



Subject card

Subject name and code	Embedded Systems and Microprocessors, PG_00067278						
Field of study	Informatics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2027/2028		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study 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	2	Language of instruction			Polish		
Semester of study	4	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Geoinformatics -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Krzysztof Bikonis				
	Teachers		dr inż. Krzysztof Bikonis				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45		4.0		26.0	75
Subject objectives	The aim of the course is to familiarize students with the basics features of embedded systems based on microcontrollers, construction, organization and architecture of modern microcontrollers, acquire skills programming selected microcontrollers.						

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 programs in C language and compiles programs up to the level of processor instructions, runs and tests programs.	[SU4] Assessment of ability to use methods and tools
	[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student is able to create and verify connections between systems included in the laboratory stand.	[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 and understands the principles, methods and techniques of programming microcontrollers on the example of the Arduino module with the ATmega328 microcontroller and the system for the Internet of Things using Bluetooth Low Energy (nRF52840) and Arduino MKR WIFI 1010 with the inertial sensor (BNO055).	[SW1] Assessment of factual knowledge
	[K6_W44] knows and understands, to an advanced extent, architecture, design principles and methods of hardware and software support for local and distributed information systems, including computing systems, databases, computer networks and information applications, as well as the principles of human-computer interaction, the operation and evaluation criteria of data processing, storage and transfer methods, including computational algorithms, artificial intelligence and data mining as well as standards and methods of IT systems administration, monitoring of processes and robustness to undesirable phenomena and activities	The student knows and understands the architecture and design principles of simple embedded systems based on microcontrollers.	[SW1] Assessment of factual knowledge

Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. History and development trends of microprocessors. 2. Architecture of the microprocessor system. 3. Blocks supervising microprocessor operation. Interrupt system. 4. Types of memory. I / O system. 5. Programming microprocessors. Assembler. 6. Microcontrollers. Basic definitions. 7. Architecture of PIC and AVR microcontroller. 8. Specialized I / O systems - SPI, UART, 1-wire, i2c, USB. 9. Definition of the embedded system. 10. Embedded systems design, hardware platforms, software, testing. 11. Basic peripheral systems. 12. Selected aspects of operating system functioning for embedded systems. 13. Real-time systems for embedded systems. 14. Development environments for creating applications for embedded systems. 15. Modeling methods for embedded systems. 16. Energy saving methods in embedded systems. 17. Program testing methods for embedded systems. <p>Course content – laboratory</p> <ol style="list-style-type: none"> 1. Digital input/output ports. 2. Matrix keyboard, 8-segment display. 3. RS232 serial interface, alphanumeric LCD display. 4. I2C serial interface. 5. Analog-to-digital converter, timing circuits, interrupts. 6. Distance sensor, motion sensor. 7. Graphical display, accelerometer. 8. RFID reader. 9. Introduction to the concept of acceleration measurement using an integrated accelerometer. 10. Basic properties and operating principle of a micromechanical gyroscope. 11. Earth's magnetic field measurement using magnetoresistive sensors. 12. LED, GPIO, and timer on the Nrf52. USB interface and sensors on the Nrf52. 13. ADC on the Nrf52 and phototransistor. 14. Bluetooth advertising and connectionless communication on the Nrf52. 											
Prerequisites and co-requisites	No requirements											
Assessment methods and criteria	<table border="1" data-bbox="451 943 1487 1039"> <thead> <tr> <th data-bbox="451 943 794 969">Subject passing criteria</th> <th data-bbox="794 943 1139 969">Passing threshold</th> <th data-bbox="1139 943 1487 969">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 969 794 996">Written exam</td> <td data-bbox="794 969 1139 996">51.0%</td> <td data-bbox="1139 969 1487 996">50.0%</td> </tr> <tr> <td data-bbox="451 996 794 1039">Practical exercise</td> <td data-bbox="794 996 1139 1039">51.0%</td> <td data-bbox="1139 996 1487 1039">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Written exam	51.0%	50.0%	Practical exercise	51.0%	50.0%
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Written exam	51.0%	50.0%										
Practical exercise	51.0%	50.0%										
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. M. Margolis, B. Jepson, N. R. Weldin, Arduino. Przepisy na rozpoczęcie, rozszerzanie i udoskonalanie projektów, 2020. 2. R. Baranowski, Mikrokontrolery AVR ATmega w praktyce, BTC, 2005. 3. S. Pietraszek, Mikroprocesory jednocukładowe PIC, Helion 2002. 4. T. Jabłoński, K. Pławsiuk, Programowanie mikrokontrolerów PIC w języku C, BTC 2005. 5. Tomasz Francuz, Język C dla mikrokontrolerów AVR, od podstaw do zaawansowanych aplikacji, Helion 2011. 6. Rafał Baranowski, "Mikrokontrolery AVR ATmega w praktyce", BTC 2005. 										
	Supplementary literature	<ol style="list-style-type: none"> 1. Dokumentacja procesora ATmega328 2. Dokumentacja układu nRF52840(PCA10059) 3. Dokumentacja układu IMUBNO055 										
	eResources addresses											
Example issues/ example questions/ tasks being completed												
Practical activities within the subject	Not applicable											

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