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

2. Data about the subject

2.1 Subject name	***Big Data***			Subject code	**1.00**
2.2 Course responsible / lecturer	Assoc.prof.dr.eng. Oprișa Ciprian-Pavel - Ciprian.OPRISA@cs.utcluj.ro				
2.3 Teachers in charge of seminars / Laboratory / project	Lect.dr.eng. Varga Robert - Robert.VARGA@cs.utcluj.ro				
2.4 Year of study	I	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V – verification)	E
2.7 Subject category	Formative category: DA – advanced, DS – speciality, DC – complementary				DS
	Optionality: DI – imposed, DO – optional (alternative), DF – optional (free choice)				DI

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	2	Seminars	1	Laboratory	0	Project	0
3.2 Number of hours per semester	52	of which:	Course	28	Seminars	14	Laboratory	0	Project	0
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										15
(b) Supplementary study in the library, online and in the field										15
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										15
(d) Tutoring										10
(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	Artificial Intelligence - bachelor, Distributed systems - bachelor
4.2 Competence	Operating with fundamental computer science concepts

5. Requirements (where appropriate)

5.1. For the course	Blackboard, Projector, PC, MS Teams Platform
5.2. For the applications	PC, Specific Software

6. Specific competence

6.1 Professional competences	analyse big data analyse business processes 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: • develop an analytical approach • taking a proactive approach • developing strategies to solve problems • being open minded • coordinate engineering teams

7. Expected Learning Outcomes

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

Skills	The student is able to: • create data sets • design databases in the cloud • develop data processing applications • establish data processes • manage data • manage quantitative data • manage research data • perform dimensionality reduction • process data • store digital data and systems • use data processing techniques • use databases • create data models • interpret technical requirements • use software design patterns • use software libraries • adapt to changes in technological development plans
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	Understanding big data concepts and methods for handling complexities; Solutions identification and design based on a given context; The development of competences and skills for the development of systems for big data
8.2 Specific objectives	Knowledge extraction from big data; Network systems; Ability to design and implement pipelines for big data processing

9. Contents

9.1 Lectures	Hours	Teaching methods	Notes
Big Data Overview	2	Lectures using blackboard and projector; involving students in debate	
Big Data Storage	2		
Distributed File Systems	2		
Similarity measurement	2		
Map Reduce	2		
Recommendation systems	2		
Finding Similar Items	2		
Clustering	4		
Link Analysis	2		
Case Study: Apache Spark	2		
Case Study: Apache Kafka	2		
Mining Social-Network Graphs	2		
Recapitulation			

Bibliography:

- J. Leskovec, A. Rajaraman and J. D. Ullman. Mining of massive data sets. Cambridge University Press, 2020
- G. Fourny. The Big Data Textbook: From clay tablets to data lakehouses. ETH Zurich, 2024
- T. Erl, W. Khattak and P. Buhler. Big Data Fundamentals: Concepts, Drivers & Techniques. Prentice Hall Press, 2016

9.2 Applications - Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Tools for processing big data	2	Oral presentation using slides, discussions (Q&A). Using multimedia tools, interactive teaching tools. Using specific software for Big Data	
Map Reduce and Hadoop	2		
Similarity measurement	2		
Data search and analytics	2		
Clustering	2		
Apache Spark	2		
Apache Kafka	2		

Bibliography

- B. Chambers and M. Zaharia. Spark: The Definitive Guide. O'Reilly Media, Inc., 2018
- G. Shapira, T. Palino, R. Sivaram and K. Petty. Kafka: The Definitive Guide. O'Reilly Media, Inc., 2022

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

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

The class content was aligned wit other similar classes from renowned universities

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Exam	Written exam	70%
Seminar	Exercises. Presentation. Quizzes	Oral examination	30%
Laboratory	-	-	-
Project	-	-	-
Minimum standard of performance: Final grade > 5			

Date of filling in: 01.09.2025	**Responsible**	**Title First name Last name**	**Signature**
	Course	Assoc.prof.dr.eng. Oprișa Ciprian-Pavel	
	Applications	Lect.dr.eng. Varga Robert	

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 Mureșan