SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of 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		
2.2	Course responsible/lecturer				Lecturer PhD Eng. Calin ICLODEAN calin.iclodean@auto.utcluj.ro		
2.3	Teachers in charge of seminars				Lecturer PhD Eng. Calin ICLODEAN calin.iclodean@auto.utcluj.ro		
2.4 Year of study	I	2.5 Semester	1	2.6 Assessment			E
2.7 Subject category	Formative category						DS
	Optionality						DI

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	1	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0
3.4 Total hours in the curriculum	42	of which	3.5 Course	14	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	20
(b) Supplementary study in the library, online and in the field	20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(d) Tutoring	6
(e) Exams and tests	2
(f) Other activities	

3.8 Total hours of individual study (sum (3.7(a)...3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 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 Seminar / laboratory / project	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	The student should be able to: demonstrate a comprehensive knowledge of the principles and theory of operation of any generalized data network and demonstrate a comprehensive theoretical and practical knowledge of the key elements and principles of operation of commonly used automotive networks including: LIN, CAN, FlexRay, and MOST. Evaluate the impact of complex highly distributed network architectures on vehicle reliability and identify suitable systems of systems engineering approaches for the development and validation of such automotive networks.
Cross competences	The student will be able to attend evaluate the suitability of different automotive networks and apply appropriate selection criteria when choosing a network technology for a particular application. The student will be able to utilize advanced automotive network test equipment and data analysis techniques to monitor, analyses and interpret network performance and behavior.

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 automotive networks.
7.2	Specific objectives	Evaluate the requirements and critically analyses the suitability of new automotive network technologies to support advanced safety-critical systems deployment.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Vehicular Communications Networks. Basic Concepts.	2 hours	Exposure, conversation, exemplification, orientation, etc. Use of technical and visual means. Online application	
2. LIN Hardware Architecture.	2 hours		
3. CAN Protocol Description, Hardware Architecture.	2 hours		
4. CAN Message Transfer on the Bus, Error Detection.	2 hours		
5. FlexRay Hardware Architecture, Communication Protocol.	2 hours		
6. FlexRay Data Frames Structure, Static and Dynamic Segments.	2 hours		
7. MOST Architecture, Network Topologies.	2 hours		
Bibliography 1. Bosch, R., Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, Springer 2014 (link);			

2. Bosch, R., Automotive Mechatronics, Automotive Networking, Driving Stability Systems, Electronics, Springer 2015, (link);
3. Bosch, R., CAN Specification version 2.0, Robert Bosch GmbH 1991 (download link);
4. Bosch, R., CAN FD Specification version 1.0, Robert Bosch GmbH 2012 (download link);
5. Grzemba, A., MOST The Automotive Multimedia Network, Ed. Franzis Verlag, 2008 (download link);
6. Călin Iclodean, Rețele de Comunicație pentru Autovehicule, Editura Risoprint 2017 (download link);
7. Călin Iclodean, Interconectarea sistemelor virtuale de comandă și control pentru autovehicule, Volumul I, Software-in-the-Loop, Editura Risoprint 2018 (download link);
8. Kozierok, C.M., et al Automotive Ethernet: The Definitive Guide, Intrepid Control Systems 2014 (download sample);
9. Florin Mariașiu, Călin Iclodean, Aplicații Numerice în Simularea Proceselor Motoarelor cu Ardere Internă, Editura UTPRESS 2016 (download link);
10. Florin Mariașiu, Călin Iclodean, Managementul Motoarelor cu Ardere Internă, Editura Risoprint 2013 (download link);
11. Paret, Dominique, FlexRay and its Applications: Real Time Multiplexed Network, Wiley 2012 (link);

8.2. Seminars / Laboratory / Project	Number of hours	Teaching methods	Notes
1. Define the first project in the computer simulation application.	2 hours	Exercises, conversations, description, modeling, etc. Use of technical and visual means. Online application	
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, R., Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, Springer 2014 (link);
2. Bosch, R., Automotive Mechatronics, Automotive Networking, Driving Stability Systems, Electronics, Springer 2015, (link);
3. Bosch, R., CAN Specification version 2.0, Robert Bosch GmbH 1991 (download link);
4. Bosch, R., CAN FD Specification version 1.0, Robert Bosch GmbH 2012 (download link);
5. Grzemba, A., MOST The Automotive Multimedia Network, Ed. Franzis Verlag, 2008 (download link);
6. Călin Iclodean, Rețele de Comunicație pentru Autovehicule, Editura Risoprint 2017 (download link);

7. Călin Iclodean, Interconectarea sistemelor virtuale de comandă și control pentru autovehicule, Volumul I, Software-in-the-Loop, Editura Risoprint 2018 (download link);
8. Kozierok, C.M., et al Automotive Ethernet: The Definitive Guide, Intrepid Control Systems 2014 (download sample);
9. Florin Mariașiu, Călin Iclodean, Aplicații Numerice în Simularea Proceselor Motoarelor cu Ardere Internă, Editura UTPRESS 2016 (download link);
10. Florin Mariașiu, Călin Iclodean, Managementul Motoarelor cu Ardere Internă, Editura Risoprint 2013 (download link);
11. Paret, Dominique, FlexRay and its Applications: Real Time Multiplexed Network, Wiley 2012 (link);

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

The courses and the curricula are developed in close connection with Porsche Engineering.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	General subjects' evaluation.	Written evaluation.	60%
10.5 Seminars / Laboratory / Project	Create a simulation model.	Checking applications.	40%
10.6 Minimum standard of performance			

Date of filling in:		Title Surname Name	Signature
12.10.2020	Lecturer	Lecturer PhD Eng. Calin ICLODEAN	
	Teachers in charge of application	Lecturer PhD Eng. Calin ICLODEAN	

Date of approval in the department _____	Head of department Prof.dr.ing. Barabás István
Date of approval in the faculty _____	Dean Prof.dr.ing. Filip Nicolae