GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Programming Techniques in Embedded Systems, PG_00068327		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
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	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Automatic Control -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Pazio	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	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	2.0	18.0	50

Subject objectives

The aim of the course is to learn the rules and the acquisition of programming skills in embedded systems

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U07] can apply methods of process and function support, specific to the field of study	The student is able to apply knowledge of embedded systems to create real-time software. The student is able to practically use register programming methods.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[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	The student knows the rules for creating software for embedded systems with PCs. The student knows the rules for using the PC104, VME and Compact PCI buses. The student knows the rules of practical use of Linux, Windows and other operating systems. The student knows the techniques of input and output interface software. The student knows the techniques of creating real-time software. The student knows the rules for implementing the elements of self-diagnosis of embedded computer systems.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture
1. Introduction into embedded systems.
2. Embedded systems based on PC standard computers.
3. Modular computers based on PC104 standard bus.
4. Modular computers based on VME standard bus.
5. Modular computers based on COMPACT PCI standard bus.
6. Controlled object interface organization.
7. Operating system in embedded systems: WINDOWS embedded, Linux, QNX.
8. Embedded system software specificity.
9. Object interface using manufacturer handlers.
10. Object interface writing handler techniques.
11. Hardware interrupt handling techniques: interrupt service routines, interrupt initiated task for service requests.
12. Real time techniques of implementation.
13. Software handlers for standard communication interfaces.
14. Microcontrollers in embedded systems.
15. Operating systems for microcontrollers - Linux.
16. Dedicated software mini kernel techniques.
17. Dedicated software interrupt handling procedures technique.
18. Dedicated software software loop techniques.
19. Microcontroller built-in resources handling techniques.
20. Standard communication interface handling.
21. Basics of self-diagnostics in embedded system software.
22. Usage of microcontroller built-in diagnostic resources JTAG interface.
23. Embedded system examples.

Course content – project
Design a simple device equipped with sensors (e.g., environmental parameters), an encoder, a display, and a keyboard. The central unit is a board with a microcontroller (STM32 or ESP32). The device must be assembled, commissioned, and programmed.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No requirements</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam</td><td>51.0%</td><td>30.0%</td></tr>
<tr><td>Practical exercise</td><td>51.0%</td><td>60.0%</td></tr>
<tr><td>Presentations</td><td>0.0%</td><td>10.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>A. Pyrchla, B. Danowski, BIOS. Przewodnik, Helion 2007
B. Zieliński, Układy mikroprocesorowe. Przykłady rozwiązań, Helion 2002
E. Wróbel, Asembler Praktyczny kurs asemblera, Helion 2004
M. Szafarczyk, D. Śmigulska-Grądzka, R. Wypysiński Podstawy układów sterowań cyfrowych i komputerowych PWN 2007
Metzger P. "Anatomia PC", HELION, 2008
Misiurewicz P. Podstawy techniki mikroprocesorowej. WNT 1991
W. Nawrocki, Komputerowe systemy pomiarowe, WKŁ
Katalogi, strony WWW i podręczniki firmowe</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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