

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Cooperation of the power network and local energy sources		Code 1010314391010315994
Field of study Electrical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 5 / 9
Elective path/specialty Networks and Electric Power Systems	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 9 Classes: - Laboratory: - Project/seminars: 9		No. of credits 2
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art		ECTS distribution (number and %)
Responsible for subject / lecturer: Andrzej Trzeciak email: andrzej.trzeciak@put.poznan.pl tel. 61 665 2581 Elektryczny Poznań, ul. Piotrowo 3A		
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 engineering, 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		

<p>- assessment of knowledge and skills on the basis of test consisting on solving of design problem. - permanent assessment on lectures and projects.</p> <p>Obtaining additional points activity during lectures and projects, in particular way for:</p> <p>- activity on classes in any attempt to solving of the problem to solve, - skill of co-operation in workgroups.</p>		
Course description		
<p>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.</p>		
Basic bibliography:		
<p>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.</p>		
Additional bibliography:		
<p>1. Marszałkiewicz K., Grzędzielski 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.</p>		
Result of average student's workload		
Activity	Time (working hours)	
1. Participation in lectures	9	
2. Participation in project classes	9	
3. Project implementation	30	
4. Consultations	5	
Student's workload		
Source of workload	hours	ECTS
Total workload	53	2
Contact hours	23	1
Practical activities	44	1