

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electronics and electrical engineering, PG_00062721							
Field of study	Technologies for Industry 5.0							
Date of commencement of studies	October 2024		Academic year of realisation of subject			2024/2025		
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	1		Language of instruction			Polish		
Semester of study	2		ECTS credits			6.0		
Learning profile	general academic profile		Assessment form			exam		
Conducting unit	Katedra Inżynierii Materiałów Funkcjonalnych WETI -> Faculty of Electronics, Telecommunications and Informatics							
Name and surname	Subject supervisor		dr inż. Maciej Haras					
of lecturer (lecturers)	reachers							
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
	Number of study hours	30.0	15.0	30.0	0.0		0.0	75
	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	75		5.0		70.0		150
Subject objectives	The aim of the course is to acquaint students with the fundamentals of electrical engineering and electronics. Throughout the course, students will acquire knowledge enabling them to analyse electrical circuits using various analytical methods: (<i>i</i>) calculating current flows; (<i>ii</i>) voltage drops; (<i>iii</i>) power dissipated in loads; (<i>iv</i>) power supplied by sources. The course will introduce students into topics related to different types of electrical components (<i>passive and active</i>), their basic parameters, and the methods for selecting them based on operating conditions. During the course, students will acquire knowledge covering: (<i>i</i>) the principles of drawing electrical circuits; (<i>ii</i>) the operation principles of individual electrical and electronic components; (<i>iii</i>) the correct methods of creating/connecting circuits; (<i>iv</i>) the significance and interpretation of measured quantities. Throughout the classes, students will learn about the main technological trends in electronics, the operating principles and the construction of semiconductor devices such as the <i>pn</i> junction, bipolar junction transistors (<i>BJT</i>), field-effect transistors (<i>FET</i>), operational amplifiers (<i>OpAMP</i>), passive and active filters. The goal of the course is to familiarize students with the general principles of electrical circuit construction, the operation principles of passive and active components, and to provide students with knowledge on circuit analysis, component selection principles, and verification of calculation correctness.							

Learning outcomes	Course outcome	Subject outcome	Method of verification			
	[K6_W02] demonstrates knowledge and understanding of electronics, automation and telecommunications and systems theory, that enables identification of problems and formulation of solutions appropriate for the fourth and fifth industrial revolutions	Knowledge in the field of electrical engineering and electronics that enables understanding of the modern industrial systems operation. Ability to identify technical problems related to electrical engineering and electronics in modern production processes and innovative solutions formulation. Understanding of the requirements that Industry 4.0 and 5.0 place on specialists.	[SW1] Assessment of factual knowledge			
	[K6_K01] is aware of the need to constantly update and enrich knowledge and practical skills, and improve professional, personal and social competences	Knows that the knowledge and skills acquired during studies may need to be updated and developed to align with current trends and the needs of the labour market. Engages in self- education, keeping updated with new developments in the field and expanding the range of competencies. Understands that improving the professional competencies is crucial for the professional career. Actively participates in trainings, courses, conferences, and other forms of professional development to keep up with changing professional requirements. Takes responsibility for own personal and professional development—takes initiatives that contribute to the personal and professional growth.	[SK2] Assessment of progress of work			
	[K6_U02] identifies and solves problems related to signal processing and transmission, integrates measurement and control systems, manages electronic systems in the context of intelligent production processes	The student is able to identify issues related to signal processing and transmission in electronic systems and proposes appropriate methods for solving them. The student has knowledge of the principles of analog and digital signal processing, can identify different types of signals, and understands signal analysis methods.	[SU3] Assessment of ability to use knowledge gained from the subject			
Subject contents	 Introduction - general overview of the course, grading rules, course content, literature; Components in electrical circuits - sources (<i>current, voltage, controlled, etc.</i>), passive elements (<i>capacitance, inductance, resistance</i>); Electrical circuits - basic concepts and laws (<i>Kirchhoff's laws, Ohm's law, power balance</i>); Electrical circuits - schematics, circuits and symbols; Direct current (DC) circuits - solving (<i>Kirchhoff's law equations, node-voltage method</i>), power balance; Alternating current (AC) circuits - notion of impedance and reactance, peak, average, and root-mean- square (<i>RMS</i>)values, apparent, reactive, and active power; <i>RLC</i> circuits - current resonance, voltage resonance, passive filters - transfer and phase characteristics, quality factor; Semiconductors - basic definitions, doping, charge transport; pn junction and diode - operating principle, forward and reverse bias, characteristics, static and dynamic parameters; Bipolar junction transistors (<i>BJT</i>) - structure, operating principle, applications, characteristics, static and dynamic parameters; Operational amplifiers (<i>OpAMP</i>) - basic information, symbols, ideal amplifier - assumptions and their relation to real components; Operational amplifiers (<i>OpAMP</i>) - amplitude and phase transfer characteristics, active filters; Logic gates - gates types, truth tables, Boolean logic. Electronics of the future - trends, Moore's law, loT, energy harvesting. 					
Prerequisites and co-requisites	The student has knowledge in the field of mathematics (<i>definite and indefinite integration, differentiation</i>). The student knows rules and basics of the complex numbers calculus and the related notions(<i>modulus of a number, real/imaginary part, argument of a complex number</i>). The student can express a complex number in algebraic and polar forms and can convert a complex number between two representations. The student knows and applies the basic concepts and laws of electrical engineering (<i>Ohm's law, Kirchhoff's law, Joule's law, Ampere's law</i>). The student knows the definition and understands the differences between direct current (<i>DC</i>) and alternating current (<i>AC</i>). From a material standpoint, the student understands the differences between materials in terms of their electrical properties and knows the differences between insulator, semiconductor, and conductor. Understands the physical basis for the classification of materials according to their electrical conductivity.					

Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade				
and criteria		51.0%	20.0%				
		51.0%	30.0%				
		51.0%	30.0%				
		51.0%	20.0%				
Recommended reading	Basic literature Basic literature Supplementary literature eResources addresses	 S. Bolkowski, <i>Teoria obwodów</i> dodruk (PWN). w Podręczniki A Warszawa: Wydawnictwo WNT 2017. J. Hennel, <i>Podstawy elektroniki</i>. Wydawnictwa Naukowo-Techni A. Opolski, <i>Elektronika dla elek</i> Gdańskiej, 2002. M. Nowak and R. Barlik, <i>Porad</i>. Warszawa: Wydawnictwa Nauk P. Horowitz, W. Hill, G. Kalinow <i>elektroniki.</i> 1-2, wydanie 12. zm Komunikacji i Łączności, 2018. A. Chwaleba, A. Chwaleba, B. I Majdak, i P. Świstak, <i>Podstawy</i> Wydawnictwo WNT, 2021. P. Hempowicz, Red., <i>Elektrotec</i> <i>nieelektryków</i>, Wyd. 6, 2 dodr. v Mechanika. Warszawa: WNT, 2 J. Bartlett, M. Rogulski, i W. Sik <i>początkujących: praktyczne wp</i> <i>obwodów i mikrokontrolerów.</i> w Warszawa: APN Promise, 2022 J. Osiowski i J. Szabatin, <i>Podst</i> Wydawnictwo Naukowe PWN, J. Osiowski i J. Szabatin, <i>Podst</i> Warszawa: Wydawnictwo WNT 2017. R. F. Pierret, <i>Advanced semico</i> Mass: Addison-Wesley Pub. Co. J. W. Nilsson, <i>Electric circuits</i>, 7 D. R. Patrick and S. W. Fardo, Newnes, 2000. E. M. Purcell, <i>Electricity and ma</i> McGraw-Hill, 1985. C. K. Alexander and M. N. O. S <i>circuits</i>, 5th edition. New York, N 5. H. W. Beaty, Ed., <i>Handbook of</i> edition. New York: McGraw-Hill J. O. Bird, <i>Electrical circuit theo</i> Milton Park, Abingdon, Oxon: F R. L. Boylestad and L. Nashels <i>theory</i>, 11th edition. Upper Sadd Hall, 2013. G. Saggio, <i>Principles of analog</i> Raton, [Florida]: CRC Press, 749. M. E. Schultz, Grobs basic elect McGraw-Hill, 2011. J. C. Whitaker, Ed., <i>The electroc</i> Raton, FL: CRC Press, 2005. Adresy na platformie eNauczanie: 	elektrycznych, Wydanie 10-1 kkademickie. Elektrotechnika. : Wydawnictwo Naukowe PWN, i półprzewodnikowej. Warszawa: iczne, 2003. tryków. Wydawnictwo Politechniki nik inżyniera energoelektronika. icowo-Techniczne, 1998. iska, i B. Kalinowski, <i>Sztuka</i> nienione. Warszawa: Wydawnictwa Moeschke, G. Płoszajski, P. relektroniki, Wydanie I. Warszawa: chnika i elektronika dla w Podręczniki Akademickie. 2013. torski, <i>Elektronika dla</i> rowadzenie do schematów, r Technology in Action TM. 2. tawy teorii obwodów. T. 1, Wydanie wnictwa Naukowo-Techniczne: 2016. tawy teorii obwodów. T. 2: : Wydawnictwo Naukowe PWN, inductor fundamentals. Reading, 0, 1987. 10 th edition. Boston: Pearson, 2015. Understanding DC circuits. Boston: agnetism, 2 nd ed. New York: adiku, <i>Fundamentals of electric</i> NY: McGraw-Hill, 2013. electric power calculations, 3 rd , 2001. iry and technology, 5 th edition. Boat editon. Boca aylor & Francis Group, 2014. tronics, 11 th edition. Boca aylor & Francis Group, 2014. tronics, 11 th edition. Boca				
Example issues/	1. In the circuit shown in the diagra	am, calculate the current flows in the	branches and the voltage drops				
example questions/	 across the individual elements. For a bipolar junction transistor 	(<i>BJT</i>): describe the operating princip	le, draw the output characteristic.				
tasks being completed	 and the symbol with labeled terminals. Operational amplifier (<i>OpAMP</i>): Draw the symbol, label all the pins, and list the parameters of an ideal operational amplifier. For the active filter circuit schematic depicted in the figure below, calculate the gain (<i>U_{out}/U_{in}</i>) as a function of frequency. 						
Work placement	Not applicable						

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