SYLLABUS

1. Program data

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Road Vehicles, Mechatronics and Mechanics
1.3 Department	Road Vehicles and Transport
1.4 Field of study	Automotive Engineering
1.5 Study cycle	Master's Degree
1.6 Study program / Qualification	Advanced Techniques in Automotive Engineering (English) /Engineer
1.7 Form of education	IF – part-time education

2. Data about the discipline

2.1 Name of the discipline	Communication BUS Architecture					Code of Discipline	4.00
2.2 Course holder	*Associate Professor Ph.D. Iclodean Călin* *calin.iclodean@auto.utcluj.ro*						
2.3 Head of seminar/laboratory/project/practical activities	*Associate Professor Ph.D. Iclodean Călin* *calin.iclodean@auto.utcluj.ro*						
2.4 Year of study	1	2.5 Semester	1	2.6 Type of Assessment			E
2.7 Discipline regime	Formative category						DF
	Optionality						DOB

3. Total estimated time

3.1 Number of hours per week	3	of which:	3.2 Lecture	1	3.3 Seminary	0	3.3 Laboratory	2	3.3 Project	0	3.3 Practice	0
3.4 Number of hours per semester	42	of which:	3.5 Lecture	14	3.6 Seminary	0	3.6 Laboratory	28	3.6 Project	0	3.3 Practice	0

3.7 Distribution of time (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Studying according to the textbook, course material, bibliography and notes	24
(c) Additional documentation in the library, on specialized electronic platforms and in the field	24
(d) Preparation of seminars / laboratories, assignments, papers, portfolios and essays	8
(e) Tutoring	-
(f) Other activities	-
3.8 Total hours of individual study and assessment (sum of (3.7(a)…3.7(f))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credits	4

4. Preconditions (where applicable)

4.1 Curriculum	Fundamental concepts of electronics, electrical engineering, and automotive electronic systems.
4.2 Skills	Basic knowledge of motor vehicles, electronics, computer science, and the use of software applications.

5. Conditions (where applicable)

5.1. Lecture delivery	Lecture room equipped with a computer and multimedia projector.
5.2. Seminar / laboratory / project delivery	Attendance and successful completion of all laboratory activities are mandatory prerequisites for admission to the final assessment.

6. Specific skills acquired

Professional skills	Explain the operating principles of communication networks used in modern motor vehicles (LIN, CAN/CAN FD, FlexRay, MOST, and Automotive Ethernet). Analyze communication architectures and the interconnection of Electronic Control Units (ECUs) in motor vehicles. Use methods and software applications for the modeling, simulation, and validation of automotive communication networks. Identify and diagnose faults specific to automotive communication networks and interpret network messages and data packets. Apply current standards and modern technologies used in the development of automotive communication systems.
Transversal skills	Use software applications and digital tools efficiently for the development and testing of automotive communication networks. Organize and carry out professional activities responsibly, while meeting deadlines and complying with quality standards. Work effectively in multidisciplinary teams and communicate technical results clearly. Continuously develop professional competencies through the use of modern learning resources and technical documentation.

7. Expected learning outcomes

Knowledge	The student/graduate identifies and explains the operating principles of communication networks used in motor vehicles (LIN, CAN/CAN FD, FlexRay, MOST, and Automotive Ethernet). The student/graduate describes communication architectures, network protocols, and their role in the interconnection of automotive electronic systems.
Skills	The student/graduate uses software applications for the modeling, simulation, configuration, and analysis of automotive communication networks. The student/graduate interprets network messages and data packets, identifies faults, and applies diagnostic and validation methods for automotive communication networks.
Responsibility and autonomy	The student/graduate uses specialized technical resources and demonstrates autonomy in analyzing and solving problems related to automotive communications. The student/graduate demonstrates professional responsibility and collaborates effectively in the development, testing, and validation of automotive communication systems.

8. The objectives of the discipline (based on the grid of specific competencies acquired)

8.1 General objective of the discipline	Develop knowledge and competencies related to the architecture, operation, modeling, simulation, and validation of communication networks used in modern motor vehicles using software applications and methods specific to the automotive industry.
8.2 Specific objectives	Understand the operating principles and architectures of automotive communication networks (LIN, CAN/CAN FD, FlexRay, MOST, and Automotive Ethernet). Use software applications for the modeling, simulation, and analysis of communication networks employed in motor vehicles. Analyze communication messages and protocols and apply diagnostic and validation methods for automotive communication networks. Become familiar with modern standards and technologies used in the development of automotive electronic systems and communication networks, including AUTOSAR and Software-Defined Vehicles (SDVs).

9. Content

9.1 Lecture	Hrs.	Teaching methods	Observation
1. Introduction to Automotive Communication Networks: Fundamental Concepts and E/E Architectures.	2	Lectures, interactive discussions, practical examples, and case studies. Use of multimedia tools and specialized software applications.	
2. Local Interconnect Network (LIN): System Architecture and Communication Protocol.	2		
3. Controller Area Network (CAN) and CAN FD: Hardware Architecture and Node Structure.	2		
4. Controller Area Network (CAN) and CAN FD: Communication Protocol, Data Frames, and Message Management.	2		
5. FlexRay Network: Architecture, Protocol, and Deterministic Communications.	2		
6. Automotive Ethernet and High-Speed Communication Networks for Motor Vehicles.	2		
7. Integration of Communication Networks within AUTOSAR and Software-Defined Vehicle (SDV) Architectures.	2		
References (all teaching materials are available at the following address: (link): 1. Iclodean Introducere în sistemele automobilelor (link). 2. Iclodean Autonomous Vehicles for Public Transportation (link). 3. Iclodean Metode de Simulare a Sistemelor de Propulsie prin Aplicații Numerice (link). 4. Iclodean Simularea Avansată a Modelelor Virtuale de Autovehicule în CarMaker (link) 5. Iclodean Rețele de Comunicație pentru Autovehicule (link). 6. Iclodean Interconectarea sistemelor virtuale de ... control pentru autovehicule (link). 7. Varga Electric and Plug-In Hybrid Vehicles Advanced Simulation Methodologies (link). 8. Varga Electric and Hybrid Buses for Urban Transport Energy Efficiency Strategies (link). 9. AUTOSAR Standard Classic Platform (link). 10. AUTOSAR Standard Adaptive Platform (link).			

9.2 Seminar / laboratory / project / practice	Hrs.	Teaching methods	Observation
1. Definition of Project 1: Configuration of the Working Environment and Specification of Communication System Requirements.	2	Practical exercises, demonstrations, modeling, and computer-aided simulation.	
2. Development of the Virtual Model of the Automotive Communication Network.	2		
3. Configuration and Interconnection of Network Nodes, Communication Buses, and ECUs within the Virtual Model.	2		
4. Definition of Initial System Parameters and Configuration of Messages and Signals in the Virtual Model.	2		
5. Configuration of Simulation Scenarios and Parameters for the Communication Network.	2		
6. Execution of Simulations, Monitoring of Network Communications, and Collection of Results for Simulation Project 1.	2		
7. Visualization, Analysis, and Interpretation of the Results Obtained for Simulation Project 1.	2		
8. Definition of Project 2: Configuration of the Working Environment and Specification of Communication System Requirements.	2		
9. Development of the Virtual Model of the Automotive Communication Network.	2		
10. Configuration and Interconnection of Network Nodes, Communication Buses, and ECUs within the Virtual Model.	2		

9.2 Seminar / laboratory / project / practice	Hrs.	Teaching methods	Observation
11. Definition of Initial System Parameters and Configuration of Messages and Signals in the Virtual Model.	2		
12. Configuration of Simulation Scenarios and Parameters for the Communication Network.	2		
13. Execution of Simulations, Monitoring of Network Communications, and Collection of Results for Simulation Project 1.	2		
14. Visualization, Analysis, and Interpretation of the Results Obtained for Simulation Project 1.	2		
References (all teaching materials are available at the following address: (link): 1. Iclodean Introducere în sistemele automobilelor (link). 2. Iclodean Autonomous Vehicles for Public Transportation (link). 3. Iclodean Metode de Simulare a Sistemelor de Propulsie prin Aplicații Numerice (link). 4. Iclodean Simularea Avansată a Modelelor Virtuale de Autovehicule în CarMaker (link) 5. Iclodean Rețele de Comunicație pentru Autovehicule (link). 6. Iclodean Interconectarea sistemelor virtuale de ... control pentru autovehicule (link). 7. Varga Electric and Plug-In Hybrid Vehicles Advanced Simulation Methodologies (link). 8. Varga Electric and Hybrid Buses for Urban Transport Energy Efficiency Strategies (link). 9. AUTOSAR Standard Classic Platform (link). 10. AUTOSAR Standard Adaptive Platform (link).			

10. Correlating the content of the discipline with the expectations of representatives of the epistemic community, professional associations and representative employers in the field related to the program

The course content is aligned with the current requirements of the automotive industry and the academic community, reflecting employers' expectations regarding the development of competencies in automotive communication networks and electronic systems. The course develops knowledge and practical skills in the design, modeling, simulation, and validation of automotive communication networks using modern technologies and software applications, in accordance with the curricula and professional practices adopted by leading universities and automotive companies in Romania and internationally.

11. Evaluation

Activity	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight of final grade
11.4 Lecture	Level of knowledge acquisition and understanding of automotive communication networks and protocols, as well as the ability to analyze and apply these concepts.	Written examination (summative assessment)	60%
11.5 Seminar/Laboratory /Project / Practice	Ability to model, simulate, and analyze automotive communication networks, as well as the accuracy of practical assignments and laboratory work.	Continuous assessment based on laboratory activities	40%
11.6 Minimum Performance Standard Acquisition of the fundamental concepts related to automotive electronic control systems and the use of the IPG CarMaker software for modeling and simulation. Minimum passing grade for both the laboratory activities and the final examination: 5.00.			

Date of completion	Responsible	Grade, Title, Second name First NAME	Signature
09.07.2026	Lecture	*Associate Professor Ph.D. Iclodean Călin*	
	Applications	*Associate Professor Ph.D. Iclodean Călin*	

Date of approval in the ART Department Council 24.07.2026 _____	ART Department Director Prof.dr.ing. Barabás István
Date of approval in the ARMM Faculty Council 16.09.2026 _____	Dean, Prof.dr.ing. Filip Nicolae