GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electronics, PG_00055410		
Field of study	Mechatronics		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Obligatory subject group 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	3	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. Mirosław Mizan, doc. PG	
	Teachers	dr inż. Mirosław Mizan, doc. PG dr inż. Łukasz Sienkiewicz dr hab. inż. Leszek Jarzębowicz	

Lesson types and methods of instruction							
	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	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	5.0	50.0	100

Subject objectives

Teach students about the basic elements and electronic components, the basics of digital technology and microprocessor components, selection rules of electronic components in simple electronic circuits. Introduct to the design and operation of electronic devices and control equipment in the industry. Teach about the modern microelectronic systems in general machinery.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W05] has a basic knowledge in terms of electrical engineering, electronics and construction materials applied in mechatronics	Student explains principles of operation of basic elements and electronic systems used in industry.	[SW1] Assessment of factual knowledge
[K6_U04] is able to utilse known methods and mathematical models as well as analog and digital measurement methods for analysing and assesement of stationary continous and discrete mechatronics systems and processes	Student records time waveforms using an oscilloscope and advanced measurement and control devices. Interprets the measurement results. Operates modern electronic and measuring equipment. Measures voltage, current, power, frequency with meters. Student calculates the values of currents, voltages and powers in simple electronic circuits. Is able to select electronic components in selected systems of basic importance.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K6_W10] has a basic knowledge about development trends in terms of engineering and technical sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering, adequate for Mechatronics curse	Student knows new technical solutions in electronic systems and devices used in broadly understood mechatronic systems. Recognizes the importance of self-expanding knowledge and skills in the field of study and related areas. Combines knowledge from various fields to understand the principles of operation of modern mechatronic devices and systems.	[SW1] Assessment of factual knowledge

Subject contents	Lecture: Elements of passive electronics. Types and principle of operation of semiconductor devices. Semiconductor diode - types and properties. Bipolar, Field-effect and IGBT Transistor. Optoelectronics: photodiode, photovoltaics, light emitting diode, photoresistor, phototransistor, optocoupler, optical fibers. Application of semiconductor devices in power electronics - controlled and non-controlled rectifiers, inverters, pulsed DC converters. DC voltage stabilizers. Operational amplifier and its applications: generators, active filters, regulators. Unstabilized and stabilized power supplies. Fundamentals of digital technology - integrated circuits TTL and CMOS. Combinatory and sequential-mode integrated logic circuits. The basic types of logic gates and latches. Digital LSI devices: multiplexers, demultiplexers, decoders, adders, registers, counters. Input-output systems. Digital-to-analog and analog-to-digital converters. Examples of applications of microprocessors. Tutorials: Electronic passive components: resistors, capacitors, inductive coils, transformers - rated parameters, rules for the selection of elements to the circuit. The basic semiconductor devices: diodes, transistors (bipolar, field-effect, IGBTs), opto-electronic components (photodiode, photovoltaics, light emitting diode, photoresistor, phototransistor, optocoupler, fiber optics) - calculation of the bias point in the circuit, the choice of element type, the protective elements in the transient. Application of semiconductor devices in selected electronic circuits: rectifiers, parallel voltage stabilizer - selection of components, calculation of the currents and voltages in various states of system operation. Operational amplifier - the simple determination of the characteristics of utility systems. Fundamentals of digital technology - the design of system performing the desired function logic. The principles of mutual co-operation of digital circuits at the level of inputs-outputs and connecting of actuators - selection of components. Laboratory: Electronic measurement equipment - terms of use, protection against interference, oscilloscope recording of signals. Semiconductor diodes and their application - rectifiers. Optoelectronics and its applications - encoders, optical links. Operational amplifier and its application - basic systems based on operational amplifiers, active filters. Basic LSI logic gates of combinatoric and sequential type - principle of operation, electrical characteristics. Transducers for measurement of mechanical quantities: acceleration (accelerometer), angular velocity (gyroscopic sensor, incremental encoder), distance and displacement (laser rangefinder and displacement sensor).
Prerequisites and co-requisites	Basic knowledge in mathematics and physics at secondary level. Knowledge from the course of Electrical engineering (implemented in the previous semester).

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test on the content of lectures	50.0%	20.0%
Written midterm colloquiums (tutorials)	50.0%	40.0%
Practical exercise (laboratory)	50.0%	40.0%

Recommended reading

Basic literature	1. Pr. zb.: Elektrotechnika i elektronika dla nieelektryków. Podręcznik akademicki Mechanika. WNT, Warszawa 2005; 2. Tietze U. Schenk Ch.: Układy półprzewodnikowe. WNT, Warszawa 1996; 3. Horowitz P., Hill W.: Sztuka elektroniki. T.1+2. WKŁ, Warszawa 1996; 4. Laboratory instructions
Supplementary literature	1. Pr. zb. pod red. A. Opolskiego: Elektronika dla elektryków. Laboratorium. Wyd. PG, Gdańsk 2004; 2. Filipkowski A.: Układy elektroniczne analogowe i cyfrowe. WNT, Warszawa 2006; 3. Rusek M., Pasierbiński J.: Elementy i układy elektroniczne w pytaniach i odpowiedziach. WNT, Warszawa 2006
eResources addresses	Adresy na platformie eNauczanie: Elektronika dla kier. Mechatronika sem. 3 w r. akad. 2022/23 - Moodle ID: 24559 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24559

Example issues/ example questions/ tasks being completed	Selection of components parameter in a simple electronic circuits e.g. voltage divider. Calculation of currents and voltages in the rectifier circuits. Selection of components parameter in the voltage stabilizer. Calculation of circuits containing bipolar transistors. Analysis of the operational amplifier circuit - calculation the output voltage and transfer function of the system. Analysis of simple combinational logic circuits.
Work placement	Not applicable