Subject card

Subject name and code	Functional Modules of Electronic Systems, PG_00048100					
Field of study	Electronics and Telecommunications					
Date of commencement of studies	October 2024		Academic year of realisation of subject		2027/2028	
Education level	first-cycle studies		Subject group		Optional subject group 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	4		Language of instruction		Polish	
Semester of study	7		ECTS credits		3.0	
Learning profile	general academic profile		Assessment form		exam	
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics					
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Andrzej Kwiatkowski				
	Teachers	dr inż. Andrzej Kwiatkowski				

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30	3.0	42.0	75

Subject objectives	The aim of the course is to provide to students a knowledge about design, operation and parameters of the ADC, DAC and sample S/H device. As part of the course the student also learns the principle of modular devices, types of switches used in analogue commutators and examples of amplifiers configurations applied in measuring systems.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U06] can analyse the operation of components, circuits and systems related to the field of study, measure their parameters and examine technical specifications	Student analyzes the operation of selected constructions of DAC and ADC converters. He measures the parameters of the switches analog and organizes a modular measuring system based on USB interface.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
	[K6_W31] Knows the definitions of measurement error and uncertainty, measurement methods, including digital methods of time, frequency and phase measurements, transducer properties and knows digital signal processing systems.	The student recognizes and knows how to define the basic parameters of S/H devices, DAC and ADC converters Knows digital methods of signal generation of any shape. Student explains the rules of convert a digital code into voltage value and voltage value to digital value. Describes processes of amplification and commutation signals in measurement devices.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	1. Introduction and course grading 2. Elements of measurement path of measurement systems and virtual instruments 3. Programmed sources of measurement arbitrary AC and DC signals 4. Direct methods of frequency synthesis with constant and variable number of samples over period 5. Characteristics and static / dynamic parameters of digital-to-analog converters 6. Analog-to-digital converter with increase summation of voltage and current 7. Multiplying two- and four quadrant digital-to-analog converters 8. Analog-to-digital converters classification, static and dynamic parameters 9. Multi-slope integrating A/D converters 10. Sigma-delta A/D converters 11. Multiple signal folding A/D converters 12. Parallel (flash) and serial A/D converters 13. Sample-and-hold and sample-and-track fast circuits 14. Data acquisition cards 15. Analog one or multi stage multiplexers 16. Analog switch (reed relays, CMOS, J-FET, Opto-MOS) 17. Programmable measurement amplifiers 18. Galvanic isolation circuits 19. Circuits of electronic isolation of elements from electrical network using follower

Prerequisites and co-requisites	

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		50.0%	70.0%
		50.0%	30.0%
Recommended reading	Basic literature	1. Jakubiec J., Roj.: Pomiarowe przetwarzanie próbkujące. Wyd. Politechniki Śląskiej. 2. Łakomy M., Zabrodzki J.: Scalone przetworniki a/c i c/a. PWN. 3. Noty aplikacyjne przetworników a/c i c/a Analog Devices	
	Supplementary literature	1. Kulka Z., Libura A., Nadachowski M.: Przetworniki a/c i c/a, WKiŁ 2. Winiecki W.: Organizacja komputerowych systemów pomiarowych, Oficyna Wyd. Politechniki Warszawskiej	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		