# Syllabus

## *Course Description*

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| **Course Title** | Cloud Computing and Distributed Systems |
| **Course Code** | 76061 |
| **Course Title Additional** | |
| **Scientific-Disciplinary Sector** | INFO-01/A |
| **Language** | English |
| **Degree Course** | Master in Software Engineering |
| **Other Degree Courses (Loaned)** | |
| **Lecturers** | dr. Florian Hofer,<br>Florian.Hofer@unibz.it<br>https://www.unibz.it/en/faculties/engineering/academic-staff/person/37220 |
| **Teaching Assistant** | |
| **Semester** | Second semester |
| **Course Year/s** | 1 |
| **CP** | 6 |
| **Teaching Hours** | 40 |
| **Lab Hours** | 20 |
| **Individual Study Hours** | 90 |
| **Planned Office Hours** | 18 |
| **Contents Summary** | • Distributed Systems Principles<br>• Network Technologies<br>• Virtualization<br>• Distributed Systems: Internet-of-Things, Edge Computing, Blockchain<br>• Cloud Systems Principles<br>• Cloud Security |
| **Course Topics** | In recent years, cloud computing has transformed the ICT landscape, with both public and private infrastructures supporting many digital services and data. Technology providers and |

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| | developers are increasingly adopting technologies such as virtualization, containerization, and microservices. Consequently, new cloud-native applications are emerging, capitalizing on the scalability and reliability of cloud services.<br>This course provides a comprehensive introduction to cloud computing and distributed systems through a practical approach. By the end, you will (1) understand distributed systems fundamentals and cloud computing models and technologies, (2) gain knowledge in networking, orchestration, and security, and (3) effectively use advanced platforms to manage cloud infrastructures and orchestrate workloads. |
| **Keywords** | Cloud, Microservices, Edge, Container, Virtualization. |
| **Recommended Prerequisites** | Basic coding skills, basic operating systems and networking knowledge |
| **Propaedeutic Courses** | |
| **Teaching Format** | The course combines interactive lectures with practical project work and lab exercises to provide both theoretical foundations and hands-on experience with clouds and distributed systems. |
| **Mandatory Attendance** | Attendance is not compulsory, but non-attending students must contact the lecturer at the start of the course to agree on the modalities of independent study. |
| **Specific Educational Objectives and Learning Outcomes** | Knowledge and understanding<br>D1.3 have an in-depth knowledge of the scientific method of investigation applied to even complex systems and innovative technologies that support Software Engineering and its various fields of applications.<br>D1.5 know the fundamentals, techniques, and methods of design, customisation and implementation of software to support the automation of new-generation software systems for industrial production, company business, education, and society.<br>Applying knowledge and understanding<br>D2.4 ability to define an innovative technical solution to an application problem that respects technical, functional, and organisational constraints and requirements.<br><br>Making judgements<br>D3.1 ability to independently select documentation from various sources, including technical books, digital libraries, technical |

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| | scientific journals, web portals, or open source software and hardware tools.<br>D3.4 ability to reconcile conflicting project objectives, find acceptable compromises within the limits of cost, resources, time, knowledge, or risk.<br><br>Communication skills<br>D4.2 ability to structure and draft scientific and technical descriptive documentation of project activities for diverse audiences.<br>D4.4 ability to prepare and deliver presentations with technical content in English for diverse audiences.<br>D4.5 ability to interact and collaborate in the realisation of a project or research with peers and experts.<br>Learning skills<br>D5.1 ability to independently extend the knowledge acquired during the course of study by reading and understanding scientific and technical documentation in English.<br>D5.3 in the context of a problem solving activity, ability to extend even incomplete knowledge with regard to the final objective of the project. |
| **Specific Educational Objectives and Learning Outcomes (additional info.)** | The course belongs to the type caratterizzanti – discipline informatiche.<br>The Cloud Computing and Distributed Systems course focuses understanding, designing and implementing distributed and cloud systems to solve real life problems. The main educational objectives of the course are:<br>• Understand the core concepts of distributed systems and cloud computing<br>• Cloud infrastructure from the ground up<br>• Analyze trade-offs between cloud deployment models and providers<br>• Distributed systems<br>• Performance, scalability, and availability measurements in the cloud<br>• Security and privacy in cloud computing<br>• Edge computing technologies<br>• Address real-world problems using cloud computing. |
| **Assessment** | The assessment of the course consists of an oral exam and a |

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| | project. For the project, the students are required to implement a distributed system or cloud-based solution for specific problems (e.g., auto-scaling, security, performance, consensus). The project will focus on one or more topics covered during the lectures and labs. The outputs of the project are:<br>• a written report describing problem statement, proposed solution, system design and architecture, functionality, development problems/solutions (D1.3, D2.4, D3.1, D3.4, D4.2)<br>• a working demo of the application (D1.5, D5.1, D5.3)<br>• a project presentation (D4.4, D4.5)<br>The project grade can optionally be integrated through lab exercises, practice test and experience reporting.<br>The oral exam will evaluate the student's knowledge (D1.3, D1.5) and how this knowledge can be applied to specific problems (D2.4). It will assess proficiency in communicating technical content effectively to diverse audiences through well-structured scientific documentation and presentations (D4.2, D4.4). The course labs and activities will evaluate their decision-making capacity in the context of Cloud Computing (D3.4), exercising their communication skills (D4.2, D4.5). |
| **Evaluation Criteria** | The evaluation of the course is weighted as follows:<br>• Oral exam 50%;<br>• Project, integrated with lab exercises, 50%.<br>Note: Positive project results are necessary to attend the oral exam.<br>Projects must be evaluated BEFORE the final exam, otherwise the exam cannot be registered.<br>In case of a positive mark, the project will count for the remaining regular exam sessions. |
| **Required Readings** | • Erl, T., Puttini, R., Mahmood Z., Cloud Computing. Concepts, Technology & Architecture, 2nd Edition, Pearson, 2023, ISBN: 978-0138052256 (available through UniBz online library)<br>• Lecture slides.<br><br>Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it |
| **Supplementary Readings** | • Coulouris, G., Dollimore, J., Kindberg, T., Blair, G., Distributed Systems. Concepts and Design (5th Edition), Pearson, 2011, ISBN: ¿ 978-0132143011 Hardcover, 978- |

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| | 0273760597 Paperback<br>• Woolf, B., Cloud Application Architecture Patterns: Designing, Building, and Modernizing for the Cloud, O'Reilly Media, 2025, ISBN: 978-1098116903 (available through UniBz online library)<br>• Aws: The Complete Guide From Beginners To Advanced For Amazon Web Services, 2019, 979-8477732074<br>• Online resources: https://aws.amazon.com/getting-started/ |
| **Further Information** | |
| **Sustainable Development Goals (SDGs)** | Decent work and economic growth, Responsible consumption and production, Industry, innovation and infrastructure |