

SYLLABUS¹

1. Information about the Program

1.1 Higher education institution	Politehnica University of Timisoara
1.2 Faculty ² / Department ³	Automation and Computing / Computer and Software Engineering
1.3 Chair	-
1.4 Domain of study	Computers and Information Technology
1.5 Study level	Bachelor of science
1.6 Study program / Qualification	Computers / engineer

2. Information about the Course

2.1 Course	Digital Signal Processing						
2.2 Lecturer	Prof. Dr. habil. eng. Mihai V. Micea						
2.3 Academic staff for seminars/labs	T/Assist. Dr. eng. Valentin Stângaciu						
2.4 Study year	3	2.5 Semester	2	2.6 Assessment type	E	2.7 Course type	Elective

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

3.1 Hours / week	4	of which: 3.2 lecture hours	2	3.3 seminar/lab hours	2
3.4 Total curriculum hours	94	of which: 3.2 lecture hours	28	3.3 seminar/lab hours	28
Time distribution					hours
Study using manuals, support materials, bibliography and notes					18
Supplementary documentation in library, specialty electronic platforms and on site					10
Supplementary preparation for seminars/labs, homework, reviews, portfolios and essays					10
Tutoring activities					7
Exams					3
Other					
3.7 Total - hours of individual study	38				
3.8 Total - hours per semester	104				
3.9 Credits	4				

4. Prerequisites (if appropriate)

4.1 curriculum related	<ul style="list-style-type: none"> • Mathematical analysis • Computer assisted mathematics
4.2 competence related	<ul style="list-style-type: none"> • Competences and knowledge of arithmetic, analytic and trigonometric calculus

5. Conditions (if appropriate)

5.1 for lectures	<ul style="list-style-type: none"> • Large/medium sized room • Support equipment: laptop, video-projector, board
5.2 for seminars/labs	<ul style="list-style-type: none"> • Laboratory with 10-20 workstations • Hardware/software development kits for DSP-based applications (10-20 pcs): DSP-based development systems, corresponding C programming environments, software analysis and debugging tools • Discrete logic development boards, integrated circuits, I/O modules, microphones, speakers and headphones • Laboratory instrumentation (10-20 pcs): multimeters, stabilized programmable power sources, oscilloscopes, logic analyzers • Hardware development equipments and tools: soldering stations, universal programmers for memory modules, electronic toolkits, connectors and wires

¹ Formularul corespunde Fișei Disciplinei promovată prin OMECTS 5703/18.12.2011 (Anexa3);

² Se înscrie numele facultății care gestionează programul de studiu căruia îi aparține disciplina;

³ Se înscrie numele departamentului căruia i-a fost încredințată susținerea disciplinei și de care aparține titularul cursului;

6. Specific competencies acquired

Professional competencies ⁴	<ul style="list-style-type: none"> • Operating with the scientific, engineering and IT fundamentals • Designing hardware, software and communication components • Problem solving by using computer science and engineering tools • Improving the performance of hardware, software and communication systems • Designing, managing the life cycle, integrating and managing the integrity of hardware, software and communication systems • Designing intelligent systems
Transversal competencies	<ul style="list-style-type: none"> • Behaving honorably, responsibly and ethical, according to the law, to ensure problem solving • Identifying, describing and executing the processes of project management, by fulfilling various roles within the team, and describing the results in the field of activity, in a clear and concise manner, verbal and in writing, using the Romanian language and an international language • Proving action and initiative spirit to get current with the knowledge at professional, economic and management levels

7. Objectives of the course (issued from the list of the competencies acquired)

7.1 General goal	<ul style="list-style-type: none"> • Providing detailed knowledge on the basic techniques used in digital signal processing and building the necessary skills to apply these techniques in various domains
7.2 Specific objectives	<ul style="list-style-type: none"> • Learning the basic techniques used in the conversion, analysis and processing of digital signals and systems in the time and frequency domains • Building the necessary skills of using computing systems and specialized equipments (digital signal processors – DSPs) in signal processing applications • Developing abilities of designing, implementing, testing, debugging and improving the performances of hardware and software systems used in digital signal processing applications

8. Content

8.1 Lecture	Hours	Lecturing methods
1. Introduction 1.1 General considerations 1.2 Fields of application of digital signal processing, with examples 1.3 Course structure, conventions and notations	2	Lectures supported by PowerPoint presentations and video-projections, discussions, explanations and examples
2. Digital signal processors 2.1 General description of DSPs 2.2 Presentation of the DSP families Motorola/Freescale and Analog Devices 2.3 Applications	4	
3. Time domain digital signal processing 3.1 Discrete-time signals 3.2 Conversion of digital signals 3.3 Discrete-time systems (digital processors) 3.4 Convolution of discrete-time signals 3.5 Applications of the convolution 3.6 Correlation of discrete-time signals 3.7 Applications of correlation 3.8 Digital systems characterized by difference equations	10	
4. Frequency domain digital signal processing 4.1 The Z transform and its applications 4.2 Frequency domain analysis of LTI systems	12	
Bibliography <ul style="list-style-type: none"> • M.V. Micea, "Digital Signal Processing: Course Notebook", 3.3rd Edition, Politehnica University of Timisoara, 2015, online: http://dsplabs.cs.upt.ro/~micha/courses/PNS/support/DSP%20-%20Course%20Support.pdf. • J.G. Proakis, D.G. Manolakis, "Digital Signal Processing. Principles, Algorithms and Applications", 4th Edition, Prentice-Hall, 2007. • V.K. Ingle, J.G. Proakis, "Essentials of digital signal processing using MATLAB", 3rd Edition, Cengage Learning, 2012. 		

⁴ Aspectul competențelor profesionale va fi tratat cf. Metodologiei OMECTS 5703/18.12.2011. Se vor prelua competențele care sunt precizate în Registrul Național al Calificărilor din Învățământul Superior RNCIS (http://www.rncis.ro/portal/page?_pageid=117_70218&_dad=portal&_schema=PORTAL) pentru domeniul de studiu de la pct. 1.4 și programul de studii de la pct. 1.6 din această fișă.

8.2 Seminar/lab	Hours	Instruction methods
1. Introduction to the architecture and programming of the Motorola/Freescale and Analog Devices DSPs. Presentation of the corresponding application development environments and software tools.	4	Presentation of the workshop, discussions, questions and answers, implementation of the specifications, testing and debugging
2. Basic DSP programming and testing.	2	
3. Audio CODEC programming and applications.	2	
4. Programming the autonomous operation of the DSPs.	2	
5. Elementary digital signals. Parameters. Applications.	2	
6. Digital signal acquisition using the DSPs.	2	
7. Impulse response of digital systems. Applications.	2	
8. Applications of the convolution operator.	2	
9. Practical study of the time domain behavior of elementary digital filters.	2	
10. Operating principles of the RADAR and SONAR systems.	2	
11. Frequency domain analysis of digital signals.	2	
12. Frequency domain analysis of the elementary digital systems.	2	
13. Development of a spectral analyzer for audio signals.	2	
Bibliography <ul style="list-style-type: none"> • V. Stangaciu, C.S. Stangaciu, "Digital Telecommunications, Signal Acquisition and Processing: Projects and Practical Applications", Editura Politehnica, Timisoara, Romania, 2016. • M.V. Micea, "Digital Signal Processing: Course Notebook", 3.3rd Edition, Politehnica University of Timisoara, 2015, online: http://dsplabs.cs.upt.ro/~micha/courses/PNS/support/DSP%20-%20Course%20Support.pdf. • J.G. Proakis, D.G. Manolakis, "Digital Signal Processing. Principles, Algorithms and Applications", 4th Edition, Prentice-Hall, 2007. • Technical documentation and data sheets for the Analog Devices Blackfin BF537 EZ-KIT Lite and VisualDSP++. 		

9. Correlation between the course content and the requirements of the specialists in the field and the expectations of the main employers

- This course provides fundamental knowledge and skills, required in the majority of the fields related to the engineering of digital processing systems, embedded systems and modern telecommunications.

10. Evaluate

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in final mark
10.4 Lecture	Solving of a theoretical module covering course subjects	Written examination; length: 1 hour	22%
	Solving of a module with problems derived from the examples discussed during the lectures and lab workshops	Written examination; length: 2 hours	44%
10.5 Seminar /labs	Carrying out the lab workshops, according to the specifications	Presentations of the results, questions and answers	29%
	Attendance	Attendees list	5%
10.6 Minimal performance standards (minimal specific knowledge required for passing the exam, the means to assess mastering the specific knowledge)			
<ul style="list-style-type: none"> • Knowledge of the definition and the main types of discrete-time signals and systems; Main properties of discrete-time signals and systems; Definition of the convolution and correlation operations; Definition of the Z Transform and knowledge of its properties – written examination; • Basic skills of designing, implementing, testing and debugging hardware and software systems for simple digital signal processing applications – presentation of the system and results, questions and answers. 			

11. International compatibility

- Massachusetts Institute of Technology, SUA, Department of Electrical Engineering and Computer Science, Basic Undergraduate Program: "Signals and Systems" (6.003, D. M. Freeman, Q. Hu, J. S. Lim, A. S. Willsky), "Introduction to Communication, Control, and Signal Processing" (6.011, A. V. Oppenheim, G. C. Verghese)
- Carnegie Mellon University, SUA, Department of Electrical and Computer Engineering, Undergraduate Program: "Signals and Systems" (18-396), "Digital Signal Processing" (18-491), "Digital Communication and Signal Processing Systems Design" (18-551)

- University of Cambridge, UK, Department of Engineering, Undergraduate Program: "Signals and Systems" (3F1, J.M. Goncalves, N.G. Kingsbury), "Signal and Pattern Processing" (3F3, S. J. Godsill)

Date

Signature of the course instructor

Signature of the academic staff for seminars/labs

Prof. Dr. habil. eng. Mihai V. MICEA

T/Assist. Dr. eng. Valentin STÂNGACIU

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Date of approval in the Department

Signature of the Department Director

Prof. Dr. eng. Vladimir CREȚU

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