UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Software Specification and Design

2526-2-E3101Q109

Aims

The course introduces students to the fundamentals of object-oriented analysis and design, with the goal of developing practical and theoretical skills in building robust, well-designed and maintainable software through the application of methodologies, techniques and tools such as UML, design patterns and the unified process to foster a structured, modular and reusable approach to software development.

The learning path includes practical exercises and group lab activities, aiming to simulate a realistic and collaborative development environment.

Knowledge and Understanding
By the end of the course, students will have acquired a solid understanding of the principles, techniques, and methodologies of software engineering, with particular emphasis on UML modeling, design patterns, iterative and agile methodologies, and requirements analysis.

Applied Knowledge and Understanding
Students will be able to carry out common analysis and design activities inspired by the Unified Process to develop software systems. They will be able to use design patterns to solve recurring problems, produce a partial implementation consistent with design specifications, and employ integrated development environments and version control tools. Furthermore, they will be able to collaborate effectively in group work activities. Through these skills, they will be able to apply the acquired knowledge in requirements analysis and modeling, writing use cases, and designing efficient, adaptable, and high-quality software systems using appropriate techniques and tools.

Independent Judgment
The course fosters the development of critical thinking through the comparative evaluation of design and methodological solutions, the conscious use of design patterns and principles, the analysis of case studies, and model reviews, promoting autonomy in choosing the most appropriate solutions.

Communication Skills
Students will be able to effectively communicate analyses, specifications, and design solutions through UML

diagrams, written technical reports, oral presentations, and collaboration within workgroups.

Learning Skills
The course promotes the development of independent learning through an active teaching approach. By the end of the course, students will be able to independently explore advanced topics in software engineering, laying the foundation for continuous learning beyond the academic context.

Contents

Introduction to software engineering and software development processes, focusing on analysis and design activities. Application of UML for modeling and patterns for design.

Detailed program

1. Introduction to software engineering and software processes
2. Applying UML for agile modeling
3. Requirements Analysis
4. Object-oriented analysis and design
5. Responsibility-Driven Design
6. Applying desgin patterns
7. Test-driven development
8. Refactoring

Prerequisites

Knowledge on an object-oriented language like Java.

Teaching form

The lessons of the course are in italian, with some slides and papers to study in English.

Lessons, laboratory sessions, classroom exercises, laboratory exercises and homework

The lessons will be taken in presence.

6 lessons of 2 hours in presence
10 lessons of 2 hours in presence with students interactions
10 activities of 2 hours with exercises and students interactions.
8 laboratory activities of 3 hours in presence with students interactions

Textbook and teaching resource

Larman, Applying UML & Patterns: Introduction to Object-Oriented Analysis & Design, & Iterative Development, Pearson.

Slide, articles and tutorials on some topics of the course.

Semester

Second semester

Assessment method

Traditional Examination:
Assessment of learning consists of a written test with exercises and some questions on the entire course syllabus and then a compulsory oral test. The two tests will be graded in thirtieths by making a weighted average between the two tests (tends to be: oral 40% and written 60%).

Pre-examination (just at the end of the lessons):
The assessment for students taking the course consists of an extension of a project assigned during the lab activity and a compulsory oral test. The two tests will be graded in thirtieths by taking a weighted average between the two tests (tends to be: oral 60% and written 40%).

For the grade to be awarded, it is also STRICTLY REQUIRED that BOTH tests (Project/Written and Oral) be rated SUFFICIENT by the teacher. Sufficiency is established by grade thresholds for the two parts (at least 18 in the oral part and at least 16 in the project part).

Assigned exercises during the Labs, graded in a range of 0-3.
The overall activity of the Labs will be evaluated and will allow between 0-3 points that will be added to the final grade if a sufficiency has been obtained in the traditional or pre- examination (at least 18 in the oral test and at least 16 in the written test).

Office hours

Francesca Arcelli Fontana: by appointment.

Oliviero Riganelli by appointment.

Sustainable Development Goals