

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Overvoltages and overvoltage protection</b>		Code <b>1010311361010310973</b>
Field of study <b>Electrical Engineering</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>3 / 6</b>
Elective path/specialty <b>High Voltage Engineering</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>First-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>30</b> Classes: <b>-</b> Laboratory: <b>15</b> Project/seminars: <b>-</b>		No. of credits <b>3</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b> <b>Technical sciences</b>		ECTS distribution (number and %) <b>3 100%</b> <b>3 100%</b>
<b>Responsible for subject / lecturer:</b>  dr inż. Krzysztof Walczak email: krzysztof.walczak@put.poznan.pl tel. 61 665 2797 Wydział Elektryczny ul. Piotrowo 3A 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Student has a basic knowledge of electrical engineering, power engineering and metrology.
2	<b>Skills</b>	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	<b>Social competencies</b>	Student understands the importance of teamwork.
<b>Assumptions and objectives of the course:</b> Knowledge of both theoretical and practical problems associated with the occurrence of overvoltages in power networks. Understanding the causes and consequences of the overvoltage generations and ways for their limitation in electrical power systems. Knowledge of standards of conduct consistent with the principles and lightning surge protection and insulation coordination in power systems in terms of overvoltage disturbances.		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b> 1. Student can name and describe basic types of overvoltage disturbances occurring in the power system. - [K_W13++, K_W19++] 2. Student is able to characterize and evaluate the resistance against overvoltage disturbance of typical devices operating in the power grid. - [K_W13++, K_W26++] 3. Student can describe the rules of procedure for reducing the impact of the overvoltages on devices operating in the power grid. - [K_W26++]		
<b>Skills:</b> 1. Student can examine and analyze the signals generated by different types of surges and assess the level of resistance to this type of distortion for selected electrical equipment. - [K_U03+++, K_U07++] 2. Student can choose components and lightning surge protection for selected electrical equipment. - [K_U03+++, K_U12++]		
<b>Social competencies:</b> 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++]		
<b>Assessment methods of study outcomes</b>		

<p>Lectures:          - assess the knowledge and skills demonstrated during written or oral tests</p> <p>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.</p>		
<b>Course description</b>		
<p>The lecture covers the following topics: classification, statistics and imitating overvoltages, waves surge in the lines: reflections on the nodes, multiple reflections, wave attenuation, waves in multi-wire systems, the surge waves in the windings of transformers and electrical machines, atmospheric surges, internal overvoltages: dynamic, resonance, ground fault and switching, equipment for protection against overvoltages: spark, surge arresters, feints and lightning conductors, the statistical and traditional concept of insulation coordination; principles of station and line surge protection, protection of buildings.</p> <p>Laboratory exercises include: measurements and evaluation of surge disturbances levels in the power system, ways to reduce the impacts of overvoltages on the power grid.</p>		
<b>Basic bibliography:</b>		
<ol style="list-style-type: none"> <li>Hasse P., Wiesinger J.: Ochrona aparatury elektrycznej przed wyładowaniami atmosferycznymi. Analiza ryzyka, projektowanie i wykonanie według najnowszych norm., Centralny Ośrodek Szkolenia i Wydawnictw SEP, Warszawa 2004.</li> <li>Duda D., Gacek Z.: Przepięcia w sieciach elektroenergetycznych i ochrona przed przepięciami, Wydawnictwo Politechniki Śląskiej, Gliwice 2015</li> <li>Flisowski Z.: Technika wysokich napięć, WNT, Warszawa, 2005.</li> <li>Sowa A.: Kompleksowa ochrona odgromowa i przepięciowa, Centralny Ośrodek Szkolenia i Wydawnictw SEP, Warszawa 2006.</li> <li>Markowska R., Sowa A.W.: Ochrona odgromowa obiektów budowlanych, Dom Wydawniczy MEDIUM, Warszawa 2009.</li> </ol>		
<b>Additional bibliography:</b>		
<ol style="list-style-type: none"> <li>Charoy A.: Kompatybilność elektromagnetyczna. Zakłócenia w urządzeniach elektronicznych, t. I-IV, WNT, Warszawa, 1999.</li> </ol>		
<b>Result of average student's workload</b>		
<b>Activity</b>	<b>Time (working hours)</b>	
1. Participation in lectures	30	
2. Participation in laboratory activities	15	
3. Consultation	8	
4. Preparation for laboratory activities and elaboration of the report	10	
5. Preparation for tests	15	
6. Participation in written or oral tests	2	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	80	3
Contact hours	53	2
Practical activities	33	1