GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Microprocessor Control Systems, PG_00038476		
Field of study	Electrical Engineering		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Przekształtników i Magazynowania Energii -> Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Paweł Szczepankowski	
	Teachers	dr hab. inż. Paweł Szczepankowski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

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	30	5.0	40.0	75

Subject objectives

The aim of the course is to deepen knowledge in the field of application of programmable logic devices in electronic solution and to obtain a basic knowledge enabling the design of control solutions using specialized industrial microcontrollers for real-time applications, in particular for electric motor drives and energy conversion.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W06	is able to design a software NIOS2 processor from Intel FPGA and write a program for handling the basic modules of this element	[SW3] Assessment of knowledge contained in written work and projects
K7_U04	has in-depth knowledge of microprocessor range control systems in which is an important element programmable logic system containing an integrated system microprocessor	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

Subject contents

The content of the subject can be divided into two parts. The first part focuses on presenting the capabilities of programmable logic devices, their internal construction and design principles, with particular emphasis on the use of processors embedded in the digital structure, such as NIOS2 32-bit versatile processor. In this part, a lot of attention is devoted to the presentation and deepening of the usable knowledge about modern diagnostic tools and supporting functional tests. During the lecture, elementary digital systems are also presented, with particular emphasis on their function in control systems. Much attention is devoted to the design of digital solutions using the NIOS2 soft-processor. The second part of the subject is intended to learn the functionality of microcontrollers used in propulsion applications and in energy processing. An important element in this part of the lecture is learning how to work with a dedicated programming environment for these microcontrollers. At this stage of teaching, the subject emphasizes the aspect of calculations and control in real-time using signal processing operations.

Prerequisites and co-requisites	Basic knowledge of the C language. Elementary information about digital circuits. Ability to use Quartus program at the basic level. Elemental information on processor operation.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	80.0%	5.0%
	50.0%	20.0%
	60.0%	25.0%
	50.0%	50.0%

Recommended reading

Basic literature	1. FPGA for DUMMIES, A Wilay Brandt, https://www.intel.com/content/www/us/en/products/programmable.html 2. Hamblen J. O., HALL T. S., Furman M. D.: Rapid Prototyping of Digital Systems. SOPC edition. Springer. 3. Zbysiński P, Pasierbiński J.: Układy programowalne, pierwsze kroki, Wydawnictwo BTC, Warszawa 2002, Second edition 2004. 4. http://www.ti.com/microcontrollers/c2000-real-time-control-mcus/overview.html 5. http://www.ti.com/product/TMS320F28379D
Supplementary literature	1. Gautam Iyer, An Introduction to Texas Instruments C2000 Real-time Control Microcontrollers: Covering LAUNCHXL-F28027 Launchpad in detail with Step-by-Step LAB Sessions with TI-CCS and Mathworks Simulink, ISBN-13: 978-1520724249, ISBN-10: 1520724241 2. Ted VanSickle, Programming Microcontrollers in C (Embedded Technology Series) 2nd Edition, ISBN-13: 978-1878707574, ISBN-10: 1878707574
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	What FPGA parameters and resources determine the quality and usability of SignalTapII Logic Analyzer? How to change the tested signals in a static way. Justify the choice of diagnostic tool. Whether fixed and ROM can be modified. Answer with a few examples. Describe the functions of the LPM_ROM circuits. Describe the functions of the LPM_COUNTER pins. What is the difference between the name of the pin and its location? How to implement a system that slows the rising edge. Draw a structure diagram and describe the functions of individual components. How to implement an element detecting a rising edge and like a falling edge. What programmable logic hardware resources can the NIOS2 soft-processor use? List the digital structures that can be integrated into the NIOS2 soft processor. Provide examples of communication protocols supported by Intel programmable devices. Which electric drive control elements can be implemented in the NIOS2 processor? What is the Qsys tool and what does it do? List the cases of using the Clock Bridge block. Characterize the Avalon ALTPLL element. Describe the meaning of the SDRAM pins. Describe the functions of the "DMA Controller" module. Give and describe the types of PIO pins. Characterize the properties of the Signals tab in the Component Editor menu. How can you design a parallel port with specific timing? Characterize the Code Composer Studio environment. Point to the block diagram of the TMS320F28379D processor in network resources and discuss its most important components. List and describe tools that support code creation for the processor. Replace and describe the processor components are intended for communication tasks. Replace and describe the processor components are designed for data exchange tasks using parallel local interfaces. List and describe the processor components associated with the pulse technique, in particular with pulse width modulation. Explain and briefly describe the functions of FPU, VCU, TMU, CLA, ADC, DAC, USB, PLL, JTAG, GPIO modules. What is the difference between the RELEASE and DEBUG versions? What tools are used in DEBUG mode?
Work placement	Not applicable