STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Cooperation of the power network and local energy sources	**1010311371010315994**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electrical Engineering	**(brak)**	**4 / 7**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Power Networks and Electric Power System	**Polish**	**obligatory**

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

No. of hours	No. of credits
Lecture: **15** Classes: **-** Laboratory: **-** Project/seminars: **15**	**3**

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	**3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge in field of power network, power flow, short-circuit calculations and methods of power generation. Basic theory of protections, electric machines (transformers and synchronous and asynchronous generators) and electrical equipment.
2	**Skills**	Effective self-education in study field. Skills in basic network calculations of power flow, short-circuits and voltage regulaton.
3	**Social competencies**	Student should have consciousness of necessity of improving his competences in innovation technologies for power engeneering, readiness to work individual and cooperate within groups.

Assumptions and objectives of the course:

Studies of various source energy characteristics in normal and fault conditions. Distributed generation and operating problems in electrical networks, power quality performance, overload risk for grid elements.

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

Knowledge:

1. Systematic knowledge in construction and properties wind farms, small hydro plants, biogas plants heat and power generating plants. - [K_W09++]
2. Knowledge in distributed generation connection methods and its cooperating with distribution networks. - [KW_24+++, K_W25++]
3. Knowledge in minimization of short-circuit thermal problems and power quality degradation. - [KW_24+++, K_W25++]

Skills:

1. Skills in connection projects of distributed generation and and determine parameters for network secure exploitation. - [K_U22++, K_U23++]
2. Ability to implementation expert and design tools for determination of secure exploitation parameters for network cooperated with distributed generation. - [K_U22++, K_U23++]
3. Use knowledge of the numeric analysis for selected issues in field of distributed generation cooperated with distributed network. - [K_U22++]

Social competencies:

1. One has an awareness of usage of modern methods for designing and high-class solutions. - [K_K05++]
2. One has an awareness of economic and social acceptance for the choosen technical solution. - [K_K05++]

Assessment methods of study outcomes

- assessment of knowledge and skills on the basis of test consisting on solving of design problem.
- permanent assessment on lectures and projects.

Obtaining additional points activity during lectures and projects, in particular way for:
- activity on classes in any attempt to solving of the problem to solve,
- skill of co-operation in workgroups.

Course description

Distributed generation characteristic: wind turbines, medium size industrial combined heat and power (CHP) installations, biomass/biogas fired plants, small hydroelectric plants (SHEP). Distributed generation connections to HV, MV and LV networks. Source regulation range, voltage levels and power flows in networks Distributed generation in fault conditions. Power quality performance in networks with distributed generation. Short-circuit risk for grid components in networks with distributed generation.

Update 2017: High power hybrid power plants, wind turbines and photovoltaic In distribution networks

Applied training methods

Lecture: the theory of the closely related to practice, Multimedia lecture

Project: case study of the real MV distribution network, working in a team

Basic bibliography:

1. Kacejko P.: Generacja rozproszona w systemie elektroenergetycznym. Wydawnictwo Politechniki Lubelskiej, Lublin, 2004 r.
2. Zajczyk R.: Zwarcia w układach elektroenergetycznych, Gdańsk, 2005 r.
3. Kahl T..: Sieci elektroenergetyczne, WNT, Warszawa, 1984 r.
4. Lubośny Z.: Farmy wiatrowe w systemie elektroenergetycznym, WNT, Warszawa, 2009 r.

Additional bibliography:

1. Marszałkiewicz K., Grządzielski I., Trzeciak A.: Ocena wielokryterialna możliwości przyłączenia jednostek wytwórczych do sieci elektroenergetycznej średniego napięcia. Wiadomości Elektrotechniczne, Warszawa, 2012, 1 - ISSN 0043-5112 ss. 3-8.
2. Thekla N., Boutsika A., Papathanassiou S.A.: Short-circuit calculations in networks with distributed generation. Electric Power Systems Research 2008 No 78.
3. Marszałkiewicz K., Grządzielski I., Trzeciak A.: Impact of Voltage Conditions on Distributed Generation Connctiivity in Medium Voltage Grids. Acta Energetica, 4/25 2015 ISSN 2300-3022

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	15
2. Consultations	5
3. Preparation to final test	3
4. Final test	2
5. Participation in project classes	15
6. Project implementation	20

Student's workload

Source of workload	hours	ECTS
Total workload	60	3
Contact hours	30	2
Practical activities	40	1