GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Microcontrollers and Distributed Microsystems, PG_00047596		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Zbigniew Czaja	
	Teachers	dr hab. inż. Zbigniew Czaja	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	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	2.0	18.0	50

Subject objectives

Learning the basics of design, operation and control of microcontrollers and their peripheral devices, and also electronic systems: digital buffers, parallel random access memories, SPLDs and CPLDs, selected systems controlled via the SPI interface.

Acquisition of the ability to analyze ("read") electronic block schemes and timings describing the behavior of the system at the time (work in "real time"), as well as effective learning skills of the technical documentation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 explains the construction and principle of operation of the microcontroller and its peripherals. Student lists topologies and properties of serial interfaces.	[SW1] Assessment of factual knowledge
[K6_W03] Knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student defines the concept of distributed electronic microsystems. Student describes the principle of operation and control of systems that are part of electronic microsystems.	[SW1] Assessment of factual knowledge

Subject contents	1. Introduction, The plan of the lecture, definition of the embedded microcontroller 2. Definition of the microcontroller and features of the core processor 3. Addressing modes of the core processor 4. Classification of core processors taking into account a memory map (definition of the memory map) and an instruction set 5. The hardward architecture, the modified hardward architecture, the Von-Neumann architecture 6. RISC and CISC architectures of the core processor 7. Internal memories of microcontrollers (program and data memories) 8. Division of the microcontrollers regarding to a way of using of external memories 9. Microcontrollers with access to system buses through ports, with directly access to system buses, embedded microcontrollers 10. An stratified model of the embedded microcontroller 11. Families of the microcontrollers 12. An oscillator circuit and circuits of generation and distribution of clock signals 13. Methods of power reduction and special modes of the microcontroller 14. Reset circuits of the microcontroller 15. Units supervising a work of the microcontroller: BOR, LVD. Circuits delaying the reset signal 16. The watchdog 17. An interrupt system with program polling of devices and a vector interrupt system 18. Parallel ports of the microcontroller – the layer of multiplexers and input/output pins 19. Overview and classification of peripheral devices of the microcontroller 20. Basic information about timers and counters 21. Configurations of timers: 16-bit counter/timer, Input Capture, Output Compare, One Pulse, PWM 22. Examples of the timers: timers in PIC16F877, ST72215G 23. Internal analog to digital converters 24. Internal analog comparators 25. Internal EEPROMs (configuration and service). Example of the EEPROM in AT90S8515 26. Characterization and division of serial interface controllers 27. The UART interface (building, principle of working, controlling) 28. Solutions of the UART interface in microcontrollers: 80C51/52, AT90S8515, PIC16F877 29. The SPI interface 30. Examples of the SPI interface in microcontrollers: ST72215G, AT90S8515, PIC16F877 31. The 1-Wire interface 32. I2C, CAN, USB interfaces 33. The parallel interface PSP 34. Types of packages of the embedded microcontrollers 35. Properties of programming of the microcontrollers 36. Programming of the core processor in an assembler language 37. Methodology of writing programs in the assembler 38. Writing programs in high level languages 39. Activating of programs written for the microcontrollers 40. Programming methods of the microcontrollers with FLASH 41. Definitions of the distributed microsystem. 42. Standards of serial interfaces in distributed microsystems 43. Features of interface configurations: bus, star, loop 44. Methods of addressing of external interface units 45. Interface functions of serial interfaces: listener, talker, repeater 46. Transmission methods in serial interfaces: synchronous, asynchronous, full and half duplex 47. Components of distributed microsystems 48. External memories: RAM and FLASH 49. Programmable circuits in distributed microsystems: SPLD and CPLD 50. Serial EEPROMs with the SPI interface 51. Mixed-signal circuit with the SPI interface: ADCs and DACs, digital potentiometers, temperature sensors, analog multiplexers and switches 52. Controllers of serial interfaces: RS232, RS485, Ethernet 53. Controllers of wire-less interfaces: IrDA, Bluethooth 54. Communication of the distributed microsystem with an user: LCD displays, LEDs, sets of switches and push-buttons 55. Power supply of the distributed microsystems
Prerequisites and co-requisites	No requirements
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	48.0%	100.0%

Recommended reading	Basic literature	Czaja Z.: Mikrosterowniki i mikrosystemy rozproszone – materiały do wykładu, http://www.pg.gda.pl/~zbczaja, Gdańsk 2014. Hadam P.: Projektowanie systemów mikroprocesorowych, Wyd. BTC, Warszawa 2004.
	Supplementary literature	Bogusz J.: Lokalne interfejsy szeregowe w systemach cyfrowych, Wyd. BTC, Warszawa 2004. Baranowski R.: Mikrokontrolery AVR ATmega w praktyce, Wyd. BTC, Warszawa 2005. Jabłoński T: Mikrokontrolery PIC16F8x w praktyce, Wyd. BTC, Warszawa 2002. Jabłoński T., Pławsiuk K.: Programowanie mikrokontrolerów PIC w języku C, Wyd. BTC, Warszawa 2005. Baranowski R.: Wyświetlacze graficzne i alfanumeryczne w systemach mikroprocesorowych, Wyd. BTC, Legionowo 2008.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	