STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Control and automatics in electric power system	**1010315441010315654**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**(brak)**	**2 / 4**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Electrical Power Engineering	**Polish**	**obligatory**

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

No. of hours	No. of credits
Lecture: **16** Classes: **-** Laboratory: **12** Project/seminars: **8**	**5**

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	**5 100%**
Technical sciences	**5 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has basic knowledge of electric circuits theory, electrical machines, electric power engineering and electric power generation.
2	**Skills**	Has ability to study, individually and effectively, the domain related to the chosen specific field, to combine the knowledge acquired in the courses completed up to now.
3	**Social competencies**	Is aware of the necessity to extend his knowledge and competencies, is ready to undertake the cooperation and act as a team member.

Assumptions and objectives of the course:

Getting familiar with tasks and functions of the automatic protections and control systems in the electric power system?s operation as well as with design fundamentals of the protection and control elements.

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

Knowledge:

1. Get acquired a knowledge necessary to understand the energy safety problems including appearing risks and ways to enhance the safety level - [K_W15++]
2. Has an ordered and theory-underpinned knowledge of information management, operational control structure, tele-mechanic systems and data acquisition systems układów telemechanik - [K_W17++]

Skills:

1. Is able to use as well as to modify, if needed, the acquired methods and mathematical models to analyze and to design the electric power networks and systems - [K_U06+++,]
2. Can formulate and test hypotheses related to the electric power system and elements? analysis including mathematical tools - [K_U10++]

Social competencies:

1. Identifies and solves properly the dilemmas concerning the state?s energy safety questions - [K_K02+++]

Assessment methods of study outcomes

Lectures:

1.Assesment of the knowledge and skills shown at the written and oral examinations ,

2.Continuous assessment during courses (bonus for activity and perception quality).

Laboratory:

1.Test of the knowledge necessary to deal with problems posed in the lab tasks.

2. Assessment of the knowledge and skills related to the lab task completion,

3. Assessment of the task report.

Project:

1.On-line assesssment of the preparation to the design tasks,

2.Evaluation of the completed design task.

Course description

Lectures. Purposes, functions and criterions of the automatic electric power protections? operation (EAZ). Protection systems for generators, lines and transformers. Functions and algorithms of the SPZ and SCO automatic systems and anti-swing systems.

Structure of the Electric power system?s control systems. frequency and interchange power control system (ARCM) - primary, secondary and tertiary control. Arrangement and requirements for control. Control-accompanying transients, non-intervention rule in secondary control. Group secondary control of voltage and passive power - ARNE and ARST systems. Perspectives for the voltage and passive power tertiary control implementation. Wind power station operation under the power control conditions.

Lab: Lab investigations of the short- circuit phenomena in electric power networks. The EAZ system -based experiments. DAKAR program applications to develop the control and automatic systems in the electric power system.

Project: Design of the chosen automatic and control systems in the electric power systems.

Basic bibliography:

1. Żydanowicz J. Elektroenergetyczna automatyka zabezpieczeniowa. WNT -Warszawa, tom I (1979), tom II (1985), tom III (1989)

2. Winkler W., Wiszniewski A. Automatyka zabezpieczeniowa w systemach elektroenergetycznych. WNT ? Warszawa 1999

3. Machowski J.: Regulacja i stabilność systemu elektroenergetycznego. OWPW, Warszawa 2007..

4. Hellmann W., Szczerba Z.: Regulacja częstotliwości i napięcia w systemie elektro-energetycznym. Warszawa, WNT 1978.

Additional bibliography:

1. Kacejko P., Machowski J. : Zwarcia w sieciach elektroenergetycznych, WNT, Warszawa, 2003r

2. Machowski J., Białek J., Bumby J. Power System Dynamics: Stability and Control. IEEE Wiley, 2008.

Result of average student's workload

Activity	Time (working hours)
1. participation in lecture courses	30
2. participation in labs	30
3. participation in project classes	15
4. participation in discussions related to lectures	5
5. participation in discussions related to labs	5
6. preparation to labs	15
7. lab reports? elaboration	15
8. participation in discussions related to project	5
9. preparing and drawing up a projects	15
10. preparation to examination	20
11. taking an examination	3

Student's workload

Source of workload	hours	ECTS
Total workload	158	5
Contact hours	73	2
Practical activities	85	3