SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Master
1.6 Program of study / Qualification	Data Science / Master
1.7 Form of education	Full time
1.8 Subject code	7.20

2. Data about the subject

2.1 Subject name				***Architectures of Information Systems***	
2.2 Course responsible / lecturer				Prof. dr. eng. Dînșoreanu Mihaela - Mihaela.Dinsoreanu@cs.utcluj.ro	
2.3 Teachers in charge of seminars/ Laboratory / project				As. drd. eng. Bogdan Bindea - bogdan.bindea@cs.utcluj.ro	
2.4 Year of study	I	2.5 Semester	2	2.6 Type of assessment (E – exam, C – colloquium, V – verification)	E
2.7 Subject category	Formative category: DA – advanced, DS – speciality, DC – complementary				DA
	Optionality: DI – imposed, DO – optional (alternative), DF – optional (free choice)				DO

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	2	Seminars	-	Laboratory	1	Project	-
3.2 Number of hours per semester	42	of which:	Course	28	Seminars	-	Laboratory	14	Project	-
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										20
(b) Supplementary study in the library, online and in the field										20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										10
(d) Tutoring										5
(e) Exams and tests										3
(f) Other activities:										

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	58
3.5 Total hours per semester (3.2+3.4)	100
3.6 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	Software Design
4.2 Competence	Design Patterns, Software architectures

5. Requirements (where appropriate)

5.1. For the course	Attending min 50% of the lectures to be admitted to take the final exam
5.2. For the applications	Compulsory attendance of 100% to be admitted to take the final exam

6. Specific competence

6.1 Professional competences	• analyse big data • analyse business processes • analyse decentralised applications • build predictive models • create data models • define software architecture • define technical requirements • design cloud architecture • develop software prototype • develop with cloud services • interpret technical requirements • manage cloud data and storage • oversee development of software • perform data cleansing • perform data mining • perform scientific research • provide technical documentation • use data processing techniques • use software design patterns • use software libraries • utilise computer-aided software engineering tools • utilise machine learning
6.2 Cross competences	The graduate: • develops an analytical approach • takes a proactive approach • develops strategies to solve problems • is open minded • coordinates engineering teams

7. Expected Learning Outcomes

Knowledge	The student has knowledge of: • cloud technologies • computer science • data analytics • data models • data storage • data warehouse • database management systems (DBMS) • digital data processing • unstructured data

Skills	The student is able to: • create data sets • design databases in the cloud • develop data processing applications • establish data processes • implement data warehousing techniques • manage ICT data architecture • manage data • manage quantitative data • manage research data • perform dimensionality reduction • process data • store digital data and systems • use data processing techniques • use databases • analyse pipeline database information • create data models
Responsibilities and autonomy	The student has the ability to work independently in order to: • develop an analytical approach • take a proactive approach • develop strategies to solve problems • be open-minded • coordinate engineering teams

8. Discipline objective (as results from the *key competences gained*)

8.1 General objective	The main objective of this discipline is to provide specific information and to prepare students for designing and building solutions based on cloud native data, machine learning platforms and multicloud tools.
8.2 Specific objectives	To achieve these general objectives, students will learn how to: • Design modern and secure cloud native or hybrid data analytics and machine learning platform • Consolidate enterprise data in a governed, scalable, and resilient data platform • Democratize access to enterprise data and govern how business teams extract insights and build AI/ML capabilities • Use streaming pipelines to enable decisions making in real time • Build an MLOps platform to move to a predictive and prescriptive analytics approach

9. Contents

9.1 Lectures	Hours	Teaching methods	Notes
Introduction to Data Lifecycle	2	Oral presentation, ppt support, discussions	
Designing Data architectures – Principles, Concepts, Technologies	2		
Cloud Architectures – Apache Spark	2		
Architecting Data Lakes	2		
Enterprise Data Warehouse	2		
Converging to Lakehouse	2		
Architecting for streaming – Streaming Ingest	2		
Stream analytics	2		
Multicloud and edge computing	2		
ML application architectures	2		
ML platform architectures	2		
MLOps	2		

Final review	2		
Project Presentations	2		

Bibliography:

1. Marco Tranquillin, Valliappa Lakshmanan, Firat Tekiner, Architecting Data and Machine Learning Platforms, 2023, ISBN: 9781098151614
2. David Ping, The Machine Learning Solutions Architect Handbook: Create machine learning platforms to run solutions in an enterprise setting, 2022, ISBN: 978-1801072168
3. Joe Reis, Matt Housley, Fundamentals of Data Engineering: Plan and Build Robust Data Systems, 2022, ISBN: 9781098108304

9.2 Applications - Seminars / Laboratory / Project	Hours	Teaching methods	Notes
Data environment setup	1	Oral presentations, hands-on lab, discussions	
Data modelling	1		
Cloud Apache Spark	1		
Data lakes	1		
Data warehouse	1		
Lakehouse	1		
Streaming environment setup	1		
Stream analytics	1		
Multicloud and edge computing	1		
ML application architecture	1		
ML platform architecture	1		
Final review and discussions	1		
Final review	1		
Project presentations	1		

Bibliography:

1. Marco Tranquillin, Valliappa Lakshmanan, Firat Tekiner, Architecting Data and Machine Learning Platforms, 2023, ISBN: 9781098151614
2. David Ping, The Machine Learning Solutions Architect Handbook: Create machine learning platforms to run solutions in an enterprise setting, 2022, ISBN: 978-1801072168
3. Joe Reis, Matt Housley, Fundamentals of Data Engineering: Plan and Build Robust Data Systems, 2022, ISBN: 9781098108304

**Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

10. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

11. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	The ability to solve domain specific problems Attendance, (inter)activity during class hours	Exam - summative, interaction - continuous	50%
Seminar	-	-	-
Laboratory	Lab tasks completion Attendance	Lab assignments - continuous	50%
Project	-	-	-
Minimum standard of performance: Lab grade >=5, Exam grade >=5			

Date of filling in:	**Responsible**	**Title First name Last name**	**Signature**

01.09.2025	Course	Prof.dr.eng. Mihaela DÎNȘOREANU	
	Applications	As.drd.ing. Bogdan Bindea	

Date of approval in the department 17.09.2025	Head of department, Prof.dr.eng. Rodica Potolea
Date of approval in the Faculty Council 19.09.2025	Dean, Prof.dr.eng. Vlad Muresan