programming knowledge needed to use Matlab and to study further programming languages. Students will begin to familiarize with programming, starting directly with the use of Matlab, applying programming techniques to read, explore, visualize and analyze geo-environmental data. They will also be guided in writing codes for statistical data analysis and numerical calculations.
2. To introduce students to data base management systems with particular emphasis in the SQL language, which allows to define and inquiry relational databases. In particular, students will learn elementary concepts in order to model reality through a database. In particular, students will become familiar with relational databases. Through the laboratory activities they will put into practice the notions of theory and will learn to retrieve the information contained in a database, through appropriate instructions in SQL. The theoretical and practical notions will allow students to be able to manage the data that typically come from experimental activities related to their course of study.

The course is based on practical activities where theory acquired during the frontal lessons is applied and tested on geo-environmental data.

At the end of the course students will be able to independently organize and query a relational database and write basic codes in matlab to analyze data.

#### Contents

- Fundamentals of programming using matlab for experimental data analysis and visualization.
- Introduction to Data Base. The Entity Relationship (ER), the relational Data Model, the SQL language
- Laboratory practical activities

## Detailed program

### 1) Fundamentals of programming (Using Matlab)

- Algorithms for the Environmental Sciences
- Scripts, functions, variable, input, output
- Data types
- Import data
- Export data
- Initializing variable and parameters
- Debugging
- Control-Flow Structures (if and switch), iterations (for, while).
- Code vectorization
- Displaying geo-environmental data (tables, time series, vectorial, rasters)
- Statistical analysis techniques
- Numerical methods (smoothing, fitting etc.) and parallel calculation
- External libraries
- Interoperability with G.I.S (geographic information system)
- Versioning system

Practical activities using Matlab to process and analyze geo-environmental data in particular applying statistical analysis and displaying functions.

### 2) Introduction to Data Base Management Systems

- The Entity Relationship Model: concepts of entity, relationship, attribute, generalization, identifier, integrity constraints.
- The Relational Data Model: concepts of relation, schema, attribute, domain, key, constraints.
- SQL, as Data Definition Language
- SQL, as Data Manipulation Language. Simple Select, the Join operator, aggregations, nested Select. Practical activities aimed at defining simple Database, and examples of queries.

## Prerequisites

None

## Teaching form

- Lessons, 1 credits (8 hrs)
- Classes, 2 credits (20 hrs)
- Laboratory, 3 credit (30 hrs)

*The course is in Italian*

## Textbook and teaching resource

- Dorothy C. Attaway (2012) Matlab : A Practical Introduction to Programming and Problem Solving. Amsterdam: Butterworth-Heinemann. Available at: [https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=380478&site=ehost-live&scope=site&ebv=EB&ppid=pp\\_Cover](https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=380478&site=ehost-live&scope=site&ebv=EB&ppid=pp_Cover) (Accessed: 5 June 2022).
- Slides of the lecturers

## **Semester**

Second semester

## **Assessment method**

### **Examination:**

- Written and eventual oral exam

### **Evaluation Type:**

- Final mark out of thirty

The exam consists of two practical activities: in the first part the student has to solve some queries on a database, using SQL and the Access interface. In the second part the student has to write some codes in matlab, that operate simple analysis on data expressed with matrices or vectors. In particular, the application of statistical measurements, data visualization and management of input output data will be required.

It is also possible an oral verification of the expertise acquired.  
Maximum mark is 30/30 cum Laude.

## **Office hours**

appointment by email to [sergio.cogliati@unimib.it](mailto:sergio.cogliati@unimib.it) and [mattia.deamicis@unimib.it](mailto:mattia.deamicis@unimib.it)

## **Sustainable Development Goals**

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