GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Real Time Systems, PG_00038097		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2021/2022
Education level	first-cycle studies	Subject group	
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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Control Systems Engineering -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tomasz Rutkowski	
	Teachers	dr inż. Tomasz Rutkowski	

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	4.0	66.0	100

Subject objectives

Gain knowledge in the real-time systems domain related to the computer control systems. Getting to know the selected real-time systems. Acquiring the ability to properly use of the known issues in the control systems design and implementation for the purposes of solving simple engineering problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_K02	The ability of individual and group work in the field of implementation and verification of control systems using environments enabling rapid prototyping and hardware-in-the-loop simulation.	[SK1] Assessment of group work skills [SK2] Assessment of progress of work
K6_W06	The student defines the real-time system. It classifies real-time systems depending on the type of time constraints. Identifies the role and location of real-time systems in computer control systems. Describes various types of digital control devices. Describes architecture and explains the basic mechanisms of the real-time operating system.	[SW1] Assessment of factual knowledge
K6_U05	The student defines the real-time system. It classifies real-time systems depending on the type of time constraints. Identifies the role and location of real-time systems in computer control systems. Describes various types of digital control devices. Describes architecture and explains the basic mechanisms of the real-time operating system.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents	LECTURE History and basic definitions and issues related to real-time systems domain. Continuous systems versus discrete systems. Differential equation versus difference equation. Examples of real-time systems: microcontrollers, DSP, FPGA, PLC/PAC, industrial computers. Structure of classical and distributed control system. Real-time systems in computer control systems, examples of: industrial networks, digital control devices, industrial databases. Structure, functioning and programming of real-time systems examples: PLC/PAC controllers, Matlab/Simulink Real-Time Windows Target. Rapid prototyping idea and tools. Hardware in the loop simulation idea. Features, architecture and fundamental elements of real-time operating systems. Selected real-time operating systems characteristics, including: QNX, RTLinux, VxWorks, Azure RTOS, Nut/OS, FreeRTOOS. TRAINING LABORATORY Introduction to PLC controllers: configuration, programming, basic control algorithms implementation. Introduction to Matlab/Simulink Real-Time Windows Target and xPC Target: configuration, basics of programming, basic mathematical models of control systems implementation and/or control algorithms implementation (rapid prototyping). Simulation analysis with hardware in the loop simulation technique. Design and implementation of a control algorithm for the autonomic mobile robot.
Prerequisites and co-requisites	Knowledge of subjects: Computer Science (0411200011) and Basics of Automatics (0411200017)

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory reports	50.0%	40.0%
Lecture test	50.0%	50.0%
Tests during training laboratories	50.0%	10.0%

Recommended reading

Basic literature	1. Sacha K. Systemy czasu rzeczywistego. Oficyna WPW 2006. 2. Szmuc T. Motet G. Specyfikacja i projektowanie oprogramowania systemów czasu rzeczywistego. AGH Uczelniane Wydawnictwo Naukowo-Dydaktyczne, Kraków 2000. 3. Kopetz H. Real-Time Systems, Design Principles for Distributed Embedded Applications. Springer Real-Time Systems Series, 2011. 4. Buttazzo G. C. Hard Real-Time Computing Systems, Predictable Scheduling Algorithms and Applications. Springer Real-Time Systems Series, 2011.
Supplementary literature	1. Szymczyk P. Systemy operacyjne czasu rzeczywistego. AGH Uczelniane Wydawnictwo Naukowo-Dydaktyczne, Kraków 2003. 2. Ułasiewicz J. System czasu rzeczywistego QNX6 Neutrino. Wydawnictwo BTC.
eResources addresses	

Example issues/ example questions/ tasks being completed	[1] Define the real time system. [2] Describe classification of the real time systems according to various time constrains types. [3] Describe role and place of real time systems in the computer control systems. [4] Describe similarities and differences between rapid control prototyping and hardware in the loop simulation techniques. [5] Describe basic architectures of real time operating systems.
Work placement	Not applicable