GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Industrial Computers and Embedded Systems, PG_00048151		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2026/2027
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	4	Language of instruction	Polish
Semester of study	7	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Marine Electronic Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Iwona Kochańska	
	Teachers	dr hab. inż. Iwona Kochańska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60	5.0	60.0	125

Subject objectives	*The objective of this course is to expose students with standards, architecture and design methodology of industrial computers, embedded systems and complex digital signal processing systems, and with programming techniques to effectively use the hardware resources of such systems.*

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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	Student observes and measures signals in real-time processing systems based on floating-and fixed-point digital signal processors.	[SU1] Assessment of task fulfilment
	[K6_U06] can analyse the operation of components, circuits and systems related to the field of study, measure their parameters and examine technical specifications	Student is able to analyse proper operation of the embedded system.	[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	Student discusses specific requirements for industrial processors and computers used in dedicated real-time systems and the resulting technical solutions. He presents architecture, functionality and performances of industrial computers of PC/104 standard and its extensions, DIMM-PC standard, VMEbus standard, and CompactPCI standard. He lists advantages and disadvantages, and compares standards of industrial computers. He presents general characteristics, architecture, and hardware implementations of real-time multiprocessor systems. He observes and analyzes operation of VMEbus, industrial system with single chip microcontroller. Student knows the basics of embedded systems architecture and capabilities of typical solutions available on the market. Student knows techniques for designing and programming multi-threaded embedded systems and the methodology of software development for embedded systems (HW / SW co-design).	[SW1] Assessment of factual knowledge

Subject contents

1. Introduction
2. Industrial computers of PC/104 standard and its extensions. General characteristic and destination of PC/104 computers
3. Mechanical specification of PC/104 computers
4. Extension of PC/104 computers to PC/104 Plus standard
5. Extension of PC/104 computers to formats EBX and EPIC
6. Advantages and disadvantages of systems based on PC/104 standard
7. Industrial computers of VMEbus standard. General characteristic of the VMEbus
8. Architecture of VMEbus computers
9. Interface of computers with VMEbus
10. Operations realized on VMEbus
11. Mechanical specification of VMEbus computers
12. Selected application of VME standard computers
13. Industrial computers of CompactPCI standard. General characteristics of the bus
14. Techniques of configuration and transmission
15. Architecture of CompactPCI computers
16. Mechanical specification
17. Tipical applications
18. Processor complex systems of digital signal processing. General characteristics.
19. Architecture.
20. Methods of hardware implementation of systems based on singlei-core processors
21. Methods of hardware implementation of systems based on multi-core processors
22. Multiprocessor systems
23. Single Board Computers (SBC). SBC architecture
24. SBC communication interfaces
25. Comparission of different SBC's
26. Embedded operating systems. POSIX standard
27. OS for embedded systems
28. Kernel and its surroundings in embedded systems
29. Process manager. Memory management. Managing the namespace.
30. Threads and processes. Methods for thread synchronization. Interprocess communication
31. File systems
32. Developing software for embedded systems. C++ programming in OS Linux
33. Working in integrated Eclipse CDT
34. Software cross-compilation for embedded systems
35. OpenCV library
36. Python programming
37. Network programming for embedded systems
38. Cloud computing. Communication with the cloud.
39. Techniques for efficient use of hardware resources. Methods for code optimization
40. Hardware and software techniques power consumption minimalization

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	50.0%	50.0%
Practical exercise	50.0%	50.0%

Recommended reading

Basic literature	1. Kozielski S., Szczerbiński A. Komputery równoległe, architektura, elementy programowania. WNT Warszaw 1994 2. Heath S. Vmebus: a practical companion. Butterworth-Heibemann 1994
Supplementary literature	No requirements
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Work placement

Not applicable