

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Metrology and measuring systems		Code 1010311431010325637
Field of study Power Engineering	Profile of study (general academic, practical) general academic	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: 30 Classes: - Laboratory: 30 Project/seminars: 15		No. of credits 5
Status of the course in the study program (Basic, major, other) other		(university-wide, from another field) university-wide
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 5 100% 5 100%
Responsible for subject / lecturer: dr hab. inż. Andrzej Odon email: andrzej.odon@put.poznan.pl tel. 61 665 2599 Elektryczny ul. Piotrowo 3a, 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge in the scope of mathematics, physics and electrotechnics
2	Skills	Ability to the efficient self-education in the area concerned with the chosen of studies
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 the measurement methodology, principles of application of analog and digital devices, and evaluation of measurement results. Knowledge of the principles of construction, design and application of measurement systems.		
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_W02 +, K_W19 +++]		
2. Ability to explain a principle of the proper choice of elements of a simple set for measurements of electrical quantities - [K_W17+++, K_W19++]		
3. Ability to describe the basic methods of signal processing used in electrical metrology and in modern measurement systems - [K_W17++, K_W19++]		
Skills:		
1. Ability to make a proper choice of the measurement method and tools to realize a measurement of the basic electrical quantities and estimate inaccuracy of the obtained results - [K_U10 ++, K_U12+]		
2. Ability to plan and make a simple measurement task with a measurement system - [K_U10 ++, K_U12+, K_U15++]		
Social competencies:		
1. Ability to think and act in the enterprising and responsible way in the area of measuring engineering - [K_K01 ++, K_K04 ++]		
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> <ul style="list-style-type: none"> - Methodology of measurements: definitions, terms, notions, standards, units of measurement. - Kinds of experiments. - Planning and realization of a measurement task. - Uncertainty of results of measurements. - Static and dynamic properties of measuring devices and equipment. - Methods of measurements. - Measuring transducers: detectors of alternating voltage, measuring amplifiers, a/c and c/a convertors. - Application of analog and digital measurement devices. - Measurements with oscilloscopes. - Introduction to the structure and organization of the wire and wire-less measurement systems. - Description of properties of the selected communication interfaces. - Examples of configuration of the measurement systems. - Examples of measurements of electrical and nonelectrical quantities, and evaluation of the measurement results. 	
<p>Basic bibliography:</p> <ol style="list-style-type: none"> 1. A. Chwaleba, M Poniński, A. Siedlecki, Metrologia elektryczna, WNT, Warszawa, 2009 2. A. Cysewska-Sobusiak, Podstawy Metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, 2010 3. J. Grzelka, E. Mazur, M. Gruca, W. Tutak, Miernictwo i systemy pomiarowe - laboratorium, WPC, Częstochowa, 2004 4. W. Nawrocki, Rozproszone systemy pomiarowe, WKiŁ, Warszawa, 2006 5. J. Piotrowski, Podstawy miernictwa, Wyd. Politechniki Śląskiej, 1997 6. J. Rydzewski, Pomiary oscyloskopowe, WNT, Warszawa, 2007 7. S. Tumański, Technika pomiarowa, WNT 2007 	
<p>Additional bibliography:</p> <ol style="list-style-type: none"> 1. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Wydanie polskie, Główny Urząd Miar, Warszawa, 1996 2. W. Winiecki, Organizacja komputerowych systemów pomiarowych, Ofic. Wyd. PW, Warszawa, 1997 3. A. Zatorski, R. Sroka, Podstawy metrologii elektrycznej, Wyd. AGH, Kraków 2011 	
Result of average student's workload	
Activity	Time (working hours)

1. Participation in lectures	30
2. Participation in laboratory exercises	15
3. Participation in consulting with the teachers	20
4. Preparation to laboratory exercises and preparation of the reports	53
5. Preparation to exam	27
6. Participation in exam	3
Student's workload	
Source of workload	hours
ECTS	
Total workload	148
Contact hours	78
Practical activities	68