

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Metrology</b>		Code <b>1010324311010320556</b>
Field of study <b>Electrical Engineering</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>1 / 1</b>
Elective path/specialty <b>-</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>First-cycle studies</b>	Form of study (full-time, part-time) <b>part-time</b>	
No. of hours Lecture: <b>30</b> Classes: <b>-</b> Laboratory: <b>20</b> Project/seminars: <b>-</b>		No. of credits <b>5</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b> <b>Technical sciences</b>		ECTS distribution (number and %) <b>5 100%</b> <b>5 100%</b>
<b>Responsible for subject / lecturer:</b>  dr inż. Przemysław Otomański email: przemyslaw.otomanski@put.poznan.pl tel. 61 665 2599 Elektryczny ul. Piotrowo 3A, 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Basic knowledge of mathematics, physics, electrotechnics and electronics
2	<b>Skills</b>	Ability to realize efficient self-education in the area related to the chosen field of study
3	<b>Social competencies</b>	Awareness of the necessity of broadening of the competences in the field of electrical engineering and willingness to cooperate in a team
<b>Assumptions and objectives of the course:</b> Knowledge of measurement methodology, attributes of modern measuring devices and equipment, principles of using analog and digital measuring devices, and evaluation of measurement results		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
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 +]		
<b>Skills:</b>		
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 ++]		
<b>Social competencies:</b>		
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 ++]		
<b>Assessment methods of study outcomes</b>		

<p>Lectures:</p> <ul style="list-style-type: none"> <li>- evaluation of the knowledge with a written test related to the content of lectures (test, computational and problem questions), awarding marks in laboratory exercises)</li> <li>- continuous estimation in all classes (awarding attendance in lectures, activity and quality of perception).</li> </ul> <p>Laboratory exercises:</p> <ul style="list-style-type: none"> <li>- continuous estimating with the tests,</li> <li>- awarding the skill increase,</li> <li>- the evaluation of knowledge and skills connected with the measuring tasks and prepared reports</li> </ul> <p>Getting additional points for the activity during classes, in particular:</p> <ul style="list-style-type: none"> <li>- the efficiency of the use of acquired knowledge to solve a given problem;</li> <li>- skill of the co-operation within the team practically realizing a given detailed task in the laboratory;</li> <li>- remarks connected with the improvement of didactic materials;</li> <li>- the aesthetic qualities of the reports</li> </ul>		
<b>Course description</b>		
<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><b>Basic bibliography:</b></p> <ol style="list-style-type: none"> <li>1. A. Cysewska-Sobusiak - Podstawy metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, Poznań 2010</li> <li>2. A. Chwaleba, M. Poniński, A. Siedlecki - Metrologia elektryczna, wyd. 9 zm., WNT, Warszawa 2000</li> <li>3. J. Rydzewski - Pomiary oscyloskopowe, WNT, Warszawa 2007</li> <li>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</li> </ol>		
<p><b>Additional bibliography:</b></p> <ol style="list-style-type: none"> <li>1. S. Bolkowski - Elektrotechnika, Wydawnictwa Szkolne i Pedagogiczne, Warszawa 2009</li> <li>2. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Główny Urząd Miar, Warszawa 1996</li> <li>3. S. Tumański - Technika pomiarowa, WNT, Warszawa 2007</li> <li>4. T. Zieliński - Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2007</li> <li>5. www.bipm.org</li> <li>6. www.gum.gov.pl</li> </ol>		
<b>Result of average student's workload</b>		
<b>Activity</b>	<b>Time (working hours)</b>	
1. Participation in lectures	30	
2. Participation in laboratory exercises	20	
3. Participation in consulting with lecturers	14	
4. Preparation to laboratory exercises and preparation of the reports	30	
5. Preparation to the exam	25	
6. Participation in the exam	4	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	123	5
Contact hours	67	2
Practical activities	59	2