STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Metrology and measuring systems	**1010315421010325637**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**(brak)**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**part-time**

No. of hours	No. of credits
Lecture: **8** Classes: **-** Laboratory: **8** Project/seminars: **-**	**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge in the scope of metrology, mathematics, physics and electrotechnics
2	**Skills**	Ability of the efficient self-education in the area of the chosen field of studies
3	**Social competencies**	Awareness of the necessity of competence broadening, ability to show readiness to work as a team

Assumptions and objectives of the course:

- Knowledge of the measurement methodology, principles of Zapoznanie się z metodyką pomiarów, zasadami eksploatacji przyrządów analogowych i cyfrowych oraz opracowywania wyników pomiarów.
- Knowledge of the principles of construction, design and applications of measurement systems.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Ability to describe the basic methods of signal processing used in electrical metrology and in modern measurement systems, especially concerned the evaluation of inaccuracy of results - [K_W05 +++]
2. Ability to indicate the basic principles of electrical quantities measurements made with analog and digital devices - [K_W05 ++]

Skills:

1. Ability to evaluate the usefulness of methods and tools used in measurements, diagnostics and support of decisions connected with energy processes - [K_W09 ++]
2. Ability to plan and make a simple measurement task with a measurement system - [K_W03 +]

Social competencies:

1. Ability to think and act in the enterprising and responsible way in the area of measurement engineering - [K_K01 ++]

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

- 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 dibital measurement devices.
- Measurements with oscilloscopes.
- Introduction to the 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.

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. 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

Additional bibliography:

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	8
2. Participation in laboratory exercises	8
3. Participation in consulting with the teachers	5
4. Preparation to laboratory exercises and preparation of reports	20
5. Preparation to exam	16
6. Participation in exam	3

Student's workload

Source of workload	hours	ECTS
Total workload	60	2

Contact hours	24	1
Practical activities	33	1