esade

TEACHING GUIDE - 2025-2026

DevOps Management

UGRA_016276

Departments	Data, Analytics, Technology and Artificial Intelligence (DATA), Dept. of Operations, Innovation & Data Sciences
Teaching Languages	English
ECTS	4
Teacher responsible	Josep Oriol Rius Canals - joseporiol.rius@esade.edu

Course Goals

- Understand Level: Students will be able to explain the fundamental principles of DevOps and MLOps and interpret their application in business contexts involving AI.
- Apply Level: Students will be able to implement complete CI/CD pipelines and execute automated deployments of AI applications using GitHub Actions and AWS.
- Create Level: Students will be able to design comprehensive MLOps solutions and develop a fully integrated RAG system with MCP following advanced DevOps practices.

Previous knowledge

This is an advanced-level course in DevOps and MLOps intended for students with prior exposure to the foundations of programming, data engineering, and cloud systems. It builds on concepts and learnign from previous courses, including Software Development for Business, Database Management and Design, Cloud Solutions, or Intro to AI and Machine Learning.

Students are expected to be familiar with the use of version control systems (e.g., Git), basic scripting (preferably in Python or Bash), and the general architecture of cloud-based applications. While deep expertise is not required, students should be comfortable navigating technical environments, reading documentation, and using the command line.

Additionally, although not mandatory, familiarity with AI coding assistants such as Claude Desktop (or similar tools) with the ability to interact with MCP servers will be highly beneficial for improving productivity during coding and infrastructure tasks. Guidance on how to take advantage of these tools will be provided during the course.

Prerequisits

This course will be managed through a dedicated eCampus website. Students

will find there all the necessary materials, including session plans, assigned readings and pre-class work, class materials, and further references. Students should familiarize themselves with this environment before the start of the course and check for updates regularly.
In addition, to participate fully in this course, students must have the following tools properly installed and configured on their personal computers:

- A Linux/Unix-compatible command-line environment, required to run CLI-based DevOps tools. Recommended options: Mac Terminal, WSL (Windows Subsystem for Linux) on Windows, or any other equivalent terminal emulator with Unix command support.
- A modern Integrated Development Environment (IDE) for coding and editing configuration files. The recommended IDE is Visual Studio Code. Detailed installation instructions will be provided, though students may choose an alternative IDE if they prefer.
- Docker engine installed and running locally, required for container-based development and testing workflows. The AWS CLI and other related CLI tools that will be used throughout the course. Installation instructions and configuration guidelines will be provided.

It is the students' responsibility to ensure that their system is fully operational before the start of the course, as these tools are essential for completing coursework and engaging in hands-on exercises.

Teaching methodology

This course consists of 4 ECTS, which corresponds to 100 hours of independent student work. This workload will be distributed approximately as follows:

- In-class sessions: 30%
- Individual practical project: 40%
- Weekly assignments: 20%
- Independent study: 10%

In-class sessions will be of the following types:

- Theoretical sessions with demonstrations, use cases, and discussion forums: Theory supported by real-world examples, interactive demonstrations, and discussion forums to guide architectural decisions and technology selection.
- Practical workshops with real infrastructure: AWS, GitHub, CI/CD tools, and others.
- Review and problem-solving sessions.

The course will follow a project-based learning philosophy, with a practical approach focused on real business scenarios. To promote this philosophy, the course expects from students:

- Active engagement and pre-class preparation.
- Independent post-session work, including preparatory tasks for subsequent classes, completion of previous session assignments, and consolidation of concepts through regular quizzes at the beginning of selected sessions.
- Continuous and active development of the RAG project.

Description

Course contribution to program

This course consolidates the Technology path within the BBAI program by equipping students with advanced DevOps and MLOps knowledge, directly connecting theoretical foundations from previous courses such as Database Management, Cloud Solutions, and Machine Learning to practical implementation scenarios. By mastering the design and execution of automated CI/CD pipelines, infrastructure as code, and container orchestration, students bridge the gap between conceptual AI models and reliable, deployable systems, ensuring readiness for complex, real-world environments.

Furthermore, this course prepares students for future academic and professional experiences, particularly internships and the Final Degree Project, by emphasizing competencies in operational excellence, automation, and modern software engineering practices. The hands-on experience gained ensures that students acquire highly sought-after skills, directly applicable to business challenges involving AI-driven solutions, observability, and sustainable system design.

Short description

This course provides advanced practical training in DevOps and MLOps, specifically tailored to the deployment and operation of artificial intelligence systems. Students will learn how to design and implement automated software delivery pipelines, manage infrastructure as code, and apply modern practices for monitoring and maintaining AI-driven applications.

The course maintains a strong focus on real-world business applications, emphasizing the rationale behind each technical decision. Practical sessions offer hands-on experience with key concepts such as security, traceability, observability, and sustainable system design.

Bibliography

Humble, J. & Farley, D., Continuous Delivery: Reliable Software Releases., Addison Wesley, 9780321601919 (Book)

Kief Morris, Infrastructure as Code: Designing and Delivering Dynamic Systems for the Cloud Age, O'Reilly Media, 109815035X (Book)

Noah Gift, Practical MLOps, O'Reilly Media, 1098103017 (Book)

Content

#	Topic
1	DevOps and MLOps Fundamentals (Sessions 1–2) Introduction to core principles of DevOps and MLOps. Understanding their role in the development and operation of AI-driven systems, and how they support the full machine learning lifecycle.
2	Version Control and CI/CD (Sessions 3, 10) Version control best practices. Designing and implementing continuous integration and continuous delivery pipelines. Automation of build, test, and deployment processes to ensure reliability and scalability.
3	Infrastructure as Code and Cloud Environments (Sessions 4, 8) Principles of infrastructure as code (IaC). Automation of infrastructure provisioning, configuration, and management. Security, compliance, and operational considerations in cloud and hybrid environments.
4	Containerization and Orchestration (Sessions 5, 8) Concepts of containerization for portability and consistency. Introduction to orchestration techniques for managing containerized applications at scale. Key aspects of networking, security, and system resilience.
5	Advanced MLOps Practices (Sessions 6, 7, 11) Techniques for managing the machine learning lifecycle in production environments. Model versioning, experiment tracking, data pipeline automation, governance, and integration with existing systems.
6	Integration, Monitoring, and Observability (Sessions 9, 12) Best practices for integrating AI models into production environments. Monitoring application performance, ensuring traceability, managing logs, and setting up alerts to maintain system health and observability.

Assessment

Tool	Assessment tool	Category	Weight %
Written and/or oral exams	Final exam. Students will be required to sit for a final written and oral exam covering all topics addressed in the course. Real-world cases will be included to assess understanding and application of key concepts. A minimum grade of 4 is required in this	Retake and ordinary round	40.00%
Written and/or oral exams	Mid-term exam. A mid-term written and oral exam will evaluate knowledge acquired during the first half of the course, ensuring progressive	Retake and ordinary round	20.00%

Tool	Assessment tool	Category	Weight %
	learning and concept consolidation.		
Individual or team exercises	Final project. Students will be required to develop a complete DevOps/MLOps pipeline demonstrating practical application of course concepts. Evaluation will consider technical correctness, innovation, sustainability, and documentation quality.	Ordinary round	30.00%
Quizzes/tests	Quizzes and class activities. Regular in-class quizzes and activities will be conducted to promote continuous learning and engagement.	Ordinary round	10.00%
Individual or team exercises	Final project. Previously submitted project will be considered. Students may optionally resubmit an improved version.	Retake	40.00%

PROGRAMS

DBAI21-Double Degree in Business Administration and Artificial Intelligence for Business (Undergraduates: Business)

DBAI21 Year 4 (Mandatory)

DBAI23-Double Degree in Business Administration and Artificial Intelligence for Business (Undergraduates: Business)

DBAI23 Year 4 (Mandatory)