



Subject card

Subject name and code	Basics of Electronics and Metrology, PG_00047648						
Field of study	Informatics						
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			3.0		
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 inż. Sylwia Babicz-Kiewlicz					
	Teachers	dr inż. Maciej Wróbel dr hab. inż. Wiesław Kordalski dr inż. Katarzyna Karpienko dr inż. Michał Ryciewicz mgr inż. Dariusz Palmowski dr inż. Sylwia Babicz-Kiewlicz dr inż. Stanisław Galla					
Lesson types and methods of instruction	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						
	Additional information: The subject is divided into 2 Blocks: Electronics and Metrology. Within each Block, the Student passes the lecture and laboratory part: <ul style="list-style-type: none">lecture in Electronics: 25% of the final grade,laboratory in Electronics: 25% of the final grade,lecture in Metrology: 25% of the final grade,laboratory in Metrology: 25% of the final grade - each of the four exercises is 10 points (total 40 scaled to 25) = 2 points preliminary test + 6 points work in class + 2 points report It is not necessary to pass (get more than 50% of points) any part or Block. The total sum of points determines the score.						
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	2.0	13.0	75		
Subject objectives	Acquirement of basic knowledge and skills in the field of electronics and metrology						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions	Student performing experiments on a analyzes their course and effect in real time. Is able to predict the expected result of the measurement and react in case of the wrong course of the experiment. Understands the basic electrical phenomena occurring in electronic systems and can use this knowledge during the experiment.	[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
	[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	Student is aware of the pace and directions of the development of electronics and metrology.	[SW1] Assessment of factual knowledge
	[K6_W10] knows and understands to an advanced degree the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	Student examines the measurement capabilities of an analog and digital oscilloscope. Measures signal parameters: duration, frequency, phase shift. Analyzes the measurement results and assesses the measurement uncertainty.	[SW1] Assessment of factual knowledge
	[K6_U12] is able, to an advanced degree, to analyze the operation of components and systems related to the field of study, and to measure their parameters and study their technical characteristics, as well as to plan and carry out experiments related to the field of study, including measurements and computer simulations, and to interpret the obtained results and draw conclusions	Student examines the basic working circuits of the transistor. Measures the frequency characteristics of operational amplifiers. It measures basic electrical quantities: voltage, current, resistance, power and electricity.	[SU1] Assessment of task fulfilment

Subject contents	<p>Electronics:</p> <p>Lecture: Types of electronic signals; electromagnetic quasi-staticity Passive elements of electric circuits and their time-domain characteristics Kirchhoff's laws; voltage and current sources; Thevenin and Norton theorems Analysis of linear circuits with harmonic excitations Impedance and admittance; resonant circuits; filters Power in sinusoidally alternating current circuits Electrons and holes in semiconductors Semiconductor diodes and their applications Field-effect transistors Bipolar transistors Static characteristics of transistors and their small-signal models Signal amplification; frequency characteristics of amplifiers Operational amplifiers Basic logical functors: Inverter, NAND, NOR. Laboratory: As part of the laboratory classes, the student should complete at least two of the following eight exercises: 1. Examination of the input stage of an operational amplifier. 2. Example applications of an operational amplifier. 3. Negative feedback. 4. Basic operating circuits of a bipolar transistor. 5. Basic operating circuits of a MOS transistor. 6. Two-stage amplifier. 7. Power amplifier. 8. Active filter (resonant amplifier).</p> <p>Metrology:</p> <ol style="list-style-type: none"> 1. Basic metrology concepts: measurement, transducer, device, measurement system 2. Digital oscilloscope: operating principle, triggering methods, applications 3. Oscilloscope measurement methods: phases, pulse parameters, X/Y characteristics of elements and systems 4. Digital methods of measuring time intervals, discretization error 5. Digital methods of measuring low and high frequencies 6. Digital phase measurements 7. Characteristics of digital voltage measurement methods 8. Integration A/C converters with double integration 9. Measurements of alternating voltages: measured parameters, AC/DC converters of effective value (True RMS) 10. Digital multimeters: resistance/voltage converters 11. Digital methods of measuring impedance parameters R, L, C, Z 															
Prerequisites and co-requisites	It is obligatory to read the Health and Safety Rules and the Regulations of the Metrology Laboratory. The teachers determine the form of verification of that. Without familiarizing yourself with the Health and Safety Rules and the Laboratory Regulations, it is not possible to start classes in the metrology laboratory.															
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="448 1720 794 1753">Subject passing criteria</th> <th data-bbox="794 1720 1139 1753">Passing threshold</th> <th data-bbox="1139 1720 1485 1753">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1753 794 1809">Kolokwium/Prace domowe w formie grywalizacji</td> <td data-bbox="794 1753 1139 1809">0.0%</td> <td data-bbox="1139 1753 1485 1809">25.0%</td> </tr> <tr> <td data-bbox="448 1809 794 1843">Kolokwium</td> <td data-bbox="794 1809 1139 1843">0.0%</td> <td data-bbox="1139 1809 1485 1843">25.0%</td> </tr> <tr> <td data-bbox="448 1843 794 1899">Test wstępny + Praca na zajęciach + Sprawozdanie</td> <td data-bbox="794 1843 1139 1899">0.0%</td> <td data-bbox="1139 1843 1485 1899">25.0%</td> </tr> <tr> <td data-bbox="448 1899 794 1933">Sprawozdanie</td> <td data-bbox="794 1899 1139 1933">0.0%</td> <td data-bbox="1139 1899 1485 1933">25.0%</td> </tr> </tbody> </table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Kolokwium/Prace domowe w formie grywalizacji	0.0%	25.0%	Kolokwium	0.0%	25.0%	Test wstępny + Praca na zajęciach + Sprawozdanie	0.0%	25.0%	Sprawozdanie	0.0%	25.0%
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Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Taylor J. R., Wstęp do analizy błędu pomiarowego, PWN, 2. Tumański S., Technika pomiarowa, WNT, 3. Chwaleba A., Poniński M., Siedlecki A., Metrologia elektryczna, WNT, 4. Stabrowski M., Cyfrowe przyrządy pomiarowe. PWN, 5. Nawrocki W., Komputerowe systemy pomiarowe, WKiŁ, 6. Dusza J. i inni, Podstawy miernictwa. Wyd. Politechniki Warszawskiej 7. Guide to the Expression of Uncertainty in Measurement. Wydanie polskie: Wyrażenie niepewności pomiaru, Przewodnik, Główny Urząd Miar 8. Sedra A., Microelectronic circuits, HRW, New York, 10. Osiowski J., Szabatin J., Podstawy teorii obwodów, t.2, WNT, 11. Stabrowski M., Cyfrowe przyrządy pomiarowe, PWN, 12. Instrukcje i materiały pomocnicze do laboratorium
	Supplementary literature	<p>A. Filipkowski: Układy elektroniczne analogowe i cyfrowe, WNT</p> <ul style="list-style-type: none"> • Domańska A., Barzykowski J., Kujawińska M., <i>Współczesna metrologia wybrane zagadnienia</i>, WNT 2016 • Jakubiec W., Malinowski J., <i>Metrologia wielkości geometrycznych</i>, PWN 2018 • Bewoor A. K., Kulkarni V. A., <i>Metrology & Measurements</i>, Tata McGraw-Hill Education 2009 (dostępna częściowo w books.gogle) • Banerjee G. K., <i>Electrical And Electronic Measurements</i>, PHI Learning Pvt. Ltd (dostępna częściowo w books.gogle)
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>PEiM - Elektronika, W/L, INF, st., sem.2 , 2024/2025 - Moodle ID: 42109 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42109</p> <p>Metrologia - Wykład EiT/ACiR/IBM/INF 2025 - Moodle ID: 27353 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27353</p> <p>Podstawy Elektroniki i Metrologii - Metrologia Laboratorium -2024/2025 - Moodle ID: 24320 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24320</p>
Example issues/ example questions/ tasks being completed	<p>Principle of operation of an integrating voltage to time converter. Use of an oscilloscope to observe and measure the parameters of analogue and digital signals.</p>	
Work placement	Not applicable	

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