COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design of electric power networks and devices [S2Elenerg1>PS]

Course

Field of study
Electrical Power Engineering

Year/Semester
1/1

Area of study (specialization)
Electric Energy Exploitation

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
30

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in the field of materials engineering, power engineering, high voltage techniques, construction of high voltage power devices.

Course objective

Acquiring the ability to design devices and complex power systems based on the acquired knowledge of applicable standards, regulations, guidelines and regulations.

Course-related learning outcomes

Knowledge:
has knowledge of the construction and operation of the power grid, in particular of overhead and cable high-voltage lines, knows the structure and principles of operation of such power equipment as transformers, capacitors, insulators, and transformers
has knowledge of the selection and design of power devices as well as the design of cable and overhead power lines

Skills:

can design an electrical system with specific parameters, using appropriate methods, techniques and tools, and develop documentation of such a project
he can use his knowledge and using literature sources, specialized catalogs and technical descriptions of devices, available in printed and electronic versions, integrate the obtained information in order to design such components of power networks as: overhead cable line, energy capacitor, bushing
can divide tasks between people cooperating in the project and assess the effects of colleagues" work

Social competences:
can think and act in an entrepreneurial way in the field of power engineering, taking into account the impact of the designed systems on the natural environment

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: Multiple-choice credit test
Project: Ongoing progress evaluation during the design classes, final evaluation of the prepared project

Programme content

Principles, applicable regulations, programs, standards and good practices in the design of devices, apparatus and power lines in terms of their electrical and thermal parameters and mechanical strength. The principles of designing cable and overhead lines, power transformers, bushing insulators and capacitors will be discussed.

Course topics

Lectures:
Standards, regulations and good practices for the design of cable lines, overhead lines, insulators and power capacitors, rules for the selection of transformers to work in networks with low and high harmonic content and the selection of filters will be presented.
Projects:
Designing of high voltage power cable and cable line supplying the customer. Designing of substation distributing equipment, cable terminations and joints, bus bars, insulators, transformer, switching and measurement devices. Calculation of maximum ampacity of power line taking into consideration power cable construction, route requirements, transmission loses limitation. Correct selection of conducting and insulating materials according to voltage value, demanded power, terrain conditions. Design of a high-voltage overhead line, taking into account the calculation of tension and sags in overhead line, current-carrying capacity, the route of the line and the selection of insulators. Designing a condenser-type transformer bushing, taking into account the current carrying capacity, selection of the hollow insulator, calculation of the electrical strength at alternating and impulse voltage, designing the electric field control in the bushing and calculating the distribution of the electric field inside the insulator. Designing a three-phase power capacitor, taking into account the selection of materials, defining the appropriate configuration of the bundles, calculating the electrical and heat resistance, selection of discharge resistors

Teaching methods

Lectures: multimedia presentation (including: drawings, photos) supplemented with examples given on the board and a presentation of examples of projects
Project: multimedia presentation with calculation examples on the board, problem methods, solving project tasks individually and in groups

Bibliography

Basic
1. IEC 287: Calculation of the continuous current rating of cables, International Electrotechnical Commission Publication, 2014
2. Włodarski R., Bucholc J., Linie kablowe bardzo wysokich napięć. Projektowanie i budowa. WNT Warszawa
3. Mościcka-Grzesiak H., Inżynieria wysokich napięć w elektroenergetyce, tom I/II, Wydawnictwo Politechniki Poznańskiej 1996/99

4. Gacek Z. Kształtowanie wysokonapięciowych układów izolacyjnych stosowanych w elektroenergetyce, Wydawnictwo Politechniki Śląskiej, Gliwice 2002
Additional
1. Babij J., Kutzner J., Zasady doboru urządzeń elektrycznych rozdzielni i stacji, Wydawnictwo Politechniki Poznańskiej
2. Pohl Z. (redaktor), Gielniak J. i inni, Napowietrzana izolacja wysokonapięciowa w elektroenergetyce, Oficyna Wydawnicza Politechniki Wrocławskiej, 2003
3. PN-EN 50341-1:2013-03, Elektroenergetyczne linie napowietrzne prądu przemiennego powyżej 1 kV - Część 1: Wymagania ogólne - Specyfikacje wspólne
4. PN-EN 50341-2-22:2016-04, Elektroenergetyczne linie napowietrzne prądu przemiennego powyżej 1 kV - Część 2-22: Krajowe Warunki Normatywne (NNA) dla Polski (oparte na EN 50341-1:2012)
5. A. Rakowska, K. Siodła, E. Gulski, R. Jongen, J. Parciak, Piętnaście lat doświadczeń z badań i diagnostyki
elektroenergetycznych linii kablowych tłumionym AC w miejscu zainstalowania, Wiadomości Elektrotechniczne - 2019, nr 9, s. 39-45
6. W. Hoppel, B. Olejnik., A. Schött, Czy słup betonowy jest słupem z materiału izolacyjnego? Wiadomości Elektrotechniczne - 2015, nr 3, s. 14-19
7. K. Szubert, Harmoniczne prądu i napięcia w sieciach dystrybucyjnych, Zeszyty Naukowe Wydziału Elektrotechniki i Automatyki Politechniki Gdańskiej nr 50/2016 str. 85-88

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50