SYLLABUS

1. Information about the program

1.1 Higher education institution	Universitatea Politehnica Timișoara
1.2 Faculty[1] / Department[2]	ELECTRONICS, TELECOMUNICATONS AND INFORMATION TECHNOLOGIES / APPLIED ELECTRONICS
1.3 Field of study (name/code[3])	ELECTRONIC ENGINEERING, TELECOMUNICATION AND INFORMATION TECHNOLOGIES/20/20/10
1.4 Study cycle	Master
1.5 Study program (name/code/qualification)	Automotive Electronic Systems /20/20/10 / 2152

2. Information about discipline

2.1a Name of discipline/The educational classe[4]	Car to Car Communication /DF						
2.1b Name of discipline in Romanian	Comunicarea de la automobil la automobil						
2.2 Coordinator (holder) of course activities	S.L. dr. ing. Maranescu Valentin						
2.3 Coordinator (holder) of applied activities[5]	S.L. dr. ing. Maranescu Valentin						
2.4 Year of study[6]	1	**2.5** Semester	1	**2.6** Type of evaluation	V	**2.7** Regime of discipline[7]	DOP

3. Total estimated time (direct activities (fully assisted), partially assisted activities and unassisted activities[8])

3.1 Number of hours fully assisted/week	4 ,of which:	course	2	seminar/laboratory/project			2
3.1* Total number of hours fully assisted/sem.	56 ,of which:	course	28	seminar/laboratory/project			0/28/0
3.2 Number of on-line hours fully assisted/sem	12 ,of which:	course	6	seminar/laboratory/project			6
3.3 Number of hours partially assisted/week	,of which:	project, research		training		hours designing M.A. dissertation	
3.3* Number of hours partially assisted/ semester	,of which:	project of research		training		hours designing M.A. dissertation	
3.4 Number of hours of unassisted activities/ week	4.93 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					1.5
		Study using a manual, course materials, bibliography and lecture notes					1.93
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					1.5
3.4* Total number of hours of unasssited asctivities/ semester	69 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					21
		Study using a manual, course materials, bibliography and lecture notes					27
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					21
3.5 Total hrs./week[9]	8.93						
3.5* Total hrs./semester	125						
3.6 No. of credits	5						

4. Prerequisites (where applicable)

4.1 Curriculum	• Electronic interfacing equipment, Information transmission theory
4.2 Learning outcomes	•

5. Conditions (where applicable)

5.1 of the course	• Notebook, beamer, witheboard
5.2 to conduct practical activities	• Lab with minimum 9 working places (with specific electronic equipment and computers)

6. Learning outcomes acquired through this discipline

Knowledge	• **C1** – Demonstrates advanced knowledge of electronics, electricity, engineering principles, physics, and mathematics required for designing and analyzing complex electronic systems. • **C16** – Demonstrates advanced knowledge of the operating principles, typologies, and applications of sensors. • **C3 (c)** – Explains advanced principles and methodologies for integrating hardware and software technologies into complex engineering systems.
Skills	• **A3** – Designs electronic systems, including circuits, equipment, and applications in fields such as automotive and instrumentation. • **A3 (c)** – Uses hardware and software communication tools and collaborates to solve complex and multidisciplinary tasks.
Responsibility and autonomy	• **RA2** – Demonstrates autonomy in leading scientific research and making complex engineering decisions, coordinating multidisciplinary technical teams. • **RA4** – Promotes innovation and lifelong learning, integrating scientific and technological progress into research and development activities. • **RA3 (c)** – Works effectively in multidisciplinary teams, promoting collaboration and shared responsibility in achieving objectives

7. Objectives of the discipline (based on the grid of learning outcomes acquired)

- Gain essential knowledge and skills for designing and implementing vehicle-to-vehicle communication systems, focusing on safety, automation and real-time data exchange in automotive environments.
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8. Content

8.1 Course	Number of hours	Of which online	Teaching methods
Introduction to V2V Communication: Concepts, Standards, and Applications	2		Lectures with multimedia support, Case study, Problem based learning, Guest lectures form industry
Wireless Communication Technologies for Automotive (DSRC, C-V2X)	4		
Network Architectures and Protocols for V2V Systems	2		
Sensor Integration in V2V Communication	2		
Vehicle Localization and Positioning Systems	2		
Data Exchange and Real-Time Communication Models	2		
Security and Privacy in Car-to-Car Communication	2		
Embedded Systems and Control Units for V2V	4		
Simulation Tools and Modeling of V2V Scenarios	2	2	
Testing and Validation of V2V Systems	2		
Case Studies: V2V in Autonomous Driving and Traffic Management	2	2	
Future Trends: 5G, Edge Computing, and AI in V2V	2	2	

	Bibliography[10] 1. Eichler, S., Schroth, C., & Eberspächer, J. *Car-to-Car Communication: Research Challenges and Applications,* Technische Universität München & University of St. Gallen 2. Zhang, X., Li, J., Zhou, J., et al., *Vehicle-to-Everything Communication in Intelligent Connected Vehicles: A Survey and Taxonomy* *Automotive Innovation*, Volume 8, 2025 3. Ali Muslam, M. M., *Enhancing Security in Vehicle-to-Vehicle Communication: A Comprehensive Review of Protocols and Techniques Vehicles*, Volume 6, Issue 1, 2024 4. Chen, J. *Comparison and Optimization of DSRC and C-V2X Technologies: Current Status, Challenges, and Future Prospects, Academic Journal of Science and Technology*, Vol. 13, Issue 2, 2024 5. Kimley-Horn (Douglas Gettman, Ph.D.), *DSRC and C-V2X: Similarities, Differences, and the Future of Connected Vehicles*

8.2 Applied activities[11]	Number of hours	Of which online	Teaching methods
CAN & V2V Protocol Simulation, Use simulation tools (e.g., CANoe, OMNeT++, NS-3) to model basic vehicle-to-vehicle communication using CAN and DSRC protocols.	6	2	Hand on labs using microcontrollers, sensors, Simulations, mini projects learning
Sensor Data Integration & Transmission: Connect sensors (GPS, accelerometer) to microcontrollers and transmit data wirelessly to another node.	6	2	
V2V Message Design & Encoding: Design and encode safety-critical messages (collision warning, lane change alert) using standardized formats (SAE J2735)	6		
Security Testing in V2V Communication: Simulate attack scenarios and implement basic encryption/authentication mechanisms	4		
V2V Communication Demo: Small-scale prototype where two mini vehicles exchange location and speed data to avoid collision	6	2	

	Bibliography[12] 1. VehicleTalk: Lightweight V2V Network Enabled by Optical Wireless Communication and Sensing, Song, Y., Mo, R., Zhang, P., et al., *IEEE VTC 2024 Spring Conference,* Proposes a hybrid V2V system using LED-based optical communication and sensing for platooning. 2. Advanced Vehicle-to-Vehicle Communication System Using AI and Cognitive Radio Technology Prasathkumar, V., et al., *JETIR, Vol. 12, Issue 3, 2025,* Describes a student-led project using sensors and simulations to demonstrate V2V communication. 3. Vehicle-to-Vehicle Communication Protocol: Components, Benefits, Challenges, Safety and Machine Learning Applications, Daddanala, R., Mannava, V., et al. *arXiv preprint,* Offers a comprehensive overview of V2V protocols and their experimental applications. 4. GitHub Project: V2V Communication for Cooperative Collision Warning, Neeraj Badhani, A practical implementation using ESP8266, STM32 microcontroller, and ultrasonic sensors. 5. Deep-Learning-Based Radio Channel Prediction for Vehicle-to-Vehicle Communications Molisch, A. F., Chu, L., *Pacific Southwest Region University Transportation Center, 2024,* Explores predictive modeling for V2V channels using real-world data and machine learning.

9. Evaluation

Type of activity	**9.1** Evaluation criteria[13]	**9.2** Evaluation methods	**9.3** Share of the final grade

9.4 Course	Written exam: assesses understanding of V2V concepts, protocols, standards, and architectures	Esay	66%
9.5 Applied activities	**S:**		
	L: Evaluation of hands-on experiments, sensor integration, and communication setups	Observation of individual results + quizz	34%
	P:		
	Pr:		
	Tc-R[14]:		

9.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified[15]

- Understanding of basic V2V communication principles and technologies (DSRC, C-V2X), Ability to describe the architecture and protocols used in vehicle-to-vehicle systems – exam essay scored at least 50%.
- Lab: demonstrate a basic V2V functionality and perform one simulation scoring 50%
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Date of completion 24.09.2025	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
Head of Department (signature)	**Date of approval in the Faculty Council** [16] 7.10.2025	**Dean (signature)**