

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Electric Power Systems - Operation and Control</b>		Code <b>1010315341010314897</b>
Field of study <b>Electrical Engineering</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>2 / 4</b>
Elective path/specialty <b>Electric Power Systems</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>Second-cycle studies</b>	Form of study (full-time, part-time) <b>part-time</b>	
No. of hours Lecture: <b>9</b> Classes: <b>-</b> Laboratory: <b>9</b> Project/seminars: <b>-</b>		No. of credits <b>2</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>2 100%</b> <b>2 100%</b>
<b>Responsible for subject / lecturer:</b>  dr inż. Ireneusz Grządzielski email: ireneusz.grzadzieski@put.poznan.pl tel. 61 665 2635 (2392) Faculty of Electrical Engineering Piotrowo 3A, 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Possesses basic knowledge of the theory of electrical circuits, electromagnetic field, electrical machines, High voltage techniques, electric power engineering and electrical power generation
2	<b>Skills</b>	Has effective self-study ability in the domain of the chosen field of studies, is able to integrate the knowledge acquired at the credited courses
3	<b>Social competencies</b>	Is aware of the need to develop his knowledge and competencies, is ready to undertake the cooperation and team work
<b>Assumptions and objectives of the course:</b> Getting knowledge of the electric power system operation under transient operating conditions, electric power system stability investigations under both the small disturbances and the instantaneous high disturbances in the active power balance. Stability enhancement means. Practical service of the program DAKAR in the scope of transient states analysis for low and large disturbance as well as during system failures.		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b> 1. Has knowledge of development trends and the most important new achievements in electrical engineering - [K_W04+] 2. Has widened knowledge of the electric power system construction and operation - [K_W16+++] 3. Has knowledge related to the construction of optimizing and decision algorithms enabling the stable operation of the electric power system - [K_W17++]		
<b>Skills:</b> 1. Can run analysis of the complex electric systems using suitable tools, modifying the existing analysis methods, if necessary - [K_U07++] 2. Can design the electrical elements, devices and systems regarding set criterions, both operational and economic ones - [K_U12++]		
<b>Social competencies:</b> 1. Understands the need to formulate and transfer to the society, using also the mass media, the information and opinions related to the electrical engineering achievements - [K_K02++]		
<b>Assessment methods of study outcomes</b>		

<p>Lectures:</p> <ol style="list-style-type: none"> <li>1. Assessment of the knowledge and skills shown at the written and oral examinations ,</li> <li>2. Continuous assessment during courses ( bonus for activity and perception quality).</li> </ol> <p>Laboratory:</p> <ol style="list-style-type: none"> <li>1. Test of the knowledge necessary to deal with problems posed in the lab tasks.</li> <li>2. Assessment of the knowledge and skills related to the lab task completion,</li> <li>3. Assessment of the task report.</li> </ol>		
<b>Course description</b>		
<p>Lectures : Transient states in electric power system: types of states, system disturbances. Scope of the transient states' study and analysis. Models of the System elements for the transient analysis needs. Electric power system stability. Small swing of the generators' rotor - local angle stability. Power-angle characteristics. Influence of the voltage regulation on local stability. Stability under the large instantaneous disturbance of the active power balance - global angle stability. Voltage stability - voltage stability conditions. Stability enhancement means.</p> <p>Laboratory: involves experiments carried out using the DAKAR program, in the scope of steady states and of the transient states of in the transmission and distribution networks of the electric power system described during lectures.</p>		
<b>Basic bibliography:</b>		
<ol style="list-style-type: none"> <li>1. Machowski J. : Stany nieustalone i stabilność systemu elektroenergetycznego. WNT, Warszawa, 1989.</li> <li>2. Machowski J.: Regulacja i stabilność systemu elektroenergetycznego. OWPW, Warszawa 2007.</li> <li>3. Machowski J., Bialek J., Bumby J. Power System Dynamics: Stability and Control. IEEE Wiley, 2008.</li> <li>4. Poradnik Inżyniera Elektryka . t.3. WNT, Warszawa 2005</li> </ol>		
<b>Additional bibliography:</b>		
<ol style="list-style-type: none"> <li>1. Z. Kremens, M. Sobierajski: Analiza systemów elektroenergetycznych. WNT, Warszawa, 1996.</li> <li>2. Zb. Jasicki : Elektromechaniczne stany przejściowe w systemach energetycznych. T.1 i 2. PWN, Warszawa, 1987</li> </ol>		
<b>Result of average student's workload</b>		
<b>Activity</b>	<b>Time (working hours)</b>	
1. participation in lecture courses	9	
2. participation in labs	9	
3. participation in discussions related to lectures	6	
4. participation in discussions related to labs	6	
5. preparation to labs	15	
6. lab reports	15	
7. preparation to examination	15	
8. taking an examination	3	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	49	2
Contact hours	29	1
Practical activities	23	1