University of Gdańsk

Subject card

Subject name and code	Computer System Architecture, PG_00168616						
Field of study	Informatics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study Optional 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		5.0		
Learning profile	practical		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Janusz Młodzianowski				
	Teachers						
Lesson types	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		0.0		0.0	60
Subject objectives	1. Discussion of basic concepts in electronics. 2. Presentation of selected topics related to the design and operation of digital electronic circuits. 3. Introduction to microcontroller programming using Arduino.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[INFL3_K01] knows the limitations of their own knowledge and understands the need for further education	Discussion of basic concepts in electronics. Presentation of selected topics related to the design and operation of digital electronic circuits. Introduction to microcontroller programming using the Arduino. The student understands fundamental laws of electronics, with particular emphasis on Ohm's and Kirchhoff's Laws. The student is able to explain behavior of basic electronic components such as resistors, capacitors, inductors, diodes, and transistors in electronic circuits. The student understands how basic Boolean algebra operations can be implemented using transistor based logic. The student is familiar with the internal architecture of a typical microcontroller from a programmer's perspective. The student understands the concept and operation of interrupt mechanisms in microcontroller systems. The student can identify and describe the core functional blocks of a typical microcontroller. The student is capable in using basic Arduino functions for controlling the digital and analog input/output lines of a microcontroller. The student understands the principles of operation and application of communication interfaces such as RS232C, SPI, I2C and 1Wire. The student is familiar with the working principles of basic sensors and transducers for non-electrical physical quantities such as temperature, light intensity, humidity, and pressure. The student can perform calculations of current and voltage in electronic circuits. The student is able to design simple combinational logic functions. The student can minimize combinational logic expressions using Karnaugh maps. The student is capable of explaining the operation of basic sequential logic elements such as RS flip-flops, latches, D flip-flops, JK-Master-Slave flip-flops, counters, and shift registers. The student can develop simple embedded programs using the Arduino IDE. The student is able to carry out basic simulations of electronic circuits using software tools such as Tina-TI, Atanua, and VHDL.	[SK4] test/exam - oral or written

<table>
<tr><td>Subject contents</td><td>Fundamental relationships between voltage and current. Properties of resistors, capacitors, and inductors.
Concept of impedance, voltage and current sources.
Recognition and interpretation of standard electronic component symbols.
Series and parallel connections of impedances. Voltage divider principle.
Generalized Ohms Law. integrator and differentiator circuits.
Frequency and phase characteristics of analog circuits.
Operating principles of semiconductor diodes, transistors, and operational amplifiers.
Simulation of analog circuits using SPICE-based software tools.
Use of transistors as switching elements.
Fundamentals of Boolean algebra. Basic logic gates: AND, NAND, OR, NOT, XOR.
Implementation of logic gates using the 74-series NAND gate.
Concepts of combinational and sequential logic systems.
RS flip-flop as a basic memory element.
MSI functional blocks: encoder, multiplexer, demultiplexer, comparator, adder, flip-flop, register, counter.
Synthesis of logic functions. Canonical forms of logic expressions. Karnaugh maps.
Digital circuit simulation using Atanua software.
Introduction to programmable logic devices and elements of the VHDL language (GHDL).
Structure and operating principles of a typical microcontroller (ATmega328 and/or Microchip).
Internal microcontroller architecture: data and address buses, control signals, internal registers.
Integrated functional blocks within microcontrollers (SFR, GPIO, timers, CCP/PWM modules, USART, ADC converters).
Interrupt system architecture.
Microcontroller development environments (Arduino IDE, C compilers). Arduino simulation tools.
Basic communication interfaces in microcontroller systems: RS232C, SPI, I2C, 1Wire, Bluetooth, Wi-Fi.
Controlling simple input/output devices using a microcontroller.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Ability to program in the C and/or Python languages.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td></td><td>51.0%</td><td>70.0%</td></tr>
<tr><td></td><td>51.0%</td><td>30.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. M. Olszewski, "Elektronika dla Informatyków i studentów kierunków nieelektrycznych", Helion, 2022.
2. P. Horowitz, W. Hill, Sztuka elektroniki., WKŁ 1995.
3. https://www.arduino.cc</td></tr>
<tr><td>Supplementary literature</td><td>1. L. Grabowski, Pracownia elektroniczna., WSiP 1999.
2. R. Zielonko et al., Laboratorium z podstaw miernictwa., Wydawnictwo PG, 1998.
3. M. Nadachowski, Z. Kulka, Analogowe układy scalone., WKL 1979.
4. J. Pieńkoś, J. Turczyński, Układy TTL w systemach cyfrowych., WKŁ 1980.
5. P. Metzger, A. Jełowiecki, Anatomia PC,</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. State Kirchhoff's Voltage Law.
2. Explain how the NOT operation can be implemented using an NPN transistor.
3. Describe the operating principle of an RS flip-flop constructed from NAND gates.
4. Write an Arduino program that sends the string "Arduino" to the serial port.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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