DISTRIBUTED SYSTEMS

1. Subject Information

Faculty	Computers, Informatics and Microelectronics				
Department	Software Engineering and Automation				
Academic Degree	Cycle I, bachelor's degree				
Study Program	Software Engineering				
Study Year	**Semester**	**Exam type**	**Formative category**	**Optional category**	**ECTS credits**
IV year	VII	E	S – Specialty subject	O – mandatory course	5

2. Total estimated time

Total curriculum hours		**Of which**				
		Auditorium hours			**Individual work**	
		Course	**Seminar**	**Laboratory work**	**Study of theoretical materials**	**Project**
Full-time study	**150**	45	--	30	75	--

3. Prerequisites

According to study curriculum	To achieve the objectives of this course, students must possess skills acquired in previous subjects covering a wide range of areas: computer programming, data structures and algorithms, computer architecture, formal and automatic languages, operating systems, object-oriented programming, object-oriented analysis and modeling, network programming.
According to competences	According to the competences, among the essential prerequisites are the application of programming languages, modeling and development environments, methodologies for software development etc.

4. Conditions for carrying out the educational process

Course	Students should be provided with a well-illuminated and ventilated auditorium, where they have the ability to hear the teacher and take notes comfortably.
Laboratory work	Students should be provided with a PC / laptop with internet connection, which is able to run and deploy their projects in a programming language of choice.

5. Competences

Professional competences	• CP1 Architecture Development and Design; • CP2 Application Design and Development; • CP5 Solution Implementation; • CP7 Sistems engineering; • CP9 Process improvement.
Transversal competences	Identifying, describing and carrying out organized activities in a team with the development of communication and collaboration skills, as well as assuming different roles (executive and leadership).

6. Course objectives

Scope	The aim of the course is for students to gain an insight into the stated field, to understand the direction in which the field is evolving and what are the benchmarks in the coming years, to understand the necessary basic concepts and to be able to apply the obtained knowledge in practice to the creation of complex systems.
Objectives	The objectives of the course are to investigate the architectural and programming requirements specific to modern distributed systems, providing the necessary information to apply the various concepts studied to system design as well as to the development of algorithms and applications.

7. Course content

Teaching Activity Topics	Number of Hours Full-Time Study
Course Topics	
T1. Reliable, Scalable and Maintainable Applications	4
T2. Data Models and Query Languages	4
T3. Storage and Retrieval	4
T4. Encoding and Evolution	4
T5. Replication	4
T6. Partitioning	4
	4
T8. The Trouble with Distributed Systems	4
T9. Consistency and Consensus	4
T10. Batch Processing	3
T11. Stream Processing	3
T12. The Future of Data Systems	3
Total Course:	**45**
Laboratory Work Topics	
LL1. Web Proxy	15
LL2. Logically Linked DBs	15
Total Laboratory Work:	**30**

8. Bibliography

Main

1. Bass, L.; Clements, P.; Kazman, R. *Software Architecture in Practice, 4th Edition*; 1st edition.; Addison-Wesley Professional, 2021; ISBN 978-0-13-688567-2.
2. *Distributed Systems: Concepts and Design*; Coulouris, G.F., Ed.; International computer science series; 5. ed.; Addison-Wesley: Boston Munich, 2012; ISBN 978-0-13-214301-1.
3. Tanenbaum, A.S.; Steen, M. van *Distributed Systems: Principles and Paradigms*; Second edtion.; Pearson, Prentice Hall: Upper Saddle River, NJ, 2007; ISBN 978-0-13-239227-3.
4. Sommerville, I. *Software Engineering*; International computer science series; 6th ed.; Addison-Wesley: Harlow (England) London New York [etc.], 2001; ISBN 978-0-201-39815-1.
5. Fielding, R.T. Architectural Styles and the Design of Network-Based Software Architectures, University of California, Irvine, 2000.
6. Architecture Center, Microsoft Learn Cloud Design Patterns Available online: https://learn.microsoft.com/en-us/azure/architecture/patterns/ (accessed on 4 October 2024).

	7. gRPC Guides Available online: https://grpc.io/docs/guides/ (accessed on 3 October 2024). 8. Introducing JSON Available online: https://www.json.org/json-en.html (accessed on 3 October 2024). 9. Bray, T. *The JavaScript Object Notation (JSON) Data Interchange Format*; Internet Engineering Task Force, 2017; 10. Extensible Markup Language (XML) 1.1 (Second Edition) Available online: https://www.w3.org/TR/2006/REC-xml11-20060816/ (accessed on 3 October 2024). 11. Apache Software Foundation Apache Thrift Available online: https://thrift.apache.org/ (accessed on 4 October 2024). 12. RabbitMQ: One Broker to Queue Them All | RabbitMQ Available online: https://www.rabbitmq.com/ (accessed on 4 October 2024).
Supplementary	13. Păunescu, F.; Coleşteanu, D.P. *Sisteme Cu Prelucrare Distribuită Şi Aplicaţiile Lor*; Editura Tehnică: Bucureşti, 1993; 14. Albahari, J. Threading in C#. In *C# 12 in a Nutshell: The Definitive Reference*; O'Reilly Media, 2023; p. 1083 ISBN 1-09-814744-8. 15. Lea, D. *Concurrent Programming in Java: Design Principles and Patterns*; The Java series; Addison Wesley: Reading, Mass, 1997; ISBN 978-0-201-69581-6. 16. Amazon Web Services, Inc. Overview of Amazon Web Services Available online: https://docs.aws.amazon.com/whitepapers/latest/aws-overview/introduction.html?did=wp_card&trk=wp_card (accessed on 4 October 2024).

9. Generative AI use

Permission for use	The use of generative AI in assignments and projects is permitted, provided that students adhere to the following rules: • Generative AI may be used to generate ideas, text structures, or code, but all generated materials must be reviewed and adjusted by the student to ensure that they meet academic requirements; • Any use of generative AI must be declared in the appendix section of each paper, using the phrase: "During the preparation of this paper, the author used [INSTRUMENT/SERVICE NAME] for the purpose of [REASON]. After using this tool/service, the author has reviewed and edited the content as necessary and takes full responsibility for the content of the paper.".
Usage restrictions	Students should not consider generative AI as a reliable source for information, as it does not provide clear references or documented sources: • Direct citation of AI-generated content in academic papers as a primary source is not permitted; • The activities in which the use of generative AI is prohibited are teacher-specified and are usually midterm and final assessments or ones that do not involve professional skill development activities.

10. Course evaluation

Midterm		Current Evaluation	Individual Study	Exam
M1	**M2**			
15%	15%	15%	15%	40%

Minimum standard of performance

Attendance and activity in lectures and laboratory works;

A minimum grade of "5" on each of the midterms and laboratory assignments;

Knowledge of basic processes and technologies applied to the development of distributed applications.

11. Evaluation criteria

Activity	Evaluation components	Evaluation method, evaluation criteria	Activity mark weight	Course evaluation weight
Midterm 1	Theoretical component, topics T1 -- T6	Test / MOODLE	50%	**15%**
	Theoretical component LL1	Test / MOODLE Discussions during laboratory works	50%	
Midterm 2	Theoretical component, topics T7 -- T12	Test / MOODLE	50%	**15%**
	Theoretical component LL2	Test / MOODLE Discussions during laboratory works	50%	
Current Evaluation	Practical component LL1 And LL2	Discussions during laboratory works	100%	**15%**
Individual Study	Topic research	Presentation	66%	**15%**
	Practical component LL1 and LL2	Discussions during laboratory works	34%	
Exam	Theoretical component T1 -- T12	Test / MOODLE	62.5%	**40%**
	Practical component LL1 and LL2	Discussions during laboratory works	37.5%	