Syllabus

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Department	Automation
1.4 Field of study	Systems Engineering
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Automation and Applied Informatics (English)
1.7 Form of education	Full time
1.8 Discipline code	114.00

2. Data about the subject

2.1 Subject name	***Autonomous driving: Technology, Dynamics and Control***				
2.2 Course responsible/lecturer	Prof.dr.ing. Ionut Muntean -ionut.muntean@aut.utcluj.ro				
2.3 Teachers in charge of applications	Prof.dr.ing. Ionut Muntean -ionut.muntean@aut.utcluj.ro				
2.4 Year of study	4	2.5 Semester	1	2.6 Assessment *(E/C/V)*	E
2.7 Type of subject	*DF – fundamental, DID – in the field, DS – specialty, DC – complementary*				DS
	DOB – compulsory, DOP – elective, FAC – optional				FAC

3. Estimated total time

3.1 Number of hours per week	4	of which:	Course	2	Seminar	-	Laboratory	2	Project	-
3.2 Number of hours per semester	56	of which:	course	28	Seminar	-	Laboratory	28	Project	-
3.3 Individual study										
(a) Manual, lecture material and notes, bibliography										
(b) Supplementary study in the library, online and in the field										13
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										4
(d) Tutoring										
(e) Exams and tests										2
(f) Other activities:										

3.4 Total hours of individual study (sum of (3.3(a)…3.3(f)))	19
3.5 Total hours per semester (3.2+3.4)	75
3.6 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1 Curriculum	Systems Theory, Computer Programming, Control Engineering
4.2 Competence	Mathematics, Programming, Analytical understanding

5. Requirements (where appropriate)

5.1. For the course	N/A
5.2. For the applications	The presence to application classes is mandatory

6. Specific competences

6.1 Professional competences	C1: Operating with basic concepts of mathematics, physics, measurement science, mechanical engineering, chemical engineering, electrical engineering in systems engineering C2: Operating with basic concepts of computer science, information technology and communication C3: Operating with fundamentals of control engineering, process modelling, simulation, identification and analysis methods, and computer aided design. C4: Design, implementation, testing, operation and maintenance of systems with generic and dedicated equipments, including computer networks for control engineering and applied informatics. C5: Development and implementation of automatic control structures and algorithms based on project management principles, software environments

	and technologies based on microcontrollers, signal processors, programmable logic controllers and embedded systems.
6.2 Cross competences	

7. Course objectives

7.1 General objective	Development of skills for algorithm development in the area of autonomous driving
7.2 Specific objectives	Understanding the technology and strategies used for autonomous driving Implementation of algorithms for perception and sensor data fusion Implementation of planning and motion control algorithms Have an overview of safety concepts used in autonomous vehicles Get an overview on connectivity in vehicles

8. Contents

8.1 Lecture	No.hours	Teaching methods	Notes
Introduction	2	Slides presentation, explanations and demonstrations, discussions, case studies	
Radar sensors	2		
Ultrasonic and Lidar sensors	2		
Introduction to video sensors	2		
3D computer vision I	2		
3D computer vision II	2		
The Path to Deep Learning	2		
Convolutional Neural Networks	2		
CNN Architectures and Applications	2		
Connectivity and data analytics	2		
Powertrain control- Model based development	2		
Steering systems	2		
Vehicle dynamics	2		
Bibliography 1. IEEE Explore articles on autonomous driving (shared on the courses)=Automation: From Driver Assistance Systems to Automated Driving, VDA, 2015 2. Automotive handbook, Robert Bosch GmbH, 2007			

8.2 Aplications (seminar/laboratory/project)	No.hours	Teaching methods	Notes
Introduction		Laboratory stands, case studies, open discussions	
Application with ultrasonic sensors			
Application with video sensors			
Object detection applications			
Object detection applications			
Object detection applications			
GPS + odometry fusion with Kalman filters			
Occupancy grid +SLAM			
Detection of free space and obstacle			
Robot car with framework for path planning and motion control			
Electric power steering application I			
Electric power steering application II			
CAN communication; safety concepts			
Application on connectivity			
Bibliography Will be shared at each laboratory			

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

The content of the course and applications is developed together with an Automotive Company.

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Evaluation of the acquired skills, activity within lectures	Exam or project work	100%
Seminar			
Laboratory			
Project			
Minimum standard of performance: Exam grade or project work >5			

Date of filling in:		**Title Firstname NAME**	**Signature**
13.02.2025	Course	Prof.dr.ing. Ionut MUNTEAN	
	Aplications	Prof.dr.ing. Ionut MUNTEAN	

Date of approval by the Department Board Automation

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Head of Departament
Prof.dr.ing. Honoriu VĂLEAN

Date of approval by the Faculty Council Automation and Computer Science

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Dean
Prof.dr.ing. Vlad MUREȘAN