SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and information Technology
1.3 Department	Telecommunications Technologies and Systems
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Telecommunications Technologies and Systems
1.7 Form of education	Full time
1.8 Subject code	TST-E55.20

2. Data about the subject

2.1 Subject name	Digital Signal Processors						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Professor Eugen LUPU, PhD eugen.lupu@com.utcluj.ro						
2.4 Teacher in charge with laboratory / project	Assoc. Prof. Simina EMERICH, PhD, simina.emerich@com.utcluj.ro						
2.5 Year of study	IV	2.6 Semester	8	2.7 Assessment	V	2.8 Subject category	DS/DO

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28

Distribution of time	hours
Manual, lecture material and notes, bibliography	30
Supplementary study in the library, online specialized platforms and in the field	19
Preparation for seminars / laboratories, homework, reports, portfolios and essays	16
Tutoring	2
Exams and tests	2
Other activities:	

3.7 Total hours of individual study	69
3.8 Total hours per semester	125
3.9 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 curriculum	Microprocessors basics, Signal Processing, Programming
4.2 competence	programming skills: assembly language, C

5. Requirements (where appropriate)

5.1. for the course	Cluj-Napoca
5.2. for the seminars / laboratories / projects	Cluj-Napoca

6. Specific competences

Professional competences	**C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information** **C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks**
Transversal competences	N / A

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

7.1 General objective	Developing the competences regarding the use digital signal processors in signal processing applications
7.2 Specific objectives	1. Understanding of main architectures of DSP 2. Understanding basic DSP concepts and programming using Texas Instruments family TMS320 as reference 3. To assess the requirements of a DSP for a specific application 4. To develop applications on DSP platforms using assembly language or CCS IDE

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Course description. Evaluation mode. General features of digital signal processors (DSP) . Digital versus analog processing. Typical DSP algorithms . Other possible architectures to develop applications of digital signal processing (ASIC , FPGA , ASSP , GPP) . Families of digital signal processors company Texas Instruments (TMS320). Applications on DSP .	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .pptx presentation, projector, blackboard
2. Parallelism in digital signal processing . Processing Architectures (von Neumann, Harvard, SISD, VLIW). The goals of parallelism. Special architectures in digital signal processing. Components and architectures used in digital signal processing.		
3. Digital Signal Processing. Overview. Principles and algorithms.		
4. Introduction to digital signal processors. Texas Instruments TMS320 DSP families. Overview of TMS320C25. Pins and signals. The internal architecture.		
5. TMS320C25 programming. Addressing modes (immediate, direct, indirect). FFT algorithm. "Bit -reverse" addressing. C2x instruction set overview .		
6. Application Development on C2x . Using timer and interrupt system. Sinewave Generators. FIR filters . Examples of implementation.		
7. First continuous assessment		

8. TMS320C5x family . Enhancements to the C2x architecture. Areas of application .		
9. C5000 family overview. DSP for communications.		
10. TMS320C5416 processor . Architecture . Memory map . Interrupts System. Peripherals.		
11. TMS320C5416 processor . The instruction set. Examples.		
12. TMS320C55x family . Enhancements to the C54x architecture.		
13. Performance digital signal processors . VLIW architecture presentation. TMS320C6X family . Overview .		
14. Second continuous assessment		

Bibliography

1. Lupu, E. s.a *Procesoare digitale de semnal. Familia TMS320C2X.Prezentare si aplicatii,* Promedia 1997
2. [***] TI User Manuals TMS320C2x, TMS320C5x, TMS320C54x, TMS320C62x
3. [***] www.ti.com
4. Nedevschi, S. *Procesoare de semnal. Familia C5x.Curs,* UT Pres 1997
5. Arsinte, R. – *Arhitecturi paralele şi procesoare de semnal*, Ed. Politehnica Timişoara 2000
6. Emerich S., Lupu E. Procesoare digitale de semnal - Lucrări practice Ed. Galaxia Gutenberg 2014
7. [***] www.bdti.com

Course SLIDES: http://elupu.utcluj.ro/

8.2 Laboratory	Teaching methods	Notes
1. Number representation and arithmetic for DSP. Q15 format.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards,
2. Simulation applications for the DSP family TMS320C2x.		
3. SIDERAL TMS320C25 EVM		
4. Applications development under CCS. C54xx Simulator.		
5. System development kit TMS320C5416		
6. TMS320C5416 DSK application development system		
7. Final evaluation, recoveries		
8.3 Project	Teaching methods	Notes
1. Examples of topics: application development platform in CCS C5416, C5510, C5505, C5515; Development of DSP applications in MATLAB (64x, 67x). Theme setting, content and structure of the project	work monitoring, recommendation references	Use of laboratory instrumentation, experimental boards,
2. Documentation gathering and study		
3. Learning to use platforms and software tools		
4. Establishing organizational applications, application development		
5. Application development on the selected plaform		
6. Testing the application		
7. Project defending		

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

The discipline content and the acquired skills are in agreement with the expectations of the professional organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job (in the field of Telecommunications Engineer; Electronics Design Engineer; Multimedia Applications Developer; System and Computer Design Engineer; Communications Design Engineer), and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	*Written Check*	*60%*
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	*Project+Laboratory*	*30%+10%*
10.6 Minimum standard of performance			

Qualitative level:

Minimal knowledges:

- ✓ *Knowledge of Texas Instr. processors architecture*
- ✓ *Knowledge of main families of TI DSPs.*
- ✓ *Knowledge of main Software IDE to develop applications*

Minimal competences:

- ✓ *To know the main architectural elements of DSP*
- ✓ *To be able to develop applications on TMS320C2x or C5000 DSPs*
- ✓ *To know to use the CCS IDE tool*

Quantitative level:

- ✓ *Perform all laboratory work*
- ✓ *To defend the project*
- ✓ *The exam, project and laboratory notes must be at least 5.*
- ✓ *The final mark for the subject is calculated with the relation: 0.60 * Exam score + 0.15 * Labs score+0.25* Prj score*

Date of filling in:		**Title Surname NAME**	**Signature**
20.06.2023	Course	Professor Eugen LUPU, PhD	
	Applications	Assoc. Prof. Simina EMERICH, PhD	

Date of approval in the Council of the Communications Department 11.07.2023	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications and Information Technology 12.07.2023	Dean Prof. Ovidiu POP, Ph.D.