GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Digital Signal Processors, PG_00048091		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam

Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics	
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Janusz Smulko
	Teachers	prof. dr hab. inż. Janusz Smulko dr inż. Bartłomiej Dec

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	3.0	27.0	75

Subject objectives

Knows how to program digital signal processors and knows the selected digital signals algorithms and their implementation methods.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	136/5000 Acquires knowledge in the field construction and programming of systems digital for typical implementations digital algorithms signal processing.	[SW1] Assessment of factual knowledge
[K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study	Familiar with the practical implementation of digital algorithms signal processing in selected set run with processor signal.	[SU1] Assessment of task fulfilment

Subject contents	1. Principles of digital signal processing: methods of signal sampling, development of digital techniques, the recommended literature 2. Main elements of digital signal systems (aliasing filters, A/D and D/A converters, digital signal processor) 3. Comparison between analog and digital techniques (programming and characteristic recurrence, adaptive algorithms) 4. Rules of digital signal processor (DSP) choice 5. Characterization of DSP architecture and interacting circuits 6. Techniques of DSP programming (file structure) 7. Analysis of an example DSP program 8. Functions of DSP/BIOS modules 9. Parameters and benchmarks of DSP computing efficiency 10. Usage of MATLAB for DSP programming (automatic code generation) 11. Fixed and floating point numbers in DSP - properties 12. Functional blocks of DSP in Analog Devices, type 21xx 13. Assembler for Analog Devices DSP, type 21xx 14. Interacting circuits for DSP methods of connection 15. Architecture of DSP, Analog Devices type SHARC 16. Architecture of DSP, Texas Instruments type TMS320C2xxx 17. Adaptive filtering in DSP an example program 18. Architecture and assembler of DSP, Texas Instruments type TMS320C5xxx 19. Introduction to architecture of DSP, Texas Instruments type TMS320C6xxx 20. Addressing, data paths and data buffers for DSP, Texas Instruments type TMS320C6xxx 21. Assembler word structure for DSP Texas Instruments type TMS320C6xxx 22. Methods of code optimization for DSP 23. FFT algorithm; graph and programming 24. Welch method of power spectrum estimation 25. Mallat algorithm and wavelet transform 26. Future of digital signal processors 27. Final exam
Prerequisites and co-requisites	Introduction to digital signal processing

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Exam	50.0%	66.0%
Laboratory reports	60.0%	34.0%

Recommended reading	Basic literature	J. Smulko: Lecture materials available at his www site S.W. Smith: *The scientist and engineer's guide to digital signal processing*. 1997. R. Chassaing: Digital signal processing and applications with the C6713 and C6416 DSK. Wiley, 2005.
	Supplementary literature	D. Stranneby: *Digital signal processing: DSP and applications*. Newnes, 2001.
	eResources addresses	Adresy na platformie eNauczanie: Procesory sygnałowe - 2022/2023 - Moodle ID: 24575 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24575

Example issues/ example questions/ tasks being completed	1. Basic concepts of digital signal processing: the concept of digital signal, methods signal sampling, dynamics of digital techniques development, presentation of recommended literature 2. Characteristics of the basic elements of the structure of the digital signal processing system (filters anti-aliasing, A / C and C / A converters, signal processor) 3. Comparison of analog and digital techniques (programmability and repeatability of characteristics digital systems, the possibility of implementing adaptive algorithms) 4. Rules for selecting signal processors (DSP) 5. Characteristics of DSP architecture and cooperating systems 6. Techniques for writing DSP control programs (file structure) 7. Analysis of the sample DSP control program 8. Functions of DSP / BIOS modules in DSP programming 9. Parameters assessing the speed of data processing by DSP 10. The use of MATLAB in the process of preparing the program controlling the work of DSP (automatic program code generation tools) 11. Representation of fixed and floating point numbers in DSP - properties 12. Detailed architecture of functional blocks of Analog Devices signal processors, family 21xx 13. Assembler basics for DSP 21xx family (addressing modes, memory areas, interrupt handling, program structure) 14. Systems cooperating with DSP methods of connection 15. Architecture of Analog Devices SHARC processors 16. PS architecture of the TMS320C2xxx family from Texas Instruments 17. Adaptive filtration in the DSP sample program 18. Architecture and DSP assembly of the TMS320C5xxx family from Texas Instruments 19. Introduction to the DSP Architecture of the TMS320C6xxx family from Texas Instruments 20. Addressing methods, paths and data buffers in DSP of the TMS320C6xxx family from Texas Instruments 21. Assembler structure of the control word in DSP of the TMS320C6xxx family from Texas Instruments 22. Methods for optimizing the DSP control code 23. FFT algorithm; flow graph and graph program 24. The method of power spectral density estimation according to Welch 25. Wavelet transform, Mallat's algorithm 26. The future of DSP development 27. Exam
Work placement	Not applicable