

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Fundamentals of metrology</b>		Code <b>1010341741010321408</b>
Field of study <b>Mathematics in Technology</b>	Profile of study (general academic, practical) <b>general academic</b>	Year /Semester <b>2 / 4</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 (Polish Qualifications Framework level six)</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>30</b> Classes: <b>-</b> Laboratory: <b>30</b> Project/seminars: <b>-</b>		No. of credits <b>5</b>
Status of the course in the study program (Basic, major, other) <b>major</b>		(university-wide, from another field) <b>university-wide</b>
Education areas and fields of science and art <b>Technical sciences Technical sciences</b>		ECTS distribution (number and %) <b>5 100% 5 100%</b>
<b>Responsible for subject / lecturer:</b>  dr hab. inż. Andrzej Odon email: andrzej.odon@put.poznan.pl tel. 61 665 2599 Faculty of Electrical Engineering -ul. Piotrowo 3a, 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Basic knowledge in the scope of mathematics, physics and electrotechnics [K_W03 (P6S_WG)]
2	<b>Skills</b>	Ability to the efficient self-education in the area concerned with the chosen of studies [K_U10 (P6S_UW)]
3	<b>Social competencies</b>	Awareness of the necessity of broadening of the competences in the field of electrical engineering and willingness to work as a team [K_K01 (P6S_KK)]
<b>Assumptions and objectives of the course:</b> Knowledge of the metrological and operational properties of basic measuring tools and evaluation of measuring results. Develop the skills of the appropriate selection of measurement methods and devices for the implementation of engineering measurement tasks		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b> 1. Well-ordered knowledge of the classification of basic measurement methods and the mathematical methods of determining measurement inaccuracy – [K_W07 (P6S_WG)] 2. Ability to describe the basic methods of signal processing used in electrical metrology [K_W07 (P6S_WG)] 3. Ability to describe the basic methods of signal processing used in electrical metrology - [K_W07 (P6S_WG)]		
<b>Skills:</b> 1. Ability to make a proper choice of the measurement method and tools to realize a measurement of the basic electrical quantities - [K_U07 (P6S_UW)] 2. Ability to plan and make a simple measurement task with a measurement system - [K_U09 (P6S_UW)]; [K_U11 (P6S_UW)]		
<b>Social competencies:</b>		

- |  |
|--|
| 1. Awareness of the limitations of his knowledge and of the need to constantly improve it - [K_K01 (P6S_KK)], [K_K02 (P6S_KK)] |
| 2. Ability to think and act in the enterprising and responsible way – [K_K03 (P6S_KO)]   |

### Assessment methods of study outcomes

#### Lectures:

- 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).

#### Laboratory exercises:

- continuous estimating with the tests,
- awarding the skill increase,
- the evaluation of knowledge and skills connected with the measuring tasks and prepared reports

#### Getting additional points for the activity during classes, in particular:

- 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

#### Updating 2018:

Methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports.

#### Lectures:

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.

#### Laboratory:

Detailed reviewing of particular exercises reports. Realization of laboratory tasks in teams, taking into account the specific computational experiments covering:

- Basic concepts of metrology
- Measuring tools - classification, metrological properties
- Basics of error calculation
- Develop of measurement results - direct measurement, indirect measurement
- Mathematical methods for determining the uncertainty of measurement.
- Electromechanical and electronic meters ? construction, principle of operation, metrological properties
- Analog converters of electrical quantities ?converters of average, RMS and peak voltage value, voltage and current transformers-
- DC and AC measurement systems,
- Power measurements in one-phase and three-phase systems
- Measurements with oscilloscopes
- A/C and C/A converters
- Digital measurements of frequency and voltage
- Selected issues of advanced measurement systems

#### Basic bibliography:

1. A. Chwaleba, M Poniński, A. Siedlecki Metrologia elektryczna, WNT, Warszawa, 2010,
2. A. Cysewska-Sobusiak Podstawy Metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, 2010
3. J. Dusza, G. Gortat, A. Leśniewski, Podstawy miernictwa, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.
4. W. Nawrocki Rozproszone systemy pomiarowe, WKiŁ, Warszawa, 2006
5. J. Rydzewski, Pomiary oscyloskopowe, WNT, Warszawa, 2007
6. S. Tumański, Technika pomiarowa, WNT 2007

#### Additional bibliography:

1. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Wydanie polskie, Główny Urząd Miar, Warszawa, 1996
2. A. Zatorski, R. Sroka, Podstawy metrologii elektrycznej, Wyd. AGH, Kraków 2011

<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	30	
3. Participation in consulting with the teachers	10	
4. Preparation to laboratory exercises and preparation of the reports	25	
5. Preparation to exam and participation in exam	30	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	125	5
Contact hours	70	2
Practical activities	55	2