Załącznik nr 9
do Zarządzenia Rektora PŚk Nr 35/19
w brzmieniu ustalonym Zarządzeniem Nr 12/22

COURSE DESCRIPTION

Course code	full-time studies	**E-ID-EN-02-s2**
	part-time studies	**E-IZ-EN-02-s2**
Course name	**Miernictwo cyfrowe**	
Course name in English	**Digital measurements**	
Valid from academic year	**2022/23**	

PLACEMENT IN THE TEACHING PROGRAM

Field of study	**Computer Science**
Level of education	**1st degree**
Studies profile	**General**
Form and method of teaching classes	**Full-time and part-time studies**
Specialization	**All specializations/Information systems / Computer graphics / Information and communication technology**
Organizational unit responsible for the course	**Department of Computer Science, Electronics and Electrical Engineering**
Course coordinator	**Jerzy Augustyn, KUT prof., DSc, PhD**
Approved by	**Dean of the Faculty of Electrical Engineering, Automatic Control and Computer Science Roman Deniziak, KUT prof., DSc, PhD**

GENERAL CHARACTERISTIC OF THE COURSE

Course affiliation		**Computer Science**
Course status		**Obligatory**
Language		**English**
Semester	full-time studies	**Semester II**
	part-time studies	**Semester II**
Requirements		**Mathematical analysis and algebra, Fundamentals of electronics, Theory of logic systems**
Exam (YES/NO)		**No**
ECTS		**3**

Course form		**lecture**	**classes**	**laboratory**	**project**	**other**
Hours per semester	full-time studies	**30**		**15**		
	part-time-studies	**18**		**9**		

LEARNING RESULTS

Category	Result Symbol	Learning Results	References to the field of study results
Knowledge	W01	has ordered knowledge of the theory of electric circuits as well as the theory of signals and methods of their processing	INF_W5
	W02	has basic knowledge in the field of metrology, knows and understands the methods of measuring and extracting basic quantities characterizing electronic components and systems of various types, knows the computational methods and IT tools necessary to analyze the results of the experiment	INF_W5
	W03	knows the principles of measuring apparatus application and the properties of basic measuring instruments, knows the principles of measurement systems operation	INF_W5
Skills	U01	can use properly selected measuring methods and instruments that enable the measurement of basic quantities characterizing electrical and electronic elements and systems, is able to design and realize a simple measurement system	INF_U5
	U02	is able to use the computer methods in measurements	INF_U5
Social competence	K01	is aware of the importance of knowledge in solving engineering problems in the field of metrology and the need for continuous improvement of professional competences	INF_K1
	K02	understands the potential consequences of decisions made on the basis of incomplete knowledge related to the uncertainty evaluation of measurement results	INF_K2

COURSE CONTENT

Course Form	Content
lecture	Elements of circuit theory. Basic concepts of metrology. Units and systems of measures. Standards of electrical quantities and time, Measurement error, error limits, calculation of uncertainty of the measurement result. Measuring converters. Classification of measurement signals. Sampling, quantization and coding of signals. Methods of writing binary numbers. Signal processing in the time and frequency domains. Fourier transform, properties of the discrete Fourier transform (DFT). Digital-to-analog and analog-to-digital conversion: selected processing methods. Errors in measurements of discrete signals. Analog-to-digital interface. Measurements of time, frequency and phase shift. Digital methods for measuring voltage, current, power and energy. Digital methods of measuring resistance and impedance. Algorithmic methods in measurements. Millimeters and digital oscilloscopes. Arbitrary waveform generators. Sensor measuring systems. Measurement systems.
laboratory	Selected issues from: Application of a digital millimeter in measurements. Digital frequency and phase shift measurement Examination of the analog-to-digital converter. Application of the digital oscilloscope in measurements. Digital signal processing.

LEARNING RESULTS VERIFICATION METHODS

Result Symbol	Learning results verification methods					
	Oral Exam	Written Exam	Midterm	Project	Report	Other
W01			x			
W02			x			
W03			x			x
U01					x	
U02					x	
K01						x
K02					x	

ASSESSMENT FORMS AND CRITERIA

Course Form	Assessment Form	Assessment Criteria
lecture	pass with a grade	Obtaining over 50% of the colloquium points
laboratory	pass with a grade	Obtaining a positive assessment from all laboratory reports. Obtaining over 50% of the colloquium points

STUDENT'S VOLUME OF WORK

ECTS Balance												
No.	Activity Type	Student Involvement										Unit
		full-time studies					part-time studies					
1.	Participation in classes according to the schedule	Lec	C	Lab	P	S	Lec	C	Lab	P	S	h
		30		15			18		9			
2.	Other (consultations, exams)	1		2			1		2			h
3.	**Total with the direct assist of an academic teacher**	**48**					**30**					h
4.	**Number of ECTS, that students obtains with the direct assist of an academic teacher**	**1,9**					**1,2**					ECTS
5.	**Hours of unassisted student work**	**27**					**45**					h
6.	**Number of ECTS that student obtains working unassisted**	**1,1**					**1,8**					ECTS
7.	**Practical classes volume of work**	**27**					**27**					h
8.	**Number of ECTS obtained by student at practical classes**	**1,1**					**1,1**					ECTS
9.	**Total student's volume of work expressed in hours**	**75**					**75**					h
10.	**ECTS**	**3**										

BIBLIOGRAPHY

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3. Lyons R.G.: Wprowadzenie do cyfrowego przetwarzania sygnałów, WKiŁ Warszawa, 2010. (Lyons R. G.: Understanding Digital Signal Processing, Pearson Education, 2010)
4. Chwaleba A,. Poniński M., Siedlecki A.: Metrologia elektryczna, WNT, Warszawa, 2010
5. Kamieniecki A.: Współczesny oscyloskop. Budowa i pomiary, wydawnictwo BTC, 2009
6. Skubis T. Opracowanie wyników pomiarów, Wydawnictwo Politechniki Śląskiej, Gliwice 2003