

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Zaawansowane stacje i urządzenia elektroenergetyczne**
 Name in English: **Advanced Substations and Electrical Equipment**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Renewable Energy Systems**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **optional**
 Subject code: **ELR042335**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30			15	
Number of hours of total student workload (CNPS):	90			30	
Form of crediting:	examination			crediting with grade	
For group of courses mark (X) final course:					
Number of ECTS points:	3			1	
including number of ECTS points for practical (P) classes :				1	
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10			0.70	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Possesses a knowledge in the field of the fundamentals of electrotechnics.
2. Has a basic knowledge in the field of the theory of electric circuits.
3. Can correctly and effectively apply a knowledge of linear algebra and analytical geometry to qualitative and quantitative analysis of mathematical issues connected with studied engineering branch.
4. Can apply a mathematical apparatus to analysis of linear electric circuits with sinusoidal AC force.
5. Can apply a mathematical apparatus to analysis of temporary states in linear electrical circuits.
6. Understands a need and knows possibilities of continuous education, increasing of professional, personal and social competences.
7. Has awareness of responsibility for own work.

SUBJECT OBJECTIVES

- C1. Possession a knowledge of physical phenomena occurred in electrical devices.
- C2. Possession a knowledge of important parameters of electrical devices in aspect of their designing.
- C3. Getting to know of principles of electrical devices designing.
- C4. Getting to know of relations between construction, correct exploitation, reliability and effectiveness of use of electrical devices in power network.
- C5. Possession a knowledge of function of power substations.
- C6. Acquisition of abilities to design low voltage electrical installation for supply of different electricity receivers in objects with varied character of use.
- C7. Acquisition of abilities to design MV electrical installation for supply of object with varied character of use.
- C8. Acquisition of abilities to selection of LV and MV switchgears and MV/LV container transformer substations for required work conditions.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

- PEK_W01 Knows physical phenomena occurred in electrical devices.
- PEK_W02 Knows of principles of electrical devices designing.
- PEK_W03 Possesses a knowledge of function of power substations.

relating to skills:

- PEK_U01 Can design low voltage electrical installation for supply of different electricity receivers in objects with varied character of use.
- PEK_U02 Can design MV electrical installation for supply of object with varied character of use.
- PEK_U03 Can select LV and MV switchgears and MV/LV container transformer substations for required work conditions.

relating to social competences:

- PEK_K01 Can think and act in creative and enterprising way. He/she is able to rank appropriately the priorities needed for realizing the respective task.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Short circuit currents in power electric systems, characteristic values and parameters, ways of their calculation.	2
Lec 2	Thermal effects of normal and short circuit currents.	2
Lec 3	Electro-dynamical effects of short circuit currents.	2
Lec 4	Electric arc – physical properties, extinguishing methods of arc.	2
Lec 5	Switching apparatus - basic terminology and functions in power electrical networks. Low voltage switching apparatus.	2
Lec 6	High voltage switching apparatus – classification, construction, main parameters.	2
Lec 7	Power transformers in power substations.	2
Lec 8	Current and voltage transformers in electrical power substations.	2
Lec 9	Over-voltages and over-voltage protection.	2
Lec 10	Limitation of fault currents. Short-circuit reactors.	2
Lec 11	Structures of main circuits in high-voltage electrical power substations. Supplying of industrial and residential load.	2
Lec 12	Constructional solutions of air and SF6 insulated indoor power substations.	2
Lec 13	Earthing systems in power substations.	2
Lec 14	Auxiliary devices in high-voltage power substations. Protection against electric shock in power substations.	2
Lec 15	Principles of correct operation in power substations.	2
Total hours:		30

Form of classes - project		Number of hours:
Proj 1	Description of the project task. Planning of the supply of object with varied character of use and structure of the installation.	2
Proj 2	Project of general lighting in the object.	2
Proj 3	Calculation of the power demand for the object. Calculation of reactive power compensation. Selection of capacitor bank. Selection of power transformers.	2
Proj 4	Selection of main cable supplied the object with varied character of use.	2
Proj 5	Calculation of selected circuits of power installation.	2
Proj 6	Selection of LV switchgears in the object with varied character of use.	2
Proj 7	Selection of MV/LV container power substations.	2
Proj 8	Project documentation.	1
Total hours:		15

TEACHING TOOLS USED

- N1. Lecture with the use of audiovisual techniques, multimedia presentations.
- N2. Multimedia presentation.
- N3. Problem discussion.
- N4. Presentation of the project
- N5. Consultations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F – forming (during semester)</i> <i>P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02 PEK_W03 PEK_K01	Exam in written form.
P(W)	P=F1	
F1(P)	PEK_U01 PEK_U02 PEK_U03	Assessment of project preparing.
F2(P)	PEK_U01 PEK_U02 PEK_U03	Defence of the project.
P(P)	P=0.6*F1+0.4*F2	

PRIMARY AND SECONDARY LITERATURE	
PRIMARY LITERATURE: [1] Dołęga W., Advanced substations and electrical equipment. Wrocław University of Technology, Wrocław, 2011. [2] McDonald J.D., Electric Power Substations Engineering, Wiley, 2003. [3] Seip G., Electrical Installations Handbook, Springer Verlag, 2001. [4] ABB Switchgear Manual, 10th edition, Düsseldorf, Cornelsen Verlag, 1999.	
SECONDARY LITERATURE: [1] Garzon R.D., High Voltage Circuit Breakers, Wiley, 2002. [2] Switching, Protection and Distribution in Low-Voltage Networks, Siemens handbook, 1994.	

SUBJECT SUPERVISOR
Waldemar Dołęga, waldemar.dolega@pwr.edu.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT ELR042335 - Advanced Substations and Electrical Equipment AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY Electrical Engineering AND SPECIALIZATION Renewable Energy Systems				
Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	S2RES_W17	C.1	Lec1 Lec2 Lec3 Lec4	N.1
PEK_W02	S2RES_W17	C.2 C.3 C.4	Lec5 Lec6 Lec7 Lec8 Lec9 Lec10	N.1
PEK_W03	S2RES_W17	C.5	Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_U01	S2RES_U19	C.6	Proj1 Proj2 Proj3 Proj4 Proj5 Proj6 Proj7 Proj8	N.2 N.3 N.4 N.5
PEK_U02	S2RES_U19	C.7	Proj1 Proj3 Proj7 Proj8	N.2 N.3 N.4 N.5
PEK_U03	S2RES_U19	C.8	Proj6 Proj7 Proj8	N.2 N.3 N.4 N.5
PEK_K01	K2ETK_K06	C.6 C.7 C.8	Proj1 Proj2 Proj3 Proj4 Proj5 Proj6 Proj7 Proj8	N.2 N.3 N.4 N.5