Course guide
330713 - SDLAD - System Development Lifecycle: Analysis and Design

Last modified: 09/07/2025

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: MASTER'S DEGREE IN MACHINE LEARNING AND CYBERSECURITY FOR INTERNET-CONNECTED SYSTEMS (Syllabus 2024). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Adarsh Kumar

Others:

TEACHING METHODOLOGY

AF1. Attendance and participation in master class. Presentation in class of new content and description of the study materials by the teacher and questions by the students to the teacher in relation to the content that he is explaining or presenting in the master class.
AF2. Attendance and participation in participatory class. Presentation of problems, challenges or case studies that students solve individually or in groups, with the teacher's assistance.
AF3. Carrying out laboratory practice. Completion in the laboratory and under the supervision of the teacher of tasks and experiments defined in the practice script, related to the implementation of the contents of the subject. It normally requires the preparation of a prior study and the preparation of a subsequent report. Possible field trips are considered within this typology.
AF4. Completion of tasks related to project-based learning. Students meet and manage the development of a complex project, organizing and distributing the necessary tasks and resources.
AF5. Presentation and defense of works. Students present to the rest of the class and the teacher how they have carried out the proposed tasks, be it solving problems, carrying out practices or developing projects.
AF6. Autonomous study carried out by the student outside of class hours. The student, autonomously, studies the content taught by the teacher, through notes and other materials provided by the teacher or obtained by the student himself.
AF7. Autonomous work carried out by the student outside of class hours. Tasks carried out autonomously, either individually or in a team, consisting of problem solving, exercises or the development of practices.
AF8. Attendance at tutoring session. Meeting of the student with the teacher or tutor to resolve specific doubts about content and tasks and assess the student's own progress.

LEARNING OBJECTIVES OF THE SUBJECT

- M.10.4 (S) Use entity relationship modeling, relational database design, and SQL to efficiently store, retrieve, and update data in a database.
- M.10.5 (S) Develop a system design based on the provided system requirements using advanced tools for a clear and structured design.
- M.10.7 (S) Evaluate various techniques for creating maintainable user interfaces and identify trends in multi-device UI implementation.

CONTENTS

Unit 1: Introduction to System Development Life Cycle

Description:
- Definition, purpose, and importance of System Development Life Cycle (SDLC) in system development
- Phases of SDLC and their interrelationships
- Overview of structured and object-oriented development approaches
- Stakeholders and their roles throughout the life cycle

Related activities:
All the relevant ones.

Full-or-part-time: 9h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 6h

Unit 2: System Planning and Feasibility Analysis

Description:
- Problem identification, system request, and project initiation
- Feasibility types: technical, economic, operational, legal, and schedule
- Measurement theory: scales, types, validity, and reliability
- Goal-Question-Metric (GQM) paradigm for system analysis

Related activities:
All the relevant ones.

Full-or-part-time: 9h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 6h

Unit 3: Requirements Elicitation and Analysis

Description:
- Techniques for gathering system requirements (interviews, questionnaires, observation)
- Types of requirements: functional, non-functional, and performance
- Functional and non-functional requirement modelling
- Metrics for completeness, ambiguity, and consistency in specifications
- Stakeholder-based evaluation using analytic hierarchy process (AHP)

Related activities:
All the relevant ones.

Full-or-part-time: 9h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 6h

Unit 4: System Design – Logical and Physical Models

Description:
- Logical design: data flow diagrams (DFDs), entity-relationship diagrams (ERDs)
- Physical design: system architecture, network design, and interface layouts
- Design principles: modularity, abstraction, cohesion, coupling
- Architectural styles and design principles (layered, microservices, event-driven)
- Object-oriented design metrics (CK metrics suite, MOOD metrics)
- Component-based design metrics (interface complexity, reuse factor)

Related activities:
All the relevant ones.

Full-or-part-time: 9h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 6h

Unit 5: User Interface and Database Design

Description:
- Principles of effective UI design and usability
- Interface prototyping and wireframes
- Database design: normalization, ER models, schema development
- Integration of UI with backend systems

Related activities:
All the relevant ones.

Full-or-part-time: 9h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 6h

Unit 6: System Implementation and Deployment

Description:
- Coding practices and development standards
- Integration and system testing strategies
- Deployment planning: pilot, phased, and parallel approaches
- Reliability metrics: Mean Time To Failure (MTTF), Mean Time Between Failures (MTBF), failure rate
- Maintainability indicators: defect density, code churn, refactoring frequency

Related activities:
All the relevant ones.

Full-or-part-time: 10h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 7h

Unit 7: System Maintenance and Support

Description:
- Types of maintenance: corrective, adaptive, perfective, preventive
- Change control and configuration management
- System audits and performance evaluation
- Tools for version control and issue tracking

Related activities:
All the relevant ones.

Full-or-part-time: 10h
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study : 7h

Unit 8: Modern Approaches, Case Studies, and Tools in SDLC

Description:
- Agile, DevOps, and CI/CD practices in modern SDLC
- SDLC tools: Jira, Git, Lucidchart, Draw.io, Selenium
- Metrics-enabled architectural evaluation (ATAM, SAAM)
- Tools for metric collection and visualization (SonarQube, SourceMeter, Designite)
- Case studies of successful and failed system developments: Smart city systems, mission-critical systems (e.g., aviation)

Related activities:
All the relevant ones.

Full-or-part-time: 10h
Theory classes: 1h 30m
Practical classes: 1h 30m
Self study : 7h

ACTIVITIES

Lectures

Description:
Face-to-face teacher-led learning sessions specifically focused on understanding the subject content. Lectures are provided by either the professors assigned to this course or guest lecturer from the industry.

Material:
Slide decks and other notes prepared and distributed by the lecturer.

Delivery:
Participation and technical discussions will determine the overall grade variable PAR.

Full-or-part-time: 12h
Theory classes: 12h

Independent Study

Description:
Independent study consists of studying to understand and solidify knowledge, vocabulary and techniques either alone or in a group. It includes reading material from bibliography or through independent search.

Material:
The support materials are:
- Slide decks and other notes prepared and distributed by the lecturer
- Main references of the subject.

Full-or-part-time: 43h
Self study: 43h

Laboratory work

Description:
Students practice implementing system development lifecycle. This includes hands-on learning with face-to-face tutorials, as well as practical assignments. This may mean completing practicals during independent learning time.

The practical sessions are as follows:
Practice 1 – Requirements Gathering and Analysis with Use Case Modeling
Practice 2 – Building Functional Models using Data Flow Diagrams (DFD)
Practice 3 – Feasibility and Cost-Benefit Analysis Automation
Practice 4 – Entity-Relationship and Database Schema Design
Practice 5 – UI Prototyping and Feedback Collection
Practice 6 – Object-Oriented Design using Class Diagrams
Practice 7 – Test Case Design and Automation
Practice 8 – Project Estimation and Risk Management Simulation

Material:
Instruction sheets provided by the lecturer and use cases provided by guest lecturers.

Delivery:
The requirements gathering exercises and reports to be produced by the students counts as overall grade variable LAB. A practical exam or project counts as PR.

Full-or-part-time: 12h
Laboratory classes: 12h

Exam

Description:
There will be a final exam consisting of a set of exercises to be solved on paper without any support material, in a short amount of time and by working alone.

Delivery:
The individual exam solutions are delivered and evaluated. The exam grade corresponds to the course grade variable FIN.

Full-or-part-time: 8h
Self study: 8h

GRADING SYSTEM

The final grade is calculated with the following weights:

Overall grade = 0.4 * FIN + 0.1 * PAR + 0.30 * LAB + 0.20 * PR

Grades will be based on:
- Accuracy and completeness of configuration and responses
- Secure and efficient use of open-source tools
- Quality of reports and documentation
- Demonstrated comprehension during evaluation activities

EXAMINATION RULES.

The activities will be carried out following the uses and customs of academic work and, in particular, the following guidelines will be respected:

- Those activities that are explicitly declared as individual, whether they are face-to-face or not, will be carried out without any collaboration by other people.
- The dates, formats and other delivery conditions established will be mandatory.
- If any of the activities of the subject is not carried out, it will be considered graded with zero.
- The completion of laboratory activities is a necessary condition to pass the course.
- The use of the computer laboratory will be reserved exclusively for academic activities and in no case may abusive use be made.

BIBLIOGRAPHY

Basic:
- Clarke, R. T. Systems life cycle guide: A systems development methodology. Prentice Hall, 1987.
- Hunter, M. G. Cases in systems development life cycle. McGraw-Hill Education (ISE Editions), 1998a.
- Hunter, M. G. Cases in systems development life cycle: Instructor’s manual. McGraw-Hill, 1998b.
- Systems development life cycle: a complete guide:pactical tools for self-assessment. 2020 edition. The Art of Service, 2021. ISBN 9780655925934.

RESOURCES

Other resources:
-Papers and handouts distributed by the lecturer during the course.