

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Metrology		Code 1010321331010320556
Field of study Electrical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 2 / 3
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 45 Classes: - Laboratory: 15 Project/seminars: -		No. of credits 4
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 4 100% 4 100%
Responsible for subject / lecturer: Prof. dr hab. inż. Anna Cysewska-Sobusiak email: anna.cysewska@put.poznan.pl tel. 61 665 2633 Elektryczny ul. Piotrowo 3A, 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of mathematics, physics, electrotechnics and electronics
2	Skills	Ability to realize efficient self-education in the area related to the chosen field of study
3	Social competencies	Awareness of the necessity of broadening of the competences in the field of electrical engineering and willingness to work as a team
Assumptions and objectives of the course: Knowledge of measurement methodology, attributes of modern measuring devices and equipment, principles of using analog and digital measuring devices, and evaluation of measurement results		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Ability to indicate the basic principles of electrical quantities measurements made with analog and digital devices - [K_W05 +++]		
2. Ability to describe the technical attributes of measuring equipment - [K_W05 ++]		
3. Ability to explain a principle of the proper choice of elements of a simple set for measurements of electrical quantities - [K_W14 +, K_W23 +]		
Skills:		
1. Ability to use the basic electrical measuring devices in accordance with operating manuals and to explain appropriate operation of the simple measuring systems - [K_U14 +++, K_U02 ++, K_U19 +]		
2. Ability to made a simple measuring task and evaluate the inaccuracy of the obtained results - [K_U02 ++, K_U07 ++]		
Social competencies:		
1. Ability to think and act in the enterprising way in the area of measuring engineering - [K_K04 ++]		
2. Ability to work as a team - [K_K03 ++]		
Assessment methods of study outcomes		

<p>Lectures:</p> <ul style="list-style-type: none"> - evaluation of the knowledge with a written exam related to the content of lectures (test, computational and problem questions), awarding marks in laboratory exercises) - continuous estimation in all classes (awarding attendance in lectures, activity and quality of perception). <p>Laboratory exercises:</p> <ul style="list-style-type: none"> - continuous estimating with the tests, - awarding the skill increase, - the evaluation of knowledge and skills connected with the measuring tasks and prepared reports <p>Getting additional points for the activity during classes, in particular:</p> <ul style="list-style-type: none"> - the efficiency of the use of acquired knowledge to solve a given problem; - skill of the co-operation within the team practically realizing a given detailed task in the laboratory; - remarks connected with the improvement of didactic materials; - the aesthetic qualities of the reports 	
Course description	
<p>Updating 2017:</p> <p>Methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports.</p> <p>Lectures:</p> <p>Multimedia presentations expanded by examples shown on a board. Activity of students is taken into consideration in final students evaluation. Theoretical questions are presented in the exact reference to the practice.</p> <p>Laboratory:</p> <p>Detailed reviewing of particular exercises reports. Realization of laboratory tasks in teams, taking into account the specific computational experiments covering:</p> <p>Methodology of measurements: definitions, terms, units of measurement. The current standards and recommendations. Kinds of experiments. Planning and accomplishment of measuring tasks. Analysis of errors and uncertainty of measurement results. Static and dynamic properties of measuring devices and instruments. Methods of measurement. Measuring transducers: detectors of alternating voltage, measuring amplifiers, A/C and C/A converters. Electromechanical and electronic measuring devices. Analog and digital measurements of electrical quantities. Measurements with oscilloscopes. Introduction to measuring systems. Examples of measurements of electrical quantities and evaluation of their results.</p>	
<p>Basic bibliography:</p> <ol style="list-style-type: none"> 1. A. Cysewska-Sobusiak - Podstawy metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, Poznań 2010 2. A. Chwaleba, M. Poniński, A. Siedlecki - Metrologia elektryczna, wyd. 9 zm., WNT, Warszawa 2011 3. J. Rydzewski - Pomiary oscyloskopowe, WNT, Warszawa 2007 4. A. Cysewska-Sobusiak, Z. Krawiecki, A. Odon, P. Otomański, D. Turzeniecka, G. Wiczyński - Laboratorium z metrologii elektrycznej i elektronicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2000 5. Prokop D., Filtr sygnałów prądowych w układach kondycjonowania systemów pomiarowych, Poznan University of Technology Academic Journals, Electrical Engineering, No 91, Poznań 2017, s. 93-100 6. Hulewicz A., Krawiecki Z., Narzędzia statystyczne w procesie normalizacji wyników pomiarów, Poznan University of Technology Academic Journals, Electrical Engineering No 88, Computer Applications in Electrical Engineering 2016, Poznan 2016, s. 251-260 7. Hulewicz A., Rozwiązania układowe oraz parametry detektorów wartości szczytowej, Elektronika, nr 7 2014, s. 149?153 	
<p>Additional bibliography:</p> <ol style="list-style-type: none"> 1. S. Bolkowski - Elektrotechnika, Wydawnictwa Szkolne i Pedagogiczne, Warszawa 2009 2. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Główny Urząd Miar, Warszawa 1996 3. S. Tumański - Technika pomiarowa, WNT, Warszawa 2007 4. T. Zieliński - Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2007 5. www.bipm.org 6. www.gum.gov.pl 	
Result of average student's workload	
Activity	Time (working hours)

1. Participation in lectures	45	
2. Participation in laboratory exercises	15	
3. Participation in consulting with lecturers	9	
4. Preparation to laboratory exercises and preparation of the reports	15	
5. Preparation to the exam	17	
6. Participation in the exam	4	
Student's workload		
Source of workload	hours	ECTS
Total workload	105	4
Contact hours	73	3
Practical activities	39	1