STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Electric power devices and distribution stations	**1010311451010311709**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**(brak)**	**3 / 5**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

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

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**	**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 %)

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge on electrical engineering, mathematics, physics and electrical metrology.
2	**Skills**	Able to perform mathematical and physical analysis of phenomena occurring in the electric power devices and systems and read electrical wiring schemes.
3	**Social competencies**	A sense of the need to broaden the competence and willingness to work together in a team.

Assumptions and objectives of the course:

Knowledge of phenomena occurring in electrical devices and systems as well as their mathematical and physical descriptions. Purchase of skills in the application of phenomena description to design of power supply and hazard assessment that can occurs in these systems. Knowledge of devices functioning and role of power distribution stations in system, analyze methods of station operation reliability. Able to design supply system, transformer and distribution stations and select devices. Experiment planning, selection of measurement instrument, realization of test set-up, researches performing and results analyzing.

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

Knowledge:

1. 1 Know how describe phenomena occurring in electrical devices and power supply and how they operate. - [K_W01 ++, K_W02 ++, K_W11+]

2. Know how formulate mathematical and physical description of phenomena, know principle configurations of power distribution stations, way of its functioning and analyze methods of station operation reliability. - [K_W02 +, K_W11 ++]

Skills:

1. Able to analyze the mathematical and physical descriptions of phenomena for the different operating states and conditions as well as design supply system and transformer distribution stations. - [K_U07 ++, K_U12 ++]

2. Able to perform the calculation and estimation of hazard assessment occurring in electrical devices and power supply systems as well as - [K_U07 ++, K_U12 ++, K_U16 +]

3. Able to plan of experiment, measurement instrument select, test set-up realize, perform researches and analyze of results. - [K_U10++]

Social competencies:

1. A sense of influence of proper devices selection and analysis of phenomena on ensuring supply continuity to different electricity consumers. - [K_K02 ++, K_K04 ++]

2. A sense of influence of phenomena, devices and distribution stations on the environment and the people working with electrical equipment and using them, and the consequent need for extensive cooperation both at the design stage and utilization. - [K_K02 ++, K_K04 ++]

Assessment methods of study outcomes

Lecture:

Assessment:

- to analyze the description of phenomena for selected systems, conditions and assumptions,
- to select devices and configuration of power distribution station,
- of knowledge and understanding of devices and power distribution stations functioning.

Laboratory exercises:

Skills assessment of:

- experiment planning,
- experimental set-up and devices selection,
- experiment carry out and the analyzing of results using modern methods and software,
- measurement accuracy analysis.

Getting extra points for the activity during seminar, and in particular for:

- performing analysis of phenomena, devices and power distribution stations work in system configurations and conditions that were not discussed at the lecture,
- proposing and analysis of power distribution station configurations for specific requirements,
- teamwork implementation of the extended experiment,
- use of modern methods to describe measurement results.

Course description

Heating of conductors by operating currents: determination of heating and cooling functions, steady state heating, heating by short circuit currents. Electrodynamics interactions: forces in parallel and perpendicular conductors, forces produced by alternating current and in busbar systems. Switching arc and its extinction: model of arc, DC and AC arc characteristics and extinction conditions. Transient recovery voltage (TRV) in electric power systems: periodic and non-periodic TRV in one-frequency circuit and its parameters, TRV during switching in long line ? method of traveling waves. The principles of operation and objectives of electric power devices: transformer, busbar, circuit-breakers, disconnectors, measurement transformers. Role of the transformer distribution stations in electric power system. Configuration of power stations, their equipment and operation. General principles of devices selection. Selected methods of reliability testing of station operation.

Update 2017: rated parameters, systems of power supply customer

Applied methods of education: lectures with multimedia presentation, interactive lecture with questions to student group and initiation of discussion

Basic bibliography:

1. J. Maksymiuk, J. Nowicki, Aparaty elektryczne i rozdzielnice wysokich i średnich napięć,Wydawnictwo politechniki Warszawskiej, Warszawa, 2014

2. K. Żmuda, Elektroenergetyczne układy przesyłowe i rozdzielcze. Wybrane zagadnienia z przykładami, Wydawnictwo Politechniki Śląskiej, 2014

3. I. Wasiak, Elektroenergetyka w zakresie Przesył i rozdział energii elektrycznej, Politechnika Łódzka, 2010

4. C. Królikowski, Z. Boruta, A. Kamińska, Technika łączenia obwodów elektroenergetycznych. Przykłady obliczeń, PWN Warszawa 1992

Additional bibliography:

1. J. D. Glover, M.S. Sarma, T.J. Overbye, Power System Analysis and Design, cengage Learning, Inc, Florence, KY, US, 2011

Result of average student's workload

Activity	Time (working hours)

1. participation in the class lecture	30
2. participation in the laboratory exercises	15
3. participation in the consulting on the lecture and laboratory exercises	10
4. preparation to the practical exercises	12
5. preparation of practical exercises report	16
6. preparation to the written exam	25
7. participation in the exam	2

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	110	5
Contact hours	50	2
Practical activities	31	1