

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: **ELR052335**
 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 LEARNING OUTCOMES

relating to knowledge:

- PEU_W01 Knows physical phenomena occurred in electrical devices.
- PEU_W02 Knows of principles of electrical devices designing.
- PEU_W03 Possesses a knowledge of function of power substations.

relating to skills:

- PEU_U01 Can design low voltage electrical installation for supply of different electricity receivers in objects with varied character of use.
- PEU_U02 Can design MV electrical installation for supply of object with varied character of use.
- PEU_U03 Can select LV and MV switchgears and MV/LV container transformer substations for required work conditions.

relating to social competences:

- PEU_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 LEARNING OUTCOMES 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)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Exam in written form.
P(W)	P=F1	
F1(P)	PEU_U01 PEU_U02 PEU_U03	Assessment of project preparing.
F2(P)	PEU_U01 PEU_U02 PEU_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
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