GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Microprocesor control system, PG_00057323		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-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	1	Language of instruction	English
Semester of study	2	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		

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	8.0	37.0	75

Subject objectives

Familiarization with the essence, construction and functioning of microprocessor control systems based on processors, FPGAs and mini SoC modules. The coursework was divided into two parts. The first is devoted to FPGA systems, with particular emphasis on the possibility of designing and commissioning the NIOS2 soft-processor. The aim of this part is for the student to be ready to implement such a project. Part 2 is devoted to the issue of the Internet of Things. Its purpose is to master the basic skills needed to run a system based on ESP32 modules.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U04] is able to plan and perform experiments using measurements and computer simulations, together with interpretation of results, is able to present and evaluate the course and results of work in a team realizing an advanced engineering project, is able to use technical documentation and to create it independently	The student is able to analyze the structure and function of the microprocessor control system. He can use tools for programming and debugging digital circuits in the Quartus and ModelSim environments. Runs algorithms in F28 family processors in Code Composer Studio environment. It is able to develop access to the device using WiFi networks and ESP32 modules.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K7_W06] knows the extended issues of reliability of power equipment and diagnostics of defects in this equipment	The student has knowledge in the field of tools for error detection in microprocessor controllers of power devices. He can use his knowledge of programmable circuits and processors. He can choose an FPGA electronic circuit and apply it. He knows the capabilities of multi-core F28 processors in the field of power electronics. He has general knowledge in the field of measurements and digital signal processing. Understands the implementation of the HMI interface.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_K82] is equipped to participate actively in lectures, seminars and laboratory classes conducted in foreign language	The student is familiar with the industry language and terms specific to the subject of microprocessor control systems. Can prepare technical materials in English. During engineering work, he communicates in English to the extent that allows him to perform tasks.	[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Elementary electronic circuits used in digital technology. The use of FPGAs in practice. Design, simulation and commissioning of digital structures in the Intel FPGA Quartus environment. Designing IoT applications using Arduino software and Visual Studio Code with the PlatformIO option. Creating projects for Texas Instruments TMS320F28379D signal processors in the Code Composer Studio environment. Issues of control and operation of electrical energy processing devices.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
presentation	50.0%	10.0%
project	50.0%	60.0%
questions	50.0%	30.0%

Recommended reading

Basic literature	Build Web Servers with the ESP32 and ESP8266 Rui Santos, Sara Santos RAPID PROTOTYPING OF DIGITAL SYSTEMS Michael D. Furman, James O. Hamblen
Supplementary literature	1. Zieliński B., Układy mikroprocesorowe. Przykłady rozwiązań. Helion, Warszawa 2002. 2. Zieliński T. P., Cyfrowe Przetwarzanie Sygnałów. Od teorii do zastosowań. Wydawnictwa Komunikacji i Łączności, Warszawa 2005, drugie wydanie 2007.
eResources addresses	

Example issues/ example questions/ tasks being completed	List and describe exemplary devices used to carry out measurements in digital circuits. Give an example, explain the functions and give the main functionality of JTAG emulators. List the tools for manual removal of short circuits caused by excess solder. List and describe the components of the IDE. List the desired functionalities of simulation programs. Provide sources of technical and problem documentation. Describe the construction of multi-layer PCB printing. List the types of vias used in PCBs. Give the differences between the types of vias and justify their use on the example of a PCB design. Suggest laying conductive layers for projects with the operating frequency of discrete circuits lower than 300 MHz. State the advantages and disadvantages of such a solution. Suggest the arrangement of conductive layers for projects with the operating frequency of discrete circuits greater than 300 MHz. State the advantages and disadvantages of such a solution. Provide at least 3 main design assumptions related to the construction of the PCB. What kind of files a printed circuit board project usually consists of. Using the example of an integrated circuit, give the functions of digital signal buffers. What are the types of buffers and when should they be considered. Give the differences between the LATCH type system and the REGISTER type system. Discuss an example function of the HC574 register. Give an example of using the HC573 chip. Characterize voltage translators. Characterize the 74LS47 transcoder. What is dynamic display using 7-segment displays. Give two examples of using analog switches. Give three examples of using digital switches. List 3 ways of separating digital signals.
Work placement	Not applicable