

Course syllabus

binding for the doctoral students of the CUT Doctoral School commencing their studies
in the academic year 2022/2023

Information on the course

Name of the course in Polish	Techniki pomiaru i metodyka opracowania wyników
Name of the course in English	Techniques of measurement and methodology for development of the results
Number of the ECTS points	1
Language of instruction	Polish
Category of the course	Elective
Field of education	Engineering and Technology
Discipline of education	Automatic Control, Electronics and Electrical Engineering
Person responsible for the course Contact	Krzysztof Tomczyk, <i>doctor habilitatus</i> in Engineering, prof. of CUT krzysztof.tomczyk@pk.edu.pl

Type of course, number of hours in the study programme curriculum

Semester	Credit type (G / NG)*	Lecture	Practical class	Laboratory	Computer laboratory	Project class	Seminar
2, 3, 4, 5	G	8	0	0	7	0	0

*G – graded credit, NG – non-graded credit

Course objectives

Code	Objective description
Objective 1	Introduction to the problems of measurement techniques and methodology for processing results.
Objective 2	Introduction to computer-based methods for processing measurement results.

Learning outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUT DS	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	The doctoral student knows and understands the theoretical foundations related to measurement techniques.	E_W01 E_W02	Attendance in class, written test
EUW2	The doctoral student knows and understands the theoretical foundations related to methodologies for processing measurement results.	E_W01 E_W02	Attendance in class, written test
OUTCOMES RELATED TO SKILLS			

EUU1	The doctoral student is able to prepare a report regarding the correct processing of measurement results.	E_U01	A computer laboratory report
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	The doctoral student is prepared to critically evaluate contemporary measurement techniques and methods for processing results presented in the literature.	E_K01 E_K03	Discussion

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Analogue and digital measurement techniques. Determination of errors and uncertainties in direct and indirect measurements.	EUW1, EUW2	4
W2	Uncertainties in correlated and uncorrelated measurements.	EUW2	2
W3	Errors and uncertainties in measurement data approximation.	EUW2	2
COMPUTER LABORATORY			
Lk1	Determination of errors in direct and indirect measurements.	EUW1, EUW2, EUU1, EUK1	2
Lk2	Determination of uncertainties in direct and indirect measurements.	EUW1, EUW2, EUU1, EUK1	2
Lk3	Application of the Monte Carlo method and the polynomial procedure to problems of measurement data approximation.	EUW1, EUW2, EUU1, EUK1	3

The ECTS points statement

WORKING HOURS SETTLEMENT	
Type of activity	Average number of hours (45 min.) dedicated to the completion of an activity type
SCHEDULED CONTACT HOURS WITH THE ACADEMIC TEACHER	
Hours allotted in the syllabus	15
Consultations	1
Course credit assignment	2
HOURS WITHOUT THE PARTICIPATION OF THE ACADEMIC TEACHER	
Independent study of the course contents	6
Preparation of a paper, report, project, presentation, discussion	6
ECTS POINTS STATEMENT	
Total number of hours	30
The ECTS points number	1

Preliminary requirements

No.	Requirements
1	Knowledge of basic problems related to electrical metrology.

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	Attendance in class, successful completion of a test on knowledge covered in the lecture, submission of computer laboratory reports.
METHOD OF THE FINAL GRADE CALCULATION	
The final grade is the arithmetic mean of the grade on the test of knowledge covered in the lecture and the final grade in the computer laboratory class.	

Additional information

None

The course reading list

1	Barzykowski J. et al., <i>Współczesna metrologia. Wybrane zagadnienia</i> . WNT, 2004.
2	Ziętek B. <i>Opracowanie wyników pomiaru</i> . UMK, 2001.
3	Skubis T. <i>Opracowanie wyników pomiarów. Przykłady</i> . WPS, 2003.
4	BIPM, IEC, IFCC, ILAC, ISO, IUPAP, OIML, <i>Guide to the Expression of Uncertainty in Measurement. Supplement 2 – Extension to any Number of Output Quantities</i> , 2011.
5	BIPM, IEC, IFCC, ILAC, ISO, IUPAP, OIML, <i>Guide to the Expression of Uncertainty in Measurement. Supplement 1 – Propagation of Distributions using a Monte Carlo Method</i> , 2008.