

SYLLABUS₁

1. Information about the program

1.1 Higher education institution	Politehnica University of Timisoara
1.2 Faculty ₂ / Departments ₃	Electronics and Telecommunications / Applied Electronics
1.3 Chair	—
1.4 Field of study (name/code ₄)	Electronics and telecommunications engineering / L20202010010
1.5 Study cycle	Bachelor
1.6 Study program (name/code)/Qualification	TECHNOLOGY AND TELECOMMUNICATIONS SYSTEMS / 20202010020

2. Information about the discipline

2.1 Name of discipline	Embedded Systems						
2.2 Coordinator (holder) of course activities	Dr. eng. Cătălin-Daniel CĂLEANU, Prof.						
2.3 Coordinator (holder) of applied activities ₅	Dr.eng. Radu MÎRĂU, Assistant						
2.4 Year of study ₆	III	2.5 Semester	2	2.6 Type of evaluation	E	2.7 Type of discipline	Compulsory

3. Total estimated time (hours / semester of didactic activities)

3.1 No. of hrs. / week	4 , of which:	3.2 course	2	3.3 seminar/laboratory/ project/training	2
3.4 Total no. of hrs. in the education curricula	56 , of which:	3.5 course	28	3.6 applied activities	28
3.7 Distribution of time for individual activities related to the discipline					hrs.
Study using a manual, course materials, bibliography and lecture notes					15
Additional documentation in the library, on specialized electronic platforms and on the field					4
Preparation for seminars / laboratories, homeworks, assignments, portfolios, and essays					8
Tutoring					6
Examinations					2
Other activities					
Total hrs. of individual activities					35
3.8 Total hrs. / semester ₇	91				
3.9 No. of credits	4				

4. Prerequisites (where applicable)

¹ The form corresponds to the Syllabus promoted by OMECTS 5703/18.12.2011 (Annex3).

² The name of the faculty which manages the educational curriculum to which the discipline belongs.

³ The name of the department entrusted with the discipline, and to which the course coordinator / holder belongs.

⁴ Fill in the code provided in GD no. 493/17.07.2013.

⁵ The applied activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

⁶ The year of study to which the discipline is provided in the curriculum.

⁷ It is obtained by summing up the number of hrs. from 3.4 and 3.7.

4.1 Curriculum	<ul style="list-style-type: none"> No official graduate course as prerequisite. Preferable knowledge of Electronic Circuits, Digital Integrated Circuits, uP and uC,
4.2 Competencies	<ul style="list-style-type: none"> Programming Language

5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> laptop, video projector, whiteboard
5.2 to conduct practical activities	<ul style="list-style-type: none"> laboratory, minimum 6 workplaces with PC and specific equipment

6. Specific competencies acquired

Professional competencies:	<ul style="list-style-type: none"> C1 - Operating with fundamentals of computer science, information technology and communications C3 – Computer Architecture, uP, uC, Programming Languages
Transversal competencies	<ul style="list-style-type: none"> CT2 – Tasks scheduling and management, interhuman communication CT3 – Usage of new technologies, software and datasheets, personal and professional development

7. Objectives of the discipline (based on the grid of specific competencies acquired)

7.1 General objective of the discipline	<ul style="list-style-type: none"> Understand and design embedded systems comprised of both hardware and software
7.2 Specific objectives	<ul style="list-style-type: none"> HW and SW design and implementation, modelling and simulation, testing

8. Content

8.1 Course	No. of hours	Teaching methods
1. An Introduction to Embedded Systems 1.1 Definition. Examples. 1.2 Requirements, common characteristics 1.3 The General Architecture of an Embedded System)	2	PPT presentation, examples, explanations, discussion, quizzes
2. Embedded Hardware 2.1 Embedded Processors - ARM Architecture. Enhancements to basic RISC features. The principal	12	

§ The professional competencies and the transversal competencies will be treated according to the Methodology of OMECTS 5703/18.12.2011. The competencies listed in the National Register of Qualifications in Higher Education [Registrul Național al Calificărilor din Învățământul Superior RNCIS] (http://www.rncis.ro/portal/page?_pageid=117_70218&_dad=portal&_schema=PORTAL) will be used for the field of study from 1.4 and the program of study from 1.6 of this form, involving the discipline.

<p>components of the core data path. Registers. Banked Registers. Status registers. Processor modes. Data processing instructions. The barrel shifter. Load-Store instructions. Control flow instructions. SWI. Thumb instructions. Exception treatment mechanism. Vector table. ARM7 CPU core. ARM7TDMI organization. 3 stage pipeline. ARM9TDMI. AMBA. Simple ARM based system;</p> <p>2.2 Board Memory</p> <ul style="list-style-type: none"> - SRAM. Embedded SRAM. DRAM. Embedded DRAM. Non-volatile memory. Embedded non-volatile storage. Basic ARM memory Interface. Cache memory. Definition, properties, location. Cache policies. Virtual memory. Integrating VM and cache. MMU. MMU in ARM; <p>2.3 Board I/O and Buses</p> <ul style="list-style-type: none"> - Bus. Definition. Advantages. Disadvantages. Bus types (serial, parallel, synchronous, asynchronous). PCI. I2C. SPI. USB. Ethernet, Automotive Network s& Communications Links (K-LINE, LIN, CAN, MOST, FlexRay) 		
<p>3. Embedded Software</p> <p>3.1 Software for Embedded Systems</p> <ul style="list-style-type: none"> - Requirements of Software for Embedded System. Steps in developing the software. Choice of programming languages. Compiling & linking for embedded systems. The role of the start-up code. Programming languages (C, C++, C#, Java; <p>3.2 Embedded Operating Systems</p> <ul style="list-style-type: none"> - Arguments for using an embedded OS. BSP Kernel. Processes. PCB. Programs, tasks and threads. Saving the context. ARM case. Loading the context. ARM case. Pre-emption. Embedded OS – examples. 	6	
<p>4. Design and Development. Implementation and Testing</p> <p>4.1 Embedded Systems Design</p> <ul style="list-style-type: none"> - Design Process. Hardware-Software Co-design. <p>4.2 Practical Examples</p> <p>4.3 Embedded Automotive Applications (body, chassis and safety, driver assistance, power train and transmission, infotainment and telematics, embedded automotive software, MISRA, AUTOSAR)</p>	8	

Bibliography ⁹ [1] T. Noergaard, Embedded Systems Architecture. A Comprehensive Guide for Engineers and Programmers, Elsevier Embedded Technology Series, 2005.		
[2] C. Căleanu, Embedded Systems, Course Notes, 2015, http://intranet.etc.upt.ro		
8.2 Applied activities¹⁰	No. of hours	Teaching methods
Embedded Toolchain	1	Oral presentation, discussion, hw & sw implementation, simulation, measurements, testing, quizzes
Keil uVision IDE Overview	1	
ARM Assembly Code	1	
The Embedded Board	1	
Timers and Interrupts	1	
I2C Communication	1	
The PWM Control	1	
. Embedded project	7	
Bibliography ¹¹ [1] D. Ianchiș, C. Căleanu, Practical Aspects of Embedded Systems, Editura Politehnica, 2014.		
[2] A.N. Sloss et al, ARM System Developers Guide-Designing and Optimizing System Software, Elsevier, 2004		

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

<ul style="list-style-type: none"> • Most companies from the field afferent to the program (Continental, Hella, Elster, Yazaki, Alcatel, Flextronics, etc.) require employees with strong knowledge of embedded systems.

10. Evaluation

⁹ At least one title must belong to the department staff teaching the discipline, and at least 3 titles must refer to national and international works relevant for the discipline, and which can be found in the Politehnica University Library.

¹⁰ The types of applied activities are those specified in footnote 5. If the discipline contains several types of applied activities, then these will be written consecutively in the lines of the table below. The type of activity will be written in a distinct line, as „Seminar:”, „Laboratory:”, „Project:” and/or „Practice/Training:”.

¹¹ At least one title must belong to the staff teaching the discipline.

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Theory	Written examination	1/3
	Applications	Written examination	1/3
10.5 Applied activities	S:		
	L: HW&SW implementation accuracy, measurements, calculations, homework, attendance	Oral examination, Written tests, attendance evidence	1/3
	P:		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified)			
<ul style="list-style-type: none"> • At least 5 scored (half of the subjects) at the theoretical part. • At least 5 scored (half of the subjects) at the applicative part. • At least 5 scored for the practical activity 			

Date of completion

20.09.2016

Course coordinator
(signature)

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Coordinator of applied activities
(signature)

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Head of Department
(signature)

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Date of approval in the Faculty Council¹²

Dean
(signature)

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¹² Avizarea este precedată de discutarea punctului de vedere al board-ului de care aparține programul de studiu cu privire la fișa disciplinei.