

SOFTWARE DEVELOPMENT AND DEVOPS

**Grado en Computación e Inteligencia Artificial / Bachelor in
Computer Science and Artificial Intelligence BCSAI SEP-2025
SDD-CSAI.3.M.A**

Area Computer Science

Number of sessions: 35

Academic year: 25-26

Degree course: THIRD

Number of credits: 6.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **BORJA SERRA PLANELLES**

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Co-Founder & CTO @ Muppy

Borja Serra is an engineer with extensive experience in working with large-scale banking datasets and systems. He is the co-founder of Muppy, a company dedicated to enhancing hosting experiences through digital innovation. Under his leadership, Muppy has grown to manage over 700 rooms, suites, and studios across five cities, having served more than 3,000 clients to date.

Driven by a commitment to data-centric solutions, he has led the development of various systems to optimize the client journey, including room-booking platforms, recommendation engines, management applications, and internal process automation tools. His professional interests lie in the intersection of data engineering, automation, and customer experience design.

In addition to his entrepreneurial endeavors, he maintains an active interest in emerging technologies and scalable systems architecture. He is also engaged in professional communities related to data science and engineering.

Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

The purpose of this subject is that students get a holistic view of Software Development discipline and modern DevOps methodologies. For this, issues as the following will be covered:

- Software Development Life Cycle and Methodologies.
- Software Architectural patterns and design principles, covering all the phases in software life cycle.
- DevOps frameworks, principles, practices and tooling, and their relationship with agile methodologies.
- DevOps implementation strategies for start ups and large organizations, including adoption and change management.
- Practical individual and team collaboration to design, develop and release a software feature following DevOps methodology.

This subject gives the student the tools and knowledge to fit programming into a larger framework, enabling him/her to properly develop software following well-known methodologies and understanding the role of the software developer / DevOps engineer in a modern organization.

LEARNING OBJECTIVES

Upon completing this course, students will be able to setup an end-to-end DevOps team, including agile tooling, code hosting, CI/CD and deployment strategies, using any DevOps tooling stack. To achieve this, we will go through the following objectives:

- Get an holistic vision about software development practices.
- Understand the different project management methodologies applied to Software Development, with focus on Agile methodologies.
- Leverage key software architecture concepts and patterns.
- Setup a testing plan for any software project.
- Understand core DevOps concepts applying to any vendor and how to implement them in a project or organization.
- Discuss the advantages/disadvantages of different management models in the organization applied to Software Development.
- Understand and implement basic Infrastructure as Code concepts commonly used by software engineers.
- Understand the process of continuous improvement and achieve the right mindset for flexible software architecture.
- Leverage cloud native computing to adopt DevOps.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	20.0 %	30.0 hours
Discussions	6.7 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	30.0 %	45.0 hours
Group work	30.0 %	45.0 hours
Individual studying	13.3 %	20.0 hours
TOTAL	100.0 %	150.0 hours

AI POLICY

In this course, the use of generative artificial intelligence (GenAI) is encouraged, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction to course structure and overview of Software Development and DevOps

- Academic course structure
- Software Development Life Cycle introduction
- Brief software history until Cloud computing and AI era
- DevOps introduction

SESSION 2 (LIVE IN-PERSON)

Software Development Life Cycle (SDLC)

- Study of each phase of SDLC and the different SDLC models
- Roles & responsibilities across the SDLC

- Introduction of Individual Assignment 1

SESSION 3 (LIVE IN-PERSON)

Tools Overview and Setup

- Integrated Development Environemnts: VS Code
- GitHub
- GitHub copilot

SESSION 4 (LIVE IN-PERSON)

Creational Design Patterns

- Contents:
 - Singleton Pattern
 - Builder Pattern
 - Factory Method Pattern
- Hands-on exercises

SESSION 5 (LIVE IN-PERSON)

Structural Design Patterns

- Contents:
 - Adapter Pattern
 - Proxy Pattern
 - Facade Pattern
- Hands-on exercises

SESSION 6 (LIVE IN-PERSON)

Behavioral Design Patterns

- Contents:
 - Observer Pattern
 - Strategy Pattern
 - Command Pattern
- Hands-on exercises

SESSION 7 (LIVE IN-PERSON)

Software Development General Principles & Typical Bad Practices

- Contents
 - SOLID principle
 - DRY, KISS, and other non formal principles
 - Code Smells

SESSION 8 (LIVE IN-PERSON)

Git Basics

SESSION 9 (LIVE IN-PERSON)

Software Backend Architectures

- Architectures
- APIs
- Microservices

SESSION 10 (LIVE IN-PERSON)

Software Backend Development

- HTTP frameworks
- ORM libraries
- Other tools

SESSION 11 (LIVE IN-PERSON)

Software Quality & Testing

- Testing: Unit, integration, regression, performance, & acceptance testing
- Hands-on Test-Driven Development

SESSION 12 (LIVE IN-PERSON)

Frontend Development

- Architectures: SPA & SSR
- HTML, JS & CSS basics
- Browser dev tools

SESSION 13 (LIVE IN-PERSON)

Software Deployment (I)

- Deployment automation with Github Actions
- Assignment app deployment overview

SESSION 14 (LIVE IN-PERSON)

Software Deployment (II)

- Software deployment process
- Deployment strategies
- Infrastructure as Code

SESSION 15 (LIVE IN-PERSON)

DevOps Frameworks Overview

- What is DevOps?
- DevOps frameworks overviewLean Product Management

SESSION 16 (LIVE IN-PERSON)

Review Assignment 1 Q&A for Midterm Exam

- Review Individual Assignment 1
- Summarize and discuss the midterm exam content

SESSION 17 (LIVE IN-PERSON)

Midterm exam

SESSION 18 (LIVE IN-PERSON)

Midterm exam review Group and Individual Assignment 2

- Distribution of groups for Individual Assignment 2

SESSION 19 (LIVE IN-PERSON)

Scrum Framework

- Scrum framework
- Scrum planning tools

SESSION 20 (LIVE IN-PERSON)

Software Maintenance and Operations

- Monitoring: diagnostic settings, log analytics and performance
- Connecting app to monitoring service

SESSION 21 (LIVE IN-PERSON)

Distributed Architecture

- Loosely coupled architecture
- Microservices
- Evolutionary architecture
- Conway Law

SESSION 22 (LIVE IN-PERSON)

DevOps Operations

- Site Reliability Engineering
- Incident management
- Continuous monitoring: SLA, SLI, SLO

SESSION 23 (LIVE IN-PERSON)

DevOps Continuous Delivery (I)

- Continuous Delivery overview
- Deployment Strategies

- DevOps Quality

SESSION 24 (LIVE IN-PERSON)

DevOps Continuous Delivery (II)

- Docker containers introduction
- Hands-on: running an app in a local container

SESSION 25 (LIVE IN-PERSON)

DevOps Continuous Delivery (III)

- Container infrastructure in cloud
- Deploying containers with GitHub workflows

SESSION 26 (LIVE IN-PERSON)

DevOps Continuous Delivery (IV)

- Infrastructure as Code modularization
- Modularization Strategy for Assignment II & Group Assignment

SESSION 27 (LIVE IN-PERSON)

DevOps Security (I)

- DevSecOps
- Secure software delivery
- Secure infrastructure
- Security culture
- Security Frameworks

SESSION 28 (LIVE IN-PERSON)

DevOps Security (II)

- Secure Secrets Management
- Authentication, 2FA
- Hands-on: Cloud secret management

SESSION 29 (LIVE IN-PERSON)

SysAdmin Basics (I)

- VPN, SSH tunnelling, port forwarding
- UNIX user roles

SESSION 30 (LIVE IN-PERSON)

SysAdmin Basics (II)

- SysAdmin workshop

SESSIONS 31 - 32 (LIVE IN-PERSON)

Sprint review exhibition

SESSION 33 (LIVE IN-PERSON)

Retrospective Exhibition

SESSIONS 34 - 35 (LIVE IN-PERSON)

Final Exam

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Final Exam	30 %		
Exercises	15 %		
Midterm Exam	15 %		
Individual Assignments	25 %		
Group Assignment	15 %		

RE-SIT / RE-TAKE POLICY

A. Exams

There will be one midterm (1 session, approximately 80 min) and one final exam (double sessions: 160 min).

B. Continuous Evaluation

The progress of the students will be continuously evaluated throughout the semester. Several criteria will be taken into account:

- The quality of intervention in the respective forums and blogs;
- The completion of required exercises and assignments;
- Submitting deliverables on time
- Individual effort and overall evolution throughout the semester.

IMPORTANT- The date of the midterm is tentative and might change depending on the pace of the class. **DO NOT MAKE ANY TRAVEL ARRANGEMENT CLOSE TO THE DATE OF THE MIDTERM BEFORE DISCUSSING IT WITH YOUR PROFESSOR.** The precise date will be communicated to students two weeks ahead of time. The date of the final and the retake exam **CANNOT BE CHANGED** under any circumstances.

In order to pass the course, **you need a minimum grade of 3.5 in each part (theory and practice) of the final exam.** If your grade in the final exam does not reach the threshold value of 3.5 in each part, you will fail the course, even in the case in which your weighted average (computed using the table above) exceeds 5.0.

Notice that the date of the midterm exam could change and need to be considered with flexibility. The June retakes will consist of a comprehensive exam. The grade will depend only on the performance in this exam; continuous evaluation over the semester will not be taken into account.

This exam will be designed bearing in mind that the passing grade is 5 and the maximum grade that can be attained is 8. For more details on the retake policy, please refer to section Other Information.

As per University Policy:

Each student has 4 chances to pass any given course distributed in two consecutive academic years (regular period and July period).

It is mandatory to attend 100% of the classes. Students who do not comply with at least 80% attendance will lose their 1st and 2nd chance, and go directly to the 3rd one (they will need to enroll again in this course the next academic year).

Grading for retakes will be subject to the following rules:

Those students who failed the subject in the first regular period will have to do a retake in July (except those not complying with attendance rules who are banned from this possibility).

Dates and location of the July retakes will be posted in advance and will not be changed. Please take this into consideration when planning your summer. The maximum grade that a student may obtain in the 2nd exam session is 8 out of 10. Those students in the 3rd call will be required to attend 50% of the classes. If due to schedule overlap, a different option will be discussed with the professor in order to pass the subject.

BIBLIOGRAPHY

Recommended

- Forsgren, Nicole. Humble, Jez. Kim, Gene. *Accelerate: the science behind DevOps: building and scaling high performing technology organizations*. IT Revolution. ISBN 9781942788355 (Digital)

- Gene Kim, Jez Humble, Patrick Debois & John Willis. (2016). *The DevOps Handbook*. 2nd. IT Revolution. ISBN 9781950508402 (Digital)

How to create world-class agility, reliability & security in technology organizations. A must read for any organization seeking to scale up its IT capability and expand DevOps practices across multiple lines of business.

- Frank Tsui, Orlando Karam, Barbara Bernal. (2022). *Essentials of Software Engineering*. 5th. Jones & Bartlett Learning. ISBN 1284228991 (Digital)

- Matthew Skeleton and Manuel Pais. (2019). *Team topologies: organizing business and technology teams for fast flow*. ISBN 9781942788829 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.