

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	Masters
1.6 Program of study / Qualification	Data Science / Masters
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	Internet of Things and Industry 4.0				Subject code	15.1
2.2 Course responsible / lecturer	Lect.dr.eng. Portase Raluca-Laura - raluca.portase@cs.utcluj.ro					
2.3 Teachers in charge of seminars / Laboratory / project	Lect.dr.eng. Portase Raluca-Laura - raluca.portase@cs.utcluj.ro					
2.4 Year of study	II	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V – verification)	E	
2.7 Subject category	Formative category: DF – fundamental, DS – speciality, DC – complementary					DF
	Optionality: DOB – mandatory, DOP – optional (alternative), DFA – optional (free choice)					DOP

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	1	Seminars	1	Laboratory	1	Project	-
3.2 Number of hours per semester	42	of which:	Course	14	Seminars	14	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										10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										20
(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	Big Data, Machine Learning. Distributed systems - bachelor. Design with microprocessors - 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 decentralised applications • build predictive models • create data models • debug software • define software architecture • define technical requirements • develop software prototype • develop with cloud services • implement smart contracts • interpret technical requirements • perform data cleansing • perform data mining • 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

7. Expected Learning Outcomes

Knowledge	The student has knowledge of: • cloud technologies • computer science • data analytics • data models • data storage • data warehouse • digital data processing • computer programming • smart contracts • unstructured data • 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 quantitative data • manage research data • perform dimensionality reduction • process data • use data processing techniques • use databases • analyse pipeline database information • create data models • debug software • 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

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

8.1 General objective	Facilitate the understanding of main characteristic of IoT system and the Internet 4.0 context. Knowledge of the algorithms, protocols and best practices. Design, implement, evaluate and integrate an IoT system
8.2 Specific objectives	In order to achieve this objective, students will learn to: • understanding of IoT protocols • process data from IoT environment • apply statistical methods and machine learning techniques for analysing IoT data • determine and optimize parameters • design systems for IoT with an increased security

9. Contents

9.1 Lectures			
Hours	Teaching methods	Notes	
IoT introduction notions. Distributed world	1	Lectures using blackboard and projector; involving students in debate.	
IoT Architecture. Web of things	1		
Wired and wireless technologies for the IoT	1		
Industrial Protocols and Standards for Internet of Things	2		
Intro to industrial protocols. Intro to smart cities	1		
Data in IoT networks	1		
Cloud & Edge Computing for IoT	2		
Cybersecurity in IoT & Industry 4.0	2		
Machine learning models applied to IoT	2		
Predictive maintenance models	1		
Bibliography:			
• Hands-On Industrial Internet of Things. 2nd edition. Giacomo Veneri, Antonio Capasso, Packt Publishing Limited, 2024 • Internet of Things and Data Analytics Handbook. Hwaiyu Geng. Wiley, 2017 • Internet of Things: Architectures, Protocols and Standards. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri Wiley. 2018. • Artificial Intelligence for IoT Cookbook: Over 70 recipes for building AI solutions for smart homes, industrial IoT, and smart cities. Michael Roshak. Packt Publishing Limited. 2021			

- Practical IoT Hacking: The Definitive Guide to Attacking the Internet of Things. Fotios Chantzis, Ioannis Stais, Paulino Calderon, Evangelos Deirmentzoglou, Beau Woods. No Starch Press, 2021
- The IoT Hacker's Handbook: A Practical Guide to Hacking the Internet of Things. Aditya Gupta. APress. 2019

9.2 Applications - Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Introduction to IoT	4	Oral presentation using slides, discussions (Q&A). Using multimedia tools, interactive teaching tools. Using specific software and hardware for IoT. Lab assignments.	
Web of things and IoT technologies	2		
Industrial Protocols and Standards	2		
Smart Cities & Industrial Protocols	2		
Data storage and preprocessing	2		
Cloud & Edge Computing for IoT	2		
Cybersecurity for IoT	4		
AI for IoT	2		
Federated Learning	2		
ML applications in IoT and Industry 4.0 context	4		
Project presentations	2		

Bibliography

- Hands-On Industrial Internet of Things. 2nd edition. Giacomo Veneri, Antonio Capasso, Packt Publishing Limited, 2024
- Internet of Things and Data Analytics Handbook. Hwaiyu Geng. Wiley 2017
- Machine Learning for Time-Series with Python – Ben Auffart, Packt Publishing Limited 2021
- The IoT Hacker's Handbook: A Practical Guide to Hacking the Internet of Things. Aditya Gupta. APress, 2019

**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	Exam	Written Exam – summative evaluation	50%
Seminar	Presentation; Demonstration	Oral examination - summative evaluation	20%
Laboratory	Assignments	Evaluation of assignments during the semester – continuous evaluation	30%
Project	-	-	-
Minimum standard of performance: Lab grade + seminar grade ≥ 5 , Course evaluation grade ≥ 5			

Date of filling in: 29.04.2026	Responsible	Title First name Last name	Signature
	Course	Lect.dr.eng. Raluca PORTASE	
	Applications	Lect.dr.eng. Raluca PORTASE	

Date of approval in the department

Head of department,
Prof.dr.eng. Rodica Potolea

Date of approval in the Faculty Council

Dean,
Prof.dr.eng. Vlad Mureșan