



## Subject card

Subject name and code	Embedded Systems, PG_00047844						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2024		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	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Adam Bujnowski				
	Teachers		dr inż. Adam Bujnowski				
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		3.0		42.0	75
Subject objectives	To familiarize students with construction, and programming of the embedded systems. The input and output stages and the control unit types. A typical input and output data methods will be shown. Exemplary problems related with the constriction of microprocessor systems, microcontrollers, programmable chips (FPGA) , SoC, SoM's and examples of the control algorithms. During the laboratory the practical knowledge will be presented covering the area of typical input/output control and typical algorithms.						
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		Student can write software for medical data acquisition Student can design circuit for controlling of the selected physical parameter (pressyre, temperature, etc. )		[SU4] Assessment of ability to use methods and tools [SK5] Assessment of ability to solve problems that arise in practice [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 is able to create apllications for embedded systems. Student understands and knows specific methods for implementing and applying code for embedded systems. Studeent knows specific tools for programming of embedded systems		[SW3] Assessment of knowledge contained in written work and projects		
	[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 designe controll system on the basis of given specification Student is able to design and implement controll algorithm for designed system		[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		

Subject contents	Principal definitions - embedded system,		
	Requirements criteria for the embedded systems		
	Operating systems of the embedded systems		
	Available hardware platforms for the embedded systems		
	CPU's for the embedded systems, microcontrollers, SoC's etc.		
	Typical CPU architectures - Intel, ARM, MIPS		
	Methods of reliability improvements		
	Application creation for the embedded systems		
	Power supply in the embedded systems		
	Application testing and debugging in the embedded systems		
	Interfaces and IO system in the embedded systems		
	Typical applications for the embedded systems		
Prerequisites and co-requisites	Programming (C,C++)		
	Digital circuits basics		
	Principles of electronics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	laboratory achievements	50.0%	50.0%
	final writing	50.0%	50.0%
Recommended reading	Basic literature	A. Bujnowski , Systemy wbudowane - skrypt do przedmiotu  Martin Evans , Jordan Hochenbaum , Joshua Noble, Arduino w akcji, Helion 2014  Kazimierz Lal , Krzysztof Orkisz , Tomasz Rak, RTLinux - system czasu rzeczywistego Helion , Styczeń 2003	
	Supplementary literature	Tomasz Francuz, AVR. Układy peryferyjne Helion , Maj 2014  Tomasz Francuz, Język C dla mikrokontrolerów AVR. Od podstaw do zaawansowanych aplikacji Helion , Lipiec 2011  <a href="http://mirekk36.blogspot.com/">http://mirekk36.blogspot.com/</a>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		