COURSE SYLLABUS

Academic year 2024-2025

1. Programme Information

1.1. Higher education institution	**Lucian Blaga University of Sibiu**
1.2. Faculty	Faculty of Engineering
1.3. Department	Department of Computer Science and Electrical and Electronics Engineering
1.4. Field of study	Computer Science and Information Technology
1.5. Level of study[1]	Master
1.6. Programme of study/qualification	EMBEDDED SYSTEMS

2. Course Information

2.1. Name of course	Embedded Systems Architecture	Code	ES.204.ZA
2.2. Course coordinator	Lecturer Beriliu ILIE, PhD		
2.3. Seminar/laboratory coordinator	Lecturer Beriliu ILIE, PhD		

2.4. Year of study[2]	1	2.5. Semester[3]	2	2.6. Evaluation form[4]	E
2.7. Course type[5]	A	2.8. The formative category of the course[6]			Z

3. Estimated Total Time

3.1. Course Extension within the Curriculum – Number of Hours per Week					
3.1.a. Lecture	3.1.b. Seminar	3.1.c. Laboratory	3.1.d. Project	3.1.e. Other	Total
2	-	2	-		**4**
3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum					
3.2.a. Lecture	3.2.b. Seminar	3.2.c. Laboratory	3.2.d. Project	3.2.e. Other	Total[7]
28	-	28	-		**56**

Time Distribution for Individual Study[8]	**Hours**
Learning by using course materials, references and personal notes	16
Additional learning by using library facilities, electronic databases and on-site information	16
Preparing seminars / laboratories, homework, portfolios and essays	56
Tutorial activities[9]	3
Exams[10]	3
3.3. Total Individual Study Hours[11] *($NOSI_{sem}$)*	**94**
3.4. Total Hours in the Curriculum *($NOAD_{sem}$)*	**56**
3.5. Total Hours per Semester[12] *($NOAD_{sem} + NOSI_{sem}$)*	**150**
3.6. No. of Hours / ECTS	**25**
3.7. Number of credits[13]	**6**

4. Prerequisites (if needed)

4.1. Courses that must be successfully completed first (from the curriculum)[14]	Embedded Computing, Microcontrollers
4.2. Competencies	Programming in Embedded C, Interfaces and Communications Systems,

5. Conditions (where applicable)

5.1. For course/lectures[15]	For students: Study the recommended references and scientific papers. For course room: Video projector, Whiteboard
5.2. For practical activities (lab/sem/pr/app) [16]	Lab Room with computers having installed the necessary software tools and suitable kits (see the applications)

6. Specific competencies acquired[17]

Number of credits assigned to the discipline[18]		6	Credits distribution by competencies[19]
6.1. Professional competencies	PC2	perform project management	1
	PC3	operate open source software	1.5
	PC8	model hardware	1.5
	PC10	design hardware	0.5
	PC14	test hardware	0.5
6.2. Transversal competencies	TC1	apply knowledge of science, technology and engineering	1

7. Course objectives (resulted from developed competencies)

7.1. Main course objective	Embedded Systems Design and Embedded Programming
7.2. Specific course objectives	Understanding the methodologies for designing the Embedded Systems Understanding the Embedded Systems Architecture and the strategies for Embedded Applications Design

8. Content

8.1 Lectures[20]		**Teaching methods[21]**	**Hours**
Lecture 1	A Systems Engineering approach to Embedded Systems design.	presentation using the video projector, discussions with students	2
Lecture 2	Embedded Processors. The architecture of a microcontroller.	presentation using the video projector, discussions with students	2
Lecture 3	Memory in Embedded Systems. Memory organization in Von Neumann, Harvard, and ARM architecture of a microcontroller.	presentation using the video projector, discussions with students	2
Lecture 4	Interrupts and traps in Embedded systems. Interrupts handling in embedded applications	presentation using the video projector, discussions with students	2
Lecture 5	Oscillator and PLL clock generators in microcontrollers	presentation using the video projector,	2

		discussions with students	
Lecture 6	Input/Output in Embedded Systems. I/O ports in embedded applications.	presentation using the video projector, discussions with students	2
Lecture 7	Timers in embedded applications. The General-Purpose Timers Architecture.	presentation using the video projector, discussions with students	2
Lecture 8	Capture/Compare and PWM Modules in Embedded Systems.	presentation using the video projector, discussions with students	2
Lecture 9	The Analog / Digital Converter and DAC ADC channels in embedded applications	presentation using the video projector, discussions with students	2
Lecture 10	Communications peripheral UART	presentation using the video projector, discussions with students	2
Lecture 11	I2C bus and SPI Interface	presentation using the video projector, discussions with students	2
Lecture 12	Lin bus Interface	presentation using the video projector, discussions with students	2
Lecture 13	Hardware design techniques in Embedded Systems	presentation using the video projector, discussions with students	2
Lecture 14	Software design techniques in Embedded Systems	presentation using the video projector, discussions with students	2
		Total lecture hours:	**28**

8.2 Practical activities

8.2.b. Laboratory		**Teaching methods**[22]	**Hours**
Laboratory 1	Software tools for embedded applications. IDE	study of software tools	2
Laboratory 2	Hardware setup using dedicated applications. Cube MX	embedded aplication design	2
Laboratory 3	Oscillator system setup and programming techniques	embedded aplication design	2
Laboratory 4	I/O ports programming	embedded aplication design	2
Laboratory 5	Interrupts and traps handling	embedded aplication design	2
Laboratory 6	Timer's programming	embedded aplication design	2
Laboratory 7	PWM channels Programming and Utilization	embedded aplication design	2
Laboratory 8	Analog-digital converter programming	embedded aplication design	2
Laboratory 9	Asynchronous serial interface programming	embedded aplication design	2
Laboratory 10	SPI Interface Programming	embedded aplication design	2
Laboratory 11	I2C Interface Programming	embedded aplication design	2
Laboratory 12	Debugging code in Embedded Systems	embedded aplication design	2
Laboratory 13	Bootloader in Embedded Systems	embedded aplication	2

		design	
Laboratory 14	Final evaluation	final evaluation of all embedded aplications	2
		Total laboratory hours:	28

9. Bibliography

9.1. Recommended Bibliography	T. Noergaard, *Embedded Systems Architecture. A Comprehensive Guide for Engineers and Programmers*, Elsevier, 2005
	st.com
	kiel.com
	J. A. Fisher, P. Faraboschi, C. Young, *Embedded Computing*, Elsevier, 2005
9.2. Additional Bibliography	M Predko, *Programming and Customizing the PIC Microcontroller*, McGrow Hill, 2008
	J. Ganssle, *Embedded Systems. World Class Designs*, Newnes

10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]

By periodical (formal and informal) discutions with representatives of IT companies

11. Evaluation

Activity Type	11.1 Evaluation Criteria	11.2 Evaluation Methods		11.3 Percentage in the Final Grade	Obs.[24]
11.4a Exam / Colloquy	• Theoretical and practical knowledge acquired (quantity, correctness, accuracy)	Tests during the semester[25]:	0%	60%	
		Homework:	40%		
		Other activities[26]:	0%		
		Final evaluation:	60% (min. 5)		
11.4c Laboratory	• Knowledge of the equipment, how to use specific tools; evaluation of tools, processing, and interpretation of results	• Written questionnaire • Oral response • Laboratory notebook, experimental works, reports, etc. • Practical demonstration		40%	
11.5 Minimum performance standard:[27]		Attending to minimum 50% of tasks in each component: course, laboratory and project.			

The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.

Filling Date: 10.09.2024

Department Acceptance Date: 16.09.2024

	Academic Rank, Title, First Name, Last Name	**Signature**

Course Teacher	Lecturer Beriliu ILIE, PhD	
Study Program Coordinator	Prof. Arpad GELLERT, PhD	
Head of Department	Assoc. Prof. Radu George CREȚULESCU, PhD	
Dean	Prof. Maria VINȚAN, PhD	

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[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.\ credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- C_C/C_A = Course coefficients / applications calculated according to the table

Coefficients	Course	Applications (S/L/P)
Bachelor	2	1
Master	2,5	1,5
Bachelor - foreign language	2,5	1,25

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*