GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of Electronics and Metrology, PG_00058908		
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	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	7.0
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. Sylwia Babicz-Kiewlicz dr hab. inż. Jacek Jakusz 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	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	10.0	120.0	175

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 defines the types of signals and their time courses. Recognizes the basic properties of the spectrum of signals. Classifies signal sources.	[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 describes operational amplifiers. Explains digital methods of measuring frequency, period and time. Describes methods for converting voltage to digital value. Classifies measurement interfaces.	[SW1] Assessment of factual knowledge
[K6_W08] Knows and understands the fundamental dilemmas of modern civilisation and basic economic, legal and other conditions of various types of activities related to the field of study, including the basic concepts and principles in the field of industrial property and copyright protection.	Student is aware of the pace and directions of the development of electronics and metrology.	[SW1] Assessment of factual knowledge
[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 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
[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 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.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents

1. Introduction. 2. Passive components and independent sources in DC, frequency and time domains. 3. Ohm's and Kirchhoff's laws. 4. Norton"s theorem. 5. Loop currents" and node voltages" methods. 6. Basic circuits analysis in frequency domain. 7. Electronic signals: types and timings. 8. Bipolar transistor (BJT): properties and Ebers-Moll model. 9. BJT static characteristics 10. DC and AC analysis of BJT based amplifier 11. Unipolar transistor (MOS): properties and Shichman-Hodges model 12. MOS static characteristics 13. DC and AC analysis of MOS based amplifier 14. Basic electronic circuits: operational amplifier, oscillator. 15. Basic logical gates: Invert, Nand, Nor 16. Basic metrological terms: measurement, converter, measuring instrument and system, measurement errors, standard and extended uncertainty. 17. Analog 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. DAC with R-2R ladder. 27. Flash ADC. 28. ADC with subrange 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. Virtual instruments.

Prerequisites and co-requisites

It is obligatory to read the Health and Safety Rules and the Regulations of the Metrology Laboratory. Teachers determine the form of verification. 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
Practical exercise	50.0%	50.0%
Colloquiums	50.0%	50.0%

Recommended reading

Basic literature	1. A. Sedra: Microelectronic circuits, HRW, New York, 2. M. Stabrowski: Cyfrowe przyrządy pomiarowe, PWN, 3. Instrukcje i materialy pomocnicze do laboratorium na www.eti.pg. gda.pl/katedry/kose/dydaktyka/,
Supplementary literature	1. A. Filipkowski: Układy elektroniczne analogowe i cyfrowe, WNT, 2. J. Dusza, i inni: Podstawy miernictwa, Wyd. Politechniki Warszawskiej,
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable