SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics
1.4 Field of study	Electronics Engineering, Telecommunications and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Telecommunications Technologies and Systems/ Engineer Applied Electronics/Engineer
1.7 Form of education	IF-Full time
1.8 Subject code	TST-E112.00/EA-E112.00

2. Data about the subject

2.1 Subject name	Software Development Methods for the Automotive Industry						
2.2 Subject area	Theoretical area Methodological area Analysis area						
2.3 Course responsible/lecturer	Prof. Dorin Petreus, Ph.D – dorin.petreus@ael.utcluj.ro						
2.4 Teachers in charge of applications	Prof. Dorin Petreus, Ph.D – dorin.petreus@ael.utcluj.ro						
2.5 Year of study	IV	2.6 Semester	8	2.7 Assessment	E	2.8 Subject category	DS/DFac

3. Estimated total time

3.1 Number of hours per week	4	of which, 3.2 course	2	3.3 applications	2
3.4 Total hours in the curriculum	56	of which, 3.5 course	28	3.6 applications	28
Individual study					Hours
Manual, lecture material and notes, bibliography					10
Supplementary study in the library, online and in the field					3
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					4
Tutoring					-
Exams and tests					2
Other activities……					-

3.7 Total hours of individual study	19
3.8 Total hours per semester	75
3.9 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	Microcontrollers, sensors

5. Requirements (where appropriate)

5.1. For the course	Amphitheatre, Cluj-Napoca
5.2. For the applications	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	N/A
Transversal competences	N/A

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

7.1 General objectives	Honing automotive software development skills.
7.2 Specific objectives	1. The assimilation of theoretical knowledge regarding automotive software development; 2. Using automotive tools and standards: AUTOSAR, MATLAB/Simulink, Enterprise Architect, C/C++, CAPL/CANoe/ Busmaster.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Introduction to automotive software development.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2. Automotive software development process.		
3. Automotive systems architecture.		
4. The AUTOSAR software architecture.		
5. Safety and security in the automotive industry (ISO26262).		
6. Case study and practical examples from the automotive industry.		
7. Using State Flow for creating state machines.		
8. Model based Development: basic functionalities.		
9. Model based Development: advanced functionalities.		
10. Model based Development: best practices.		
11. SW component description using UML diagrams.		
12. SW testing methods.		
13. ECU debugging concepts.		
14. Trends in the automotive industry.		
8.2 Applications	Teaching methods	Notes
1. Laboratory protection measures.	Didactic and experimental proof,	Use of laboratory instrumentation,
2. Equipment and SW tools description.		

3. CAN communication and diagnosis. 4. AUTOSAR software example. 5. Implementing redundancy and plausibility checks. 6. Methods to prevent information corruption. 7. Implementing the return and center functionality of the steering wheel. 8. Implementing the haptic feedback functionality. 9. Implementing assistance curves in an EPS system. 10. Implementing rack ends protection in an EPS system. 11. Generating code from UML diagrams. 12. Testing a SW component. 13. Debugging a SW component. 14. ECU use in vehicles.	didactic exercise, team work	experimental boards, computers, white/magnetic board

References
1. H. Manfred, P. Pfeffer, "Steering Handbook", Springer, ISBN 978-3-319-05448-3, pp 565, 2014.
2. J. Schäuffele, T. Zurawka, "Automotive Software Engineering", Springer, ISBN 978-3-658-11814-3, pp. 348, 2016.
3. Robert Bosch GmbH, "Bosch Automotive Electrics and Automotive Electronics", Springer, ISBN 978-3-658-01783-5, pp. 523, 2007.
4. N. Zaman, "Automotive Electronics Design Fundamentals", Springer, ISBN 978-3-319017583-6, 2007.
5. C. Hobbs, "Embedded Software Development for Safety-Critical Systems", Taylor & Francis Group, ISBN 978-1-4987-2670-2, 2017.
6. A.S. Vincentelli, H. Zeng, M. Di Natale, P. Marwedel, "Embedded Systems Development", Springer, ISBN 978-1-4614-3879-3, 2014.
7. M. Samek, "Practical UML Statecharts in C/C++: Event Driven Programming for Embedded Systems", ISBN 9780750687065, pp. 728, 2008.

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

The skills acquired will be required for employees in the working in the automotive or industrial software development field.

10. Evaluations

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Solving a problem and answering a set of theoretical questions	Written exam	60%
10.5 Applications	Verification of skills and abilities acquired as a result of laboratory activities	Continuous formative evaluation	40%

10.6 Minimum standard of performance

Qualitative level:

Minimal knowledge:

- ✓ Knowledge of the basic operation of studied ECUs
- ✓ Knowledge of the basic operation of studied automotive functionalities

Minimal competences:

- ✓ To be able to describe the functionality of the main automotive functionalities
- ✓ To be able to choose the proper tools and equipment in specific applications

Quantitative level:

- ✓ Participation to all applications and laboratories
- ✓ The final exam and laboratory grades to be higher than 5
- ✓ The final grade is calculated as follows: 0.6*Exam grade+0.4*laboratory grade

Date of filling in	**Responsible**	**Title, Name Surname**	**Signature**
27.09.2021	Course	Prof. Dorin Petreus, Ph.D	
	Applications	Prof. Dorin Petreus, Ph.D	

Date of approval in the Department of Communications 27.09.2021	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 27.09.2021	Dean Prof. Gabriel OLTEAN, Ph.D.