

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Microprocessor Control Systems, PG_00065787								
Field of study	Electrical Engineering								
Date of commencement of studies	February 2025		Academic year of realisation of subject			2024/2025			
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			2.0			
Learning profile	general academic profile		Assessment form			assessment			
Conducting unit	Power Converters and Energy Storage Group -> Department of Power Electronics and Electrical Machine > Faculty of Electrical and Control Engineering							cal Machines -	
Name and surname	Subject supervisor		dr hab. inż. Paweł Szczepankowski						
of lecturer (lecturers)	Teachers		dr hab. inż. Paweł Szczepankowski						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	aboratory 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 classes includ plan	n didactic led in study	Participation in consultation hours		Self-study		SUM	
	Number of study hours	of study 30		5.0		15.0		50	
Subject objectives	Ine subject aims to provide the student with knowledge of microprocessor control systems. The student will learn about the functions, applications and practical use of several digital logic elements, including DSP processors and FPGA systems. In addition, the student will learn the skills of designing the NIOS processor architecture in the Quartus Prime environment using a tool for designing platforms based on MAX10 systems and MAX10-DE10 Lite evaluation boards. The student will learn about the architecture of the TMS320F28379D processor dedicated to power electronics applications and how to configure and use it in applications. In addition, the aim of the subject is also to learn the skills of creating IoT communication solutions using the ESP32 device family and the Raspberry Pi5 microcomputer.								
Learning outcomes	Course outcome		Subject outcome			Method of verification			
	[K7_W06] has an in-depth knowledge of industrial electronics, microprocessor control systems and in the field of power electronics and drive systems, their control and diagnostic methods		Identifies microprocessor system tasks, determines the method of their implementation, and selects design and support tools for systems with DSP processors and FPGA systems. Designs conceptual and block diagrams of electronics intended for control systems in power electronics.			[SW3] Assessment of knowledge contained in written work and projects			
	IN _UU4] IS ADIE to SEIECT industrial electronics equipment and prepare their software, design systems microprocessor systems		Selects electronic circuits for the microprocessor control system. Designs a digital structure project containing an NIOS processor according to specification using tools in the Quartus Prime environment. Configures and parameterizes components of TMS320F28379D processor architecture, then runs the project based on application guidelines. Creates programs in Visual Studio Code environment with Platform IO add-on for ESP32 modules.			ISU4J Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment			

LECTURE:Basic logic circuits: buffers, latches, registers, digital isolators, voltage translators, gates flops, generators, USB bridges, voltage reset and supervision circuits, data memories. Data interface serial, parallel, isolated, differential, I2C, RS232, SPI. FPGA circuits: types, applications, construction parameters. NIOS processor: creating processor architecture, designing test applications in C, and the system. TMS320F283XX family processors: system configuration using dedicated tools such as SysConfig, beginning the program and its verification. IoT elements: building a system project with results and touch sensors. Construction of microprocessor systems used in power electronics: program, and touch sensors. Construction of microprocessors, and communication interfaces. Construction of voltage inverters in the context of mechanics and control.LABORATORY:Design, signal processor is the EBCA programmable structure using the DE40 life beard with beard with the beard with the SPCA programmable structure using the DE40 life beard with the beard with the sensors.	, flip- ces: on, starting file ture, ower							
MAX10 system. Design, start-up and tests of the TMS320F28379D processor using the F28379D LaunchPad board, the C2000Ware library and the C2000 Academy course. Design of a simple ope system for the ESP32-POE2 module: file system, configuration file, WiFi connection support, HTTP FTP server, sensor support, JSON files, website design, and data visualization.	LECTURE:Basic logic circuits: buffers, latches, registers, digital isolators, voltage translators, gates, flip- flops, generators, USB bridges, voltage reset and supervision circuits, data memories. Data interfaces: serial, parallel, isolated, differential, I2C, RS232, SPI. FPGA circuits: types, applications, construction, parameters. NIOS processor: creating processor architecture, designing test applications in C, and starting the system. TMS320F283XX family processors: system configuration using dedicated tools such as SysConfig, beginning the program and its verification. IoT elements: building a system project with file system support, WiFi network, Ethernet connection using the Arduino platform, supporting temperature, pressure, and touch sensors. Construction of microprocessor systems used in power electronics: power supplies, reset systems, transistor control path systems, overflow detection, failure handling, recording and logging, signal processor in the Context of mechanics and control.LABORATORY:Design, start-up and test the NIOS2 processor in the FPGA programmable structure using the DE10 Lite board with the MAX10 system. Design, start-up and tests of the TMS320F28379D processor using the F28379D LaunchPad board, the C2000Ware library and the C2000 Academy course. Design of a simple operating system for the ESP32-PoE2 module: file system, configuration file, WiFi connection support, HTTP server, FTP server, sensor support, JSON files, website design, and data visualization.							
Prerequisites and co-requisites								
Assessment methods Subject passing criteria Passing threshold Percentage of the final	grade							
and criteria evaluation of reports 60.0% 40.0%								
assessment of preparation and activity during the implementation of laboratory tasks 60.0% 20.0%								
evaluation of answers to questions 60.0% 40.0% from the lecture content								
Recommended reading Basic literature Paweł Hadam, Projektowanie systemów mikroprocesorowych, 83-910067-9-4 Jacek Majewski, Piotr Zbysiński, Układy FPGA w przykładach 978-83-60233-23-8 Henryk A. Kowalski, Procesory DSP w przykładach, ISBN 978-83-60233-78-8	, ISBN: , ISBN:							
Supplementary literature Dag Stranneby, Cyfrowe przetwarzanie sygnałów. Metody, alg zastosowania, ISBN: 83-921073-4-9 Andrzej Pawluczuk, Układy programowalne dla początkującyc 978-83-60233-65-8 Charles Kitchin, Lew Counts, Wzmacniacze operacyjne i pom Poradnik projektanta, ISBN: 978-83-60233-39-9	Dag Stranneby, Cyfrowe przetwarzanie sygnałów. Metody, algorytmy, zastosowania, ISBN: 83-921073-4-9 Andrzej Pawluczuk, Układy programowalne dla początkujących, ISBN: 978-83-60233-65-8 Charles Kitchin, Lew Counts, Wzmacniacze operacyjne i pomiarowe. Poradnik projektanta, ISBN: 978-83-60233-39-9							
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Example issues/ example questions/ tasks being completed Example questions:1. Provide the designation of an 8-bit buffer powered by 3.3V with a settable da direction and increased resistance to voltage overshoot on digital inputs.2. Describe the functions of DMA module in the NIOS2 processor.3. Draw and describe the I2C data frame.4. List the signals in interface and state their function.5. Characterize the EPWM module in the TMS320F28379D process List the DC and AC current sensors used in power electronics with a current output with a range no exceeding 100 mA.7. Methods of measuring voltages in microprocessor-controlled inverters.Examp 1. Design of the NIOS2 processor with SDRAM, FLASH memories and a DMA module connected t parameterized parallel port.2. Programming an EPWM module to work in a voltage inverter: dead ti PWM modulation, synchronization, ADC processing.	Example questions:1. Provide the designation of an 8-bit buffer powered by 3.3V with a settable data flow direction and increased resistance to voltage overshoot on digital inputs.2. Describe the functions of the DMA module in the NIOS2 processor.3. Draw and describe the I2C data frame.4. List the signals in the SPI interface and state their function.5. Characterize the EPWM module in the TMS320F28379D processor.6. List the DC and AC current sensors used in power electronics with a current output with a range not exceeding 100 mA.7. Methods of measuring voltages in microprocessor-controlled inverters.Example issues: 1. Design of the NIOS2 processor with SDRAM, FLASH memories and a DMA module connected to a parameterized parallel port.2. Programming an EPWM module to work in a voltage inverter: dead times, PWM modulation, synchronization, ADC processing.							
Work placement Not applicable	Not applicable							

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