### Course Description – Academic Year 2024/2025

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Information Retrieval</th>
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<tbody>
<tr>
<td>Course Code</td>
<td>73002</td>
</tr>
<tr>
<td>Scientific Sector</td>
<td>INF/01</td>
</tr>
<tr>
<td>Degree</td>
<td>Master in Computational Data Science (LM-18)</td>
</tr>
<tr>
<td>Semester</td>
<td>1</td>
</tr>
<tr>
<td>Year</td>
<td>2</td>
</tr>
<tr>
<td>Credits</td>
<td>6</td>
</tr>
<tr>
<td>Modular</td>
<td>No</td>
</tr>
<tr>
<td>Total Lecturing Hours</td>
<td>40</td>
</tr>
<tr>
<td>Total Lab Hours</td>
<td>20</td>
</tr>
<tr>
<td>Attendance</td>
<td>The attendance is not compulsory, but students are highly encouraged to attend</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Programming and algorithm data structures skills, Linear algebra, probability theory, basic machine learning concepts.</td>
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<tr>
<td>Course Page</td>
<td>Teams and <a href="https://ole.unibz.it/">https://ole.unibz.it/</a></td>
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#### Specific Educational Objectives

The course belongs to the type "caratterizzanti – discipline informatiche" in the study path without curriculum".

The objective of this course is to present the scientific underpinnings of the field of Information Retrieval (IR). The student will study fundamental, mathematically sophisticated IR concepts first and then more advanced techniques for information filtering and decision support, including transformer-based solutions and LLMs.

This course provides students with a rich and comprehensive catalogue of information search and text processing techniques that can be exploited for the design and implementation of modern IR applications.

#### Lecturer

Andrea Rosani

#### Contact

Faculty of Engineering, piazza Domenicani, 3 Bolzano,

#### Scientific Sector of Lecturer

INF/01

#### Teaching Language

English

#### Office Hours

During the lecture time span, arrange beforehand by email.

#### Lecturing Assistant (if any)

- 

#### Contact LA

- 

#### Office Hours LA

- 

#### List of Topics

- Web and mobile search
- Boolean and vector-space retrieval models
- Efficient document indexing, document mining and topic modelling
- Traditional and machine learning-based ranking approaches
- Foundation models
- Evaluation of Information Retrieval Systems
## Teaching format
Frontal lectures, exercises, lab, seminars.

## Learning outcomes
- **Knowledge and understanding:**
  - D1.4 - Sound basic knowledge of storing, querying and managing large amounts of data and the associated languages, tools and system.
- **Applying knowledge and understanding:**
  - D2.2 - Ability to address and solve a problem using scientific Methods
- **Making judgments:**
  - D3.2 - Ability to autonomously select the documentation (in the form of books, web, magazines, etc.) needed to keep up to date in a given sector.
- **Communication skills:**
  - D4.1 - Ability to use English at an advanced level with particular reference to disciplinary terminology.

## Assessment
**Final Project + oral exam**

The project will consist of the design of an IR system in a specific application domain selected by the students. The project domain, the attacked problem, the techniques, and the obtained results must be described in a report (max. 10 pages). The project can be done in groups of 2-3 people.

The oral exam is composed by the discussion of the project and some individual questions on the content of the course.

**Assessment language**
English

**Assessment Typology**
Monocratic

**Evaluation criteria and criteria for awarding marks**
- **Evaluation criteria**
  - Project: 50% of the mark
  - Final oral exam: 50% of the mark.

Important note: both project and exam are required to be passed.

### Criteria for awarding marks

- **Oral exam:** ability to present and explain information retrieval concepts, methods and algorithms. ability to select appropriate solutions for IR problems.

- **Project:** ability to implement data workflow to apply IR to real-world problems, correctness and clarity of the solution, experimental results, ability to solve IR problems with the appropriate technique.

## Required readings
The suggested book for the introduction to information retrieval topics is:

Papers about the most recent advancements with regards to algorithms, information access modalities and interfaces will be provided during the course in electronic format. Copy of the slides will be available as well.

Subject Librarian: David Gebhardi, [David.Gebhardi@unibz.it](mailto:David.Gebhardi@unibz.it)

<table>
<thead>
<tr>
<th>Supplementary readings</th>
<th>Scientific papers and additional books will be specified on each course topic during lectures.</th>
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</table>

| Software used          | Python as programming language. |