GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Electronics and Metrology, PG_00047648		
Field of study	Informatics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
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 hab. inż. Wiesław Kordalski dr inż. Maciej Wróbel mgr inż. Dariusz Palmowski dr inż. Michał Rycewicz dr inż. Stanisław Galla dr inż. Sylwia Babicz-Kiewlicz	

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						

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_W05] Knows and understands, to an advanced extent, methods of supporting processes and functions, specific to the field of study	Student understands the concept of the measurement system. Knows the simplified construction and tasks of the measuring system. Recognizes the need to properly build the system in the context of performed tasks. Kows alternative programming environments used in building a measurement system.	[SW1] Assessment of factual knowledge
	[K6_W06] Knows and understands the basic processes occurring in the life cycle of devices, facilities and systems specific to a given field of study.	Student knows and understands the processes that cause the uncalibration of measuring instruments. Is able to determine and qualify the reasons for the change of the boundary error value of the device. Understands the need to operate the device under certain conditions and the risk associated with working outside the rated conditions.	[SW1] Assessment of factual knowledge
	[K6_W42] Knows and understands, to an advanced extent, architecture, design principles and methods of hardware and software support for local and distributed information systems, including computing systems, databases, computer networks and information applications, as well as the principles of human cooperation with computers and computer-aided teamwork	Student understands the concept of the measurement system. Performs experiments using ddicated programs and computer-assisted measurement equipment.	[SW3] Assessment of knowledge contained in written work and projects
	[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.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Course outcome	Subject outcome	Method of verification
[K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	Student calibrates analog and digital electrical meters. Performs measurements of basic electrical parameters: voltage, current, resistance, power and energy. Explores measurement functions of a digital oscilloscope. Measures signal parameters: time, frequency, phase shift. Student organizes measurement system and measures parameters of selected A/D converters. Analyzes measurement results and evaluate measurement accuracy. Student defines signal types and timings. Recognizes basic properties of periodic and non-periodic signals spectrum. Classifies signal sources and RC circuits. Describes operational amplifiers and RC and relaxation oscillators. Explains digital measurement methods of time, frequency and phase shift. Describes rules of voltage to digital code conversion. Student recognizes architecture and operation modes of a digital oscilloscope. Classifies measurement systems and interfaces. Performs measurements of basic electrical parameters. Student organizes measurement system and measures parameters of selected A/D converters. Explores basic układy pracy tranzystora. Performs measurement of frequency characteristic of operational, resonant and audio frequency amplifiers.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Subject contents

1. Introduction to basic of electronics. 2. Electronic signals: kind and their cours time, into it : detailed description of harmonical signal, AM, FM, PM signals. 3. Spectrum of periodic signals: Fourier sequence, examples of signals abouy different spectra, into it spectrum of rec-tangular wave and AM signal. 4. Distortions of periodic signals: unlinear distortions (intermodulation) and linear distortions, influence of freguency characteristic of road on form of signal, typical distortions of rectangular wave. 5. Spectrum of periodic signal: Fourier integral, spectrum of rectangular pulse, spectrum of acoustic and video signals. 6. Noises, digital signals and principles of convertion of analog signals to didital signals, into it Nyquist condition. 7. Sources of signals, electric sources and measures of signals, into it: a statement about supplementary source, electronic circuits as sources of signals, absolute and relative signals. 8. RC circuits and their influence on electronic signals: switching of circuit, integral and compensate circuits, elementary low-pass and high-pass filters. 9. Voltage and current resonance, resonance LC circuits, quartz resonator. 10. Detection, demodulation and decoding of sugnals. 11. Amplification of signals transistors. 12. Amplifier with negative feedback, differential amplifier, push-pull and operational amplifier. 13. Harmonic generators. 14. Relaxetion oscilators. 15. Signal synchronisation. 16. Introduction. Basic metrological terms: measurement, converter, measuring instrument and system, measurement errors, standard and extended uncertainty. 17. Oscilloscope: Block diagram, principles of operation. 18. Time base generator, triggering methods. 19. Oscilloscope measurement methods: phase, pulse parameters, observation of device characteristics. 20. Digital method of time-interval measurement, +/-1 count error. 21. Digital methods of low and high frequency measurements. 22. Phase measurements. 23. Classification and characterization of digital voltage measurements methods. 24. Dual-slope integration ADC. 25. Voltage to frequency integration ADC. 26. DACs with binary weighted resistors and R-2R ladder. 27. Compensation ADC with successive-approximation. 28. Flash ADC. 29. Measurements of AC voltage, AC/DC converters of true RMS value. 30. Digital multimeters: 2 & 4-wire resistance to voltage converters. 31. Digital storage oscilloscope, architecture, sampling techniques, modes of operations, applications. 32. Digital measurement methods of impedance parameters R, L, C, |Z|. 33. Classification and characterization of measuring systems. 34. Measuring systems based on general purpose interface bus (GPIB), signals and lines, three wire handshake process. 35. Creating of virtual instruments.

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

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquiums	50.0%	50.0%
Practical exercises	50.0%	50.0%

Recommended reading	Basic literature	1. Taylor J. R., Wstep 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 niepewnosci pomiaru, 8. Przewodnik, Główny Urząd Miar 9. Sedra A., Microelectronic circuits, HRW, New York, 10. Osiowski J., Szabatin J., Podstawy teorii obwodów, t.2, WNT, 11. Stabrowki M., Cyfrowe przyrządy pomiarowe, PWN, 12. Instrukcje i materialy pomocnicze do laboratorium
	Supplementary literature	A. Filipkowski: Układy elektroniczne analogowe i cyfrowe, WNT
	eResources addresses	Adresy na platformie eNauczanie: PEiM - Metrologia INF st. 2023/2024 - Moodle ID: 35106 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=35106 PEiM - Metrologia INF st. 2023/2024 - Moodle ID: 35106 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=35106
Example issues/ example questions/ tasks being completed	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.	
Work placement	Not applicable	