



**UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA**

## **SYLLABUS DEL CORSO**

### **Applicazioni Web: Progettazione e Sviluppo**

2627-2-F9202P021

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#### **Aims**

The course aims to provide students with the theoretical and practical knowledge required to understand the principles, architectural models, and technologies underlying modern distributed Web applications.

By the end of the course, students will have acquired knowledge of Web protocols and standards, client-server architectures, the principles of Web APIs and REST architectures, and the main technologies and methodologies for designing and developing interactive Web applications.

Students will be able to analyze the requirements of a Web application, design its architecture, and develop its main components using modern development tools and frameworks. They will also be able to critically evaluate alternative architectural and technological solutions, justifying their choices according to application requirements and the target context.

The laboratory activities will enable students to consolidate their design and development skills through the implementation of Web applications, while fostering the ability to autonomously learn and adopt new tools and technologies.

#### **Contents**

The course introduces the principles, architectural models, and technologies for designing and developing modern distributed Web applications. It covers Web protocols and standards, client-server architectures, the principles of Web APIs and REST architectures, and the fundamentals of service-oriented application development.

A significant part of the course is devoted to laboratory activities focused on the design and development of interactive Web applications using modern front-end and back-end languages, frameworks, and development tools, with particular emphasis on HTML5, CSS3, JavaScript, JSON, React, and Node.js.

#### **Detailed program**

## Introduction to the Web and Distributed Applications

- Evolution of the Internet and the Web.
- Client-server architectures and distributed systems.
- Evolution of Web applications: static, dynamic, and Single-Page Applications (SPAs).

## Web Protocols and Standards

- The TCP/IP model and the HTTP protocol.
- URIs, Web resources, and client-server communication.
- Web APIs and REST architectural principles.
- Introduction to the Web of Services, Web of Data, and Web of Things.

## Software Architectures for Web Applications

- Principles of service-oriented computing.
- Introduction to Service-Oriented Architecture (SOA).
- Web services and the organization of distributed systems.
- Overview of cloud-native models and the role of cloud computing in Web application development.

## Data Representation and Exchange

- Data exchange formats: JSON and XML.
- Introduction to Linked Data and RDF.
- Data serialization and interoperability.

## Web Application Development Technologies

- HTML5 and CSS3.
- Modern JavaScript (ES6+).
- Asynchronous programming and interaction with Web APIs.
- Principles of user interface design.

## Development Frameworks and Tools

- Introduction to JavaScript frameworks.
- Web application development with React.
- Introduction to back-end development using Node.js.
- Integration between front-end applications and Web services.

## Laboratory Activities

- Incremental design and development of Web applications.
- Development of front-end components and integration with REST services.
- Analysis, debugging, and testing of Web applications.

## Prerequisites

Basic knowledge of programming principles, data structures, and computer networks is recommended. Familiarity with at least one programming language and the fundamentals of software development is also beneficial. The main prerequisite concepts will be reviewed during the course when needed.

## Teaching form

The course is mainly delivered on campus.

The teaching activities combine different learning modalities:

Direct Teaching (DE): lectures introducing the theoretical foundations, architectural models, and technologies for designing and developing modern distributed Web applications. The lectures cover the main Web protocols, standards, software architectures, and development tools used in contemporary Web application engineering.

Interactive Teaching (DI): laboratory sessions and practical activities focused on the design, implementation, and testing of Web applications. Through the incremental development of one or more Web applications, students apply the concepts introduced during the lectures, covering the entire software development process, including requirements analysis, architectural design, implementation, Web API integration, testing, and debugging.

Interactive Teaching (DI): learning support activities through the e-learning platform, which provides teaching materials, code examples, exercises, discussion forums, and additional resources to promote active participation, collaboration, and autonomous learning.

Part of the teaching material is also made available through video recordings on the University's e-learning platform, in accordance with institutional guidelines.

Language of instruction: Italian.

## Textbook and teaching resource

There is no single required textbook.

The teaching material includes lecture slides, lecture notes, scientific papers, technical documentation, code examples, and additional learning resources, which will be made available or referenced through the course e-learning platform.

The official documentation of the technologies and frameworks adopted during the course is considered an integral part of the learning material and will be appropriately referenced throughout the lectures.

## Semester

First semester

## Assessment method

Student learning is assessed through a written examination, which may be complemented by an oral examination.

The written examination consists of:

- multiple-choice questions aimed at assessing the knowledge and understanding of the theoretical concepts

covered during the course;

- open-ended questions designed to evaluate the ability to analyze, discuss, and compare Web application architectures, models, and technologies;
- problem-solving and software development exercises aimed at assessing the ability to apply the acquired knowledge to the design, implementation, and testing of Web applications and the integration of software components.

An optional project, carried out individually or in pairs, is also available. The project consists of designing and developing a Web application and is assessed through an individual discussion. It may contribute up to 4 bonus points to the final grade.

Upon request of either the instructor or the student, the written examination may be complemented by an oral examination, which may increase or decrease the final grade.

### Midterm Examinations

The written examination may be replaced by two midterm examinations, each consisting of multiple-choice questions, open-ended questions, and practical exercises covering both theoretical topics and laboratory activities.

Students are admitted to the second midterm examination only if they achieve at least 18/32 in the first examination. The final written examination grade is computed as the average of the two midterm examinations. No make-up examinations are provided.

### Assessment Criteria

The assessment is based on the student's ability to:

- demonstrate knowledge and understanding of the principles, architectural models, and technologies covered during the course;
- apply theoretical knowledge to the design and development of Web applications;
- analyze design problems and identify appropriate technical solutions;
- produce technically sound software solutions;
- communicate technical concepts clearly using appropriate scientific and technical terminology.

The final grade is expressed on a 30-point scale and is determined by the written examination (or the two midterm examinations), possibly complemented by the oral examination and by any bonus points obtained through laboratory assignments and the optional project.

### Office hours

prof. De Paoli: Wednesday from 10:00 to 12:00 or by appointment by writing to [flavio.depaoli@unimib.it](mailto:flavio.depaoli@unimib.it)

Questions and discussions on teaching topics can be posed using the forums in e-learning.

### Sustainable Development Goals

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