UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Technological Infrastructures for Data Science

2425-2-FDS01Q016

Aims

The main purpose of the course is to provide the student with a solid, foundational understanding of the main **technology solutions** and **software development methodologies** in support of data science.
Hands-on sessions will provide the student with the basic skills needed to interact with such tools.

Contents

The course comprises the following modules:

Module 1 - Infrastructure: Introduction to Virtualization, Cloud Computing and Containerization.

Module 2 - Platform: Data organization and distribution, Data Lake, HDFS, YARN

Module 3 - Processing: Batch vs. Streaming vs. Messaging, the cases of Hadoop, Spark, Storm, Kafka

Module 4 - Software Development: Waterfall, Agile, DevOps, DataOps, MLOps

Detailed program

Course topics divided by modules:

Module 1 - Infrastructure:

- The figure of the data engineer

- The reference architecture
- Virtualization
- Cloud Computing (Introduction, Service and deployment models, essential features)
- Containerization with Docker
- Serverless

Module 2 - Platform:

- The Data Lake
- HDFS and YARN

Module 3 - Processing:

- Batch processing (Apache Hadoop and Apache Spark).
- Stream processing (Apache Storm, Apache Spark, and Apache Flink)
- Messaging (Apache Kafka)

Module 4 - Software Development:

- Service computing
- Software engineering
- Development methodologies (Waterfall, Agile, DevOps, DataOps, MLOps)

Prerequisites

Basic knowledge of computer architecture (CPU, RAM, storage), operating systems, command shell, Python programming language and Jupyter notebooks.

Teaching form

Teaching with different teaching modes:

- 15 lectures of 2 and 3 hours in interactive mode in the presence of the teacher, but with the participation of the students through questions and hints.
- 6 laboratories of 3 hours each delivered in the classroom - interactive mode.

The course will be taught in English.

Textbook and teaching resource

Lecture notes and slide decks.

The following textbooks are referenced for further study:

- The basics of cloud computing ISBN-13: 978-0124059320 Authors: Derrick Rountree, Ileana Castrillo
- Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems

ISBN-13: 978-1449373320 Author: Martin Kleppmann

Semester

Second year, first semester

Assessment method

The assessment consists of two parts: a **written test** and an **oral discussion** on an in-depth topic.
The written test consists of open and closed questions on the course topics. This has a duration of about one hour and a maximum score of 17 points.
A typical written exam consists of 12-13 multiple-choice questions and 2-3 open-ended questions, and you have 60-75 minutes to complete them.
The oral test consists of a discussion of a topic not covered in the course or an in-depth study of a topic covered in the course. The deepening work (research work and slide creation) can be done in groups of up to 3 people but the discussion and evaluation are personal.
The topic of the deepening must be agreed in advance with the lecturer. The oral test entitles the student to a maximum of 15 points.

Once the student has taken both tests, the exam will be considered passed if both of these conditions are met:

- for both parts the student has scored more than (or equal to) 7 points
- the sum of the points for the two parts is greater than or equal to 18

In that case a grade consisting of the sum of the points can be registered.

No partial examination will be issued during the course.

Office hours

Tuesday 12:30-14:30 ask for email confirmation

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE