SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automotive Engineering, Mechatronics and Mechanics
1.3	Department	Automotive Engineering and Transportation
1.4	Field of study	Automotive Engineering
1.5	Cycle of study	Master's in Science
1.6	Program of study/Qualification	Tehnici Avansate în Ingineria Autovehiculelor (Advanced Techniques in Automotive Engineering) - în limba engleză
1.7	Form of education	Full time
1.8	Subject code	04.00

2. Data about the subject

2.1	Subject name	Communication BUS Architecture
2.2	Subject area	Vehicle Network Architecture
2.3	Course responsible/lecturer	Associate Professor PhD Iclodean Călin calin.iclodean@auto.utcluj.ro
2.4	Teachers in charge of seminars	Associate Professor PhD Iclodean Călin calin.iclodean@auto.utcluj.ro

2.5 Year of study	I	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DS/DI

3. Estimated total time

3.1 Number of hours per week	3	3.2 of which, course:	1	3.3 applications:	2
3.4 Total hours in the curriculum	100	3.5 of which, course:	14	3.6 applications:	28

Individual study	hours
Manual, lecture material and notes, bibliography	24
Supplementary study in the library, online and in the field	24
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	8
Tutoring	-
Exams and tests	2
Other activities	-

3.7	Total hours of individual study	58
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	-
4.2	Competence	General knowledge in the fields of automotive, electronics and computer science.

5. Requirements (where appropriate)

5.1	For the course	-
5.2	For the applications	Attending (100% attendance) and performing (promoting) the activities from the laboratory applications condition the admission to the final form of evaluation of the discipline.

6. Specific competences

Professional competences	Knowledge of the principles and theory regarding the communication networks used in the automotive industry, as the demonstration of theoretical and practical knowledge regarding the operation of the main types of communication networks: LIN, CAN, FlexRay and MOST. Knowledge of some typologies of architectures for the communication networks used in the construction of vehicles and the deepening of the main physical and virtual models used in the development and validation of these communication networks. Knowledge of possible faults and the way, respectively of the repair procedures. Identification of the types of signals and data packets generated and transmitted using communication networks: LIN, CAN, FlexRay and MOST.
Cross competences	Use of advanced software applications in modeling and simulating the operation of the main types of communication networks: LIN, CAN, FlexRay and MOST developed in physical and virtual environments. Execution of professional tasks according to the specified requirements following a pre-established work plan under qualified guidance. Completion of homework and projects imposed on time and at a high-quality standard. Integration within a working group, assuming specific roles and achieving good communication within the team. Achieving personal and professional development, efficiently using own resources and modern study tools.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	The general objective is to accumulate knowledge in the field of development, modeling, and simulation of the operation of the main types of communication networks: LIN, CAN, FlexRay and MOST.
7.2	Specific objectives	Assessment and analysis of requirements for new technologies integrated in vehicles in order to implement the main types of communication networks: LIN, CAN, FlexRay and MOST.

8. Contents

8.1. Lecture (Syllabus)	Methods	Notes
1. Vehicular Communications Networks. Basic Concepts.	Exposure, conversation, exemplification, orientation, etc. Use of technical and visual means.	2 hours
2. LIN (Local Interconnect Network) Architecture and Protocol.		2 hours
3. CAN (Controller Area Network) Hardware Architecture.		2 hours
4. CAN (Controller Area Network) Communication Protocol.		2 hours
5. FlexRay Hardware Architecture and Communication Protocol.		2 hours
6. FlexRay Data Frame Structure. Static and Dynamic Segments.		2 hours
7. MOST Hardware Architecture and Communication Protocol.		2 hours
8.2. Applications/Seminars	Methods	Notes
1. Define the first project in the computer simulation application.	Exercices, conversations, description, modeling, etc. Use of technical and visual means.	2 hours
2. System modeling in the computer simulation application.		2 hours
3. Connecting the elements and the nodes in the network.		2 hours
4. Defining the initial data of the simulated system.		2 hours
5. Characteristics of the simulation process.		2 hours
6. Running the computer simulations.		2 hours
7. Viewing and evaluating the results.		2 hours
8. Define the second project in the PC simulation application.		2 hours

9. System modeling in the computer simulation application.		2 hours
10. Connecting the elements and the nodes in the network.		2 hours
11. Defining the initial data of the simulated system.		2 hours
12. Characteristics of the simulation process.		2 hours
13. Running the computer simulations.		2 hours
14. Viewing and evaluating the results.		2 hours

Bibliography

1. Bosch Automotive Electrics and Automotive Electronics Systems and Components (link).
2. Bosch Automotive Mechatronics, Automotive Networking, Electronics (link).
3. Bosch Diesel Engine Management, Systems and Components (link).
4. Bosch Gasoline Engine Management Systems and Components (link).
5. Bosch Fundamentals of Automotive and Engine Technology, Standard Drives (link).
6. Bosch CAN Specification version 2.0 (download link).
7. Bosch CAN FD Specification version 1.0 (download link).
8. Grzemba MOST The Automotive Multimedia Network (download link).
9. Iclodean Metode de Simulare a Sistemelor de Propulsie prin Aplicații Numerice (download link).
10. Iclodean Rețele de Comunicație pentru Autovehicule (download link).
11. Iclodean Interconectarea sistemelor virtuale de ... control pentru autovehicule (download link).
12. Kozierok Automotive Ethernet: The Definitive Guide (download sample).
13. Mariașiu Aplicații Numerice în Simularea Proceselor Motoarelor cu Ardere Internă (download link).
14. Mariașiu Managementul Motoarelor cu Ardere Internă (download link).
15. Burnete Motoare cu Ardere Internă Procese și Management Motor (download link).
16. Paret FlexRay and its Applications: Real Time Multiplexed Network (link).
17. Varga Electric and Plug-In Hybrid Vehicles Advanced Simulation Methodologies (link).
18. Varga Electric and Hybrid Buses for Urban Transport Energy Efficiency Strategies (link).
19. Iclodean Autonomous Vehicles for Public Transportation (link).
20. Varga Simulation in the Loop of Electric Vehicles (download link).
21. FlexRay Communications System Protocol Specification version 3.0.1 (download link).
22. Freescale Automotive Solutions Setting the Pace for Innovation (download link).
23. Paret Multiplexed Networks for Embedded Systems: CAN, LIN, FlexRay, Safe-by-Wire... (link).
24. LIN Specification Package revision 2.2A (download link).
25. MatLab & Simulink Vehicle Network Toolbox version R2021a (download link).
26. AUTOSAR Standard Classic Platform (download link).
27. AUTOSAR Standard Adaptive Platform (download link).
28. AUTOSAR Application Interface (download link).

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

In the training of skills, the options of employers recommended to higher education institutions for the training of graduates are taken into account (ability to use time efficiently, ability to work in a team, ability to learn quickly, ability to coordinate teams, new opportunities in the interest company, the ability to use the computer and the Internet, the ability to adapt to new situations, etc.) and the priorities recommended by employers in training graduates (creativity and ability to innovate, the ability to negotiate, the ability to critically analyze, the ability to learn quickly , knowledge from other fields). The content of the discipline is in accordance with the study materials and methods that are used by Bosch Romania Company. The content of the discipline is in accordance with the study materials and methods that are used at other universities in the country and abroad.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The degree of assimilation of the notions presented during the course. Correctness of acquired knowledge.	Written evaluation.	60%
10.5 Applications	Ability to operate with assimilated knowledge.	Checking applications.	40%
10.6 Minimum standard of performance: final grade 5.			

Date of filling in: 07.03.2023		Title Surname Name	Signature
	Lecturer	Associate Professor PhD Iclodean Călin	
	Teachers in charge of application	Associate Professor PhD Iclodean Călin	

Date of approval in the department   Head of department
Prof.dr.ing. Barabás István

_____20.04.2023_____

Date of approval in the faculty   Dean
                11.10.2023   Prof.dr.ing. Filip Nicolae

_____