STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Disturbances in Electric Power Systems	**1010322321010314876**

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

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

No. of hours	No. of credits
Lecture: **15** Classes: **-** Laboratory: **15** 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:

dr inż. Krzysztof Walczak
email: krzysztof.walczak@put.poznan.pl
tel. 61 665 2797
Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

Responsible for subject / lecturer:

dr inż. Bogdan Staszak
email: bogdan.staszak@put.poznan.pl
tel. 61 665 2635
Faculty of Electrical Engineering
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student a basic knowledge of electrical engineering, power engineering and metrology.
2	**Skills**	Student can assemble the measurement system, can carry out measurements of basic physical quantities. Student can elaborate results. Student is able to work in a group.
3	**Social competencies**	Student understands the importance of teamwork.

Assumptions and objectives of the course:

Knowledge of both theoretical and practical problems associated with interference in electric power networks. Understanding the causes and effects of transients in power systems. Knowledge of standards of conduct consistent with the protection and coordination of power systems under disruptions.

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

Knowledge:

1. Student can name and describe basic types of disturbances occurring in the power system. - [K_W15++, K_W19+++]
2. Student is able to characterize and evaluate the resistance against disturbance of typical devices operating in the power grid. - [K_W16++, K_W19+++]
3. Student can determine the rules of procedure for reducing the impact of disturbances on devices operating in the power grid. - [K_W15++, K_W16++, K_W19+++]

Skills:

1. Student can identify the cause of the disturbances and evaluate the risks resulting therefrom for the proper operation of the power grid. - [K_U07++, K_U14++]
2. Student can examine and analyze the signals generated by various types of interferences, and assess the level of resistance to interference of selected electrical equipment. - [K_U07++, K_U14++]
3. Student can choose elements of overvoltage protection for selected electrical devices. - [K_U13++, K_U18++]

Social competencies:

1. Student is aware of the need to disseminate knowledge about the dangers of electric shock as a result of disruption or failure of the power system components. - [K_K02++]

Assessment methods of study outcomes

Lectures:

- assess the knowledge and skills demonstrated during written or oral tests

Laboratory:

- tests and rewarding knowledge necessary for the accomplishment of problems in the area of laboratory tasks,
- continuous evaluation, on each course - rewarding skills gain in the range of use of the principles and methods have met during the course,
- assessment of knowledge and skills related to the implementation of the exercise, the assessment of the report from performed exercise.

Course description

Lecture covers the following topics: classification of disturbance sources - intentional and unintended, the definitions, the basis of analysis of interfering signals occurring in power networks; transients, electromagnetic interferences, short-circuit disturbances, internal and external surges, resistance to disturbance exposure, overvoltage protection, coordination of power systems in terms of interferences.

Laboratory exercises include: measurement and evaluation of disturbances levels, study of electrical devices susceptibility an levels of resistance to electromagnetic interference, ways to reduce the impact of disturbances on the power grid.

Basic bibliography:

1. Boolen M. H., Gu I.: Signal Processing of Power Quality Disturbances, John Wiley & Sons, 2006.
2. Machczyński W.: Wprowadzenie do kompatybilności elektromagnetycznej, WPP, Poznań, 2004.
3. Normy PN-EN 61000-6-1/2/3/4: Kompatybilność elektromagnetyczna (EMC) ? Wymagania dot. odporności i emisyjności.
4. Flisowski Z.: Technika wysokich napięć, WNT, Warszawa, 2005.

Additional bibliography:

1. Charoy A.: Kompatybilność elektromagnetyczna. Zakłócenia w urządzeniach elektronicznych, t. I-IV,WNT, Warszawa, 1999.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	15
2. Participation in laboratory activities	15
3. Consultation	3
4. Preparation for laboratory activities and elaboration of the report	10
5. Preparation for tests	10
6. Participation in written or oral tests	2

Student's workload

Source of workload	hours	ECTS
Total workload	55	2
Contact hours	35	1
Practical activities	28	1