COURSE DESCRIPTION CARD - SYLLABUS

Course name
Transmission and distribution of electric power energy [N1Eltech1>PiDEE]

Course

Field of study
Electrical Engineering

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
10

Other
0

Tutorials
10

Projects/seminars
0

Number of credit points

7,00

Coordinators

dr inż. Krzysztof Szubert
krzysztof.szubert@put.poznan.pl

Lecturers

Prerequisites

Knowledge: Has basic knowledge of the theory of electrical circuits, electromagnetic field, electric machines, high voltage techniques, power engineering and electricity generation Skills: Has the ability to effectively self-study in a field related to the chosen field of study, combining knowledge acquired in the course of previously completed subjects Competences: Is aware of the need to expand their knowledge and competences, readiness to cooperate and cooperate in a group

Course objective

Acquaintance with the parameters and tasks of modern power systems, electricity transmission and distribution subsystems. Construction of AC transmission systems. Transmission of electricity over short and long distances. Control of power transmission in AC transmission systems. Application of direct current transmission systems. Distribution network operation characteristics. Voltage and reactive power regulation, short-circuit threats, reliability of distribution network operation

Course-related learning outcomes

Knowledge:
Has structured and theoretically founded knowledge of the theory of electrical circuits, knows the basic

laws of electrical engineering, knows the basic properties of electrical circuit elements, has knowledge of steady and transient states, knows the basics of long line theory.
Has knowledge in the field of design, construction and operation principles of power equipment.

Skills:
Is able to use known mathematical methods and models as well as computer simulations to analyze and evaluate the operation of electrical components and systems.
Is able to identify their non-technical aspects, including environmental, economic and legal, when formulating and solving problems regarding electrical power systems.

Social competences:
Understands the need for and knows the possibilities of lifelong learning (second and third cycle studies and postgraduate studies) as well as raising professional, personal and social competences

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: Assessment of knowledge and skills demonstrated in the written and oral exam
Auditorium exercises: Continuous assessment of classes - rewarding the increase in the ability to use known principles and methods, periodic assessment of knowledge and skills in the form of written tests.
Laboratory: Tests checking the knowledge necessary to implement the problems posed in the area of laboratory tasks, assessment of knowledge and skills related to the implementation of the exercise task, evaluation of the report of the exercise.

Programme content

Lectures: Tasks and parameters of the power system. Electricity transmission and distribution subsystems. Hierarchical structure of the power network. Construction of HV and LV AC transmission systems, contemporary development trends. Power transmission over long distances, wave phenomena, natural power. Measures to increase LV transmission capacity. Power flow control in HV and LV transmission networks. Direct current energy transmission.
Distribution network characteristics, network neutral point operation. Calculation of current flow, voltage drops and power losses in simple network systems. Basic rules for calculating closed and node networks. Voltage regulation and reactive power compensation. Calculation of short-circuit quantities based on normative recommendations. Ground faults in medium voltage networks. Criteria for choosing the cable cross section. Quality of electricity and reliability of the network and its components.
Problems occurring in steady and transient states in the power system, solutions in electromechanical systems: FACTS.
Auditorium exercises include calculations on examples illustrating the material presented in lectures. Solving tasks on the board.
The laboratory includes exercises in the field of analyzing phenomena occurring in transmission and distribution networks under normal and interference conditions using physical and digital models. Team work, editing reports, using IT tools.

Course topics

Determining substitute diagrams for network elements.
Calculation of current flow, voltage drops and power losses in simple network systems. Basic principles of calculating closed and nodal networks. Voltage regulation and reactive power compensation. Calculation of short-circuit values based on normative recommendations. Earth faults in medium voltage networks. Criteria for selecting the cable cross-section. Electricity quality and reliability of the network and its elements. Control in transmission networks. Problems occurring in steady and transient states in the power system, solutions in electromechanical systems and FACTS (STATCOM, SSC, UPFC, PST, IPC). Long lines (wave impedance, propagation coefficient, wave phenomena, telegraphists' equations) and direct current transmission.
Auditorium exercises include performing calculations using examples illustrating the material presented during lectures. Solving tasks on the board.
The laboratory includes exercises in the analysis of phenomena occurring in transmission and distribution networks under normal and disturbance conditions using physical and digital models. Working in teams,

editing reports, using IT tools.

Teaching methods

Lecture: multimedia presentation supplemented with examples given on the board
Exercises: calculating tasks at the board
Laboratories: performing tests on physical or digital models

Bibliography

Basic
Sz. Kujszczyk (pod red.): Elektroenergetyczne układy przesyłowe, WNT, Warszawa 1997.
Sz. Kujszczyk (pod red.): Elektroenergetyczne sieci rozdzielcze, tom 1 i 2, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004 r.
P. Kacejko, J. Machowski: Zwarcia w systemach elektroenergetycznych, WN-T, Warszawa 2013
Poradnik Inżyniera Elektryka. t.3. WN-T, Warszawa 2011
Additional
T. Kahl: Sieci elektroenergetyczne. WNT, Warszawa 1984
J. Popczyk: Elektroenergetyczne układy przesyłowe, WPŚ, Gliwice 1984
S. Kończykowski: Obliczanie sieci elektroenergetycznych, t.II, PWN, Warszawa 1958
Jakość energii elektrycznej w aspekcie wytwarzania, dystrybucji i użytkowania, Zeszyty Naukowe WEiA Politechniki Gdańskiej nr 50, 2016

Breakdown of average student's workload

	Hours	ECTS
Total workload	180	7,00
Classes requiring direct contact with the teacher	95	4,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	85	3,00