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	Automation
1.4 Field of study	System's Engineering
1.5 Cycle of study	Master
1.6 Program of study / Qualification	Cyber-physical systems
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	***Augmented and virtual reality***				Subject code	**8.00**
2.2 Course responsible / lecturer	prof. dr. ing. Levente Tamas					
2.3 Teachers in charge of seminars / Laboratory / project	Drd.ing. Konievic Robert					
2.4 Year of study	1	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	1	Seminars		Laboratory	1	Project	1
3.2 Number of hours per semester	100	of which:	Course	14	Seminars		Laboratory	14	Project	14
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										
(e) Exams and tests										3
(f) Other activities:										10

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	General engineering knowledge. Advanced mathematics.
4.2 Competence	Software engineering, system analysis and design

5. Requirements (where appropriate)

5.1. For the course	Optional
5.2. For the applications	Compulsory

6. Specific competence

6.1 Professional competences	• Disseminates results to the scientific community • Uses software libraries • Thinks abstractly
6.2 Cross competences	• Show initiative • Apply scientific, technological, and engineering knowledge

7. Expected Learning Outcomes

Knowledge	The students will know: • techniques, methods, and technologies for the analysis, design, implementation and optimization of applications based on programmable equipment and embedded systems • advanced applications of AI, machine learning, and AR/VR technologies in industrial contexts, including their integration into control systems, automation, and human-machine interaction
Skills	The students will be able to: • conduct scientific and interdisciplinary research, analyze data, and communicate results effectively to professional and academic audiences
Responsibilities and autonomy	• The student will be responsible for promoting collaboration, teamwork, knowledge transfer, and innovation within professional and research environments

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

8.1 General objective	The adaption and usage of augmenter/virtual reality solutions for the Industry X.0
8.2 Specific objectives	Robotics and AI specific technologies

9. Contents

9.1 Lectures	Hours	Teaching methods	Notes
1. General aspects of the design/implementation of the AR/VR systems in the era of Industry X.0	2	Presentation using beamer/online projector	The presentations include real life examples as well as case studies.
2. Main principles and architecture for augmented and virtual robotics&AI systems	2		
3. Main components of the AR/VR systems	2		
4. AI based AR/VR systems AR/VR specific systems	2		
5. AI based perception for the AR/VR	2		
6. Advanced localization and mapping in the 3D space	2		
7. AI based 3D reasoning within industrial systems	2		
Bibliography: 1. A. Blaga, L. Tamas: AR applications în MES, 2021 2. D. Scaramuzza et.al. Autonomous mobile robots. MIT Press 2008. 3. Gh.Sebesteyen –Informatica industriala.Ed. Albastra Cluj-N. 2006 4. S. Thrun et. al.: Probabilistic Robotics, MIT, 2006			
9.2 Applications - Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Introduction to AR/VR frameworks	4	Practical work including computation and discussion/or online variant on Teams	Encouraging team work 2-3 students in a group
Environment perception for the augmented world	4		
3D perception of the industrial environments	4		
Localization and tracking for AR/VR applications	2		
Bibliography www.rocon.utcluj.ro/arvr			

**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

Practical work for agents using AR/VR in the Industry X.0 environment.
Communication with robots in the era of artificial intelligence.
AI-based perception systems.

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Theoretical principles. Ability to solve applications. Ability to analyze and synthesize.	Written exam / in case of force majeure, online via the Teams platform.	0,6 (6 pts from 10)
Laboratory	Completion of laboratory work. Ability to finalize and interpret the data from the work.	Test based on laboratory/project applications / in case of force majeure, online via the platform.	0,4 (4 pts from 10)
Minimum standard of performance: 5 out of 10			

Date of filling in: 01.09.2025	**Responsible**	**Title First name Last name**	**Signature**
	Course	prof. dr. ing. Levente Tamas	
	Applications	Drd.ing. Konievic Robert	

Date of approval in the department of Automation _____	Head of department, Prof.dr.eng. Honoriu VĂLEAN
Date of approval in the Faculty of Automation and Computer Science Council _____	Dean, Prof.dr.eng. Vlad MUREȘAN