COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electric power devices and distribution stations [N1Energ2>UiSE]

Course

Field of study
Power 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
20

Laboratory classes
20

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge on electrical engineering, mathematics, physics and electrical metrology. Able to perform mathematical and physical analysis of phenomena occurring in the electric power devices and systems and read electrical wiring schemes. A sense of the need to broaden the competence and willingness to work together in a team.

Course objective

Knowledge of phenomena occurring in electrical devices and systems as well as their mathematical and physical descriptions. Purchase of skills in the application of phenomena description to design of power supply and hazard assessment that can occurs in these systems. Knowledge of devices functioning and role of power distribution stations in system, analyze methods of station operation reliability. Able to design supply system, transformer and distribution stations and select devices. Experiment planning, selection of measurement instrument, realization of test set-up, researches performing and results analyzing.

Course-related learning outcomes

Knowledge:
Know how describe phenomena occurring in electrical devices and power supply and how they operate.

Know how formulate mathematical and physical description of phenomena, know principle configurations of power distribution stations, way of its functioning and analyse methods of station operation reliability.

Skills:
Able to analyze the mathematical and physical descriptions of phenomena for the different operating states and conditions as well as design supply system and transformer distribution stations. Able to perform the calculation and estimation of hazard assessment occurring in electrical devices and power supply systems as well as perform calculations and analyses necessary for the selection of equipment in distribution stations. Able to plan experiment, measurement instrument select, test set-up realize, perform researches and analyse of results.

Social competences:
A sense of influence of proper devices selection and analysis of phenomena on ensuring supply continuity to different electricity consumers. A sense of influence of phenomena, devices and distribution stations on the environment and the people working with electrical equipment and using them, and the consequent need for extensive cooperation both at the design stage and eksploatation.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
- knowledge acquired as part of the lecture is verified by a written final exam consisting of open or test questions with different points. Passing threshold: 50% of points,
- current grading in each lecture (rewarding activities).

Laboratory classes:
- current check and rewarding knowledge necessary for the accomplishment of the problems in the area of laboratory tasks,
- evaluation of reports performed on laboratory classes,
- rewarding activities related to the implementation of laboratoy classes.

Programme content

The module program covers the following topics:
1. Classification of electrical power equipment.
2. Thermal effects of operating and overload currents.
3. Dynamic effects of short-circuit currents.
4. Electric arc.
5. Electrical power switches.
6. High-voltage switches.
7. Instrument transformers.
8. Devices and main circuits of electrical power stations.
9. Auxiliary devices and devices for managing the operation of electrical power stations.

Course topics

Lecture:
1. Classification of power equipment and selected definitions
2. Climatic, environmental and voltage exposures of power equipment
3. Operating conditions of power equipment
4. Thermal effects of operating and overload currents - heat sources in equipment, heating of wires and conductors under the influence of operating currents, thermal effects of overload currents, determination of the heating and cooling curve.
5. Dynamic effects of short-circuit currents - analysis of some characteristic conductor systems, electrodynamic forces in alternating current circuits, resistance of electrical equipment and busbars to mechanical exposures.
6. Electric arc - basic information, structure, extinguishing, arc model, characteristics of direct current and alternating current arcs, arc extinguishing conditions, arc extinguishing techniques.
7. Power switches – classification and basic parameters of switches
8. High-voltage switches – circuit breakers, disconnectors, isolators, fuses, earthing switches, short-circuit

breakers
9. Current, voltage and combined transformers.
10. Main devices and circuits of power stations – station connection systems, transformers and autotransformers, station design solutions.
11. Auxiliary devices at power stations – station's own needs, limiting short-circuit currents, lightning and surge protection, power station operation control devices.

Laboratories:
1. Discussion of classes: topics, literature, requirements, reports, health and safety
2. Long-term operation of current circuits
3. Examination of time-current characteristics of circuit breakers
4. Examination of current transformer errors
5. Occasional operation of current circuits
6. Technical method of measuring short-circuit loop impedance
7. Determination of the safety factor FS, current transformer
8. Intermittent operation of current circuits
9. Parallel operation of transformers
10. Examination of selected current transformer systems - 1f systems
11. Examination of current transformer systems used in three-phase networks
12. Examination of time-current characteristics of motor circuit breakers
13. Examination of voltage transformer
14. Summary of classes, reports and assessment

Teaching methods

Lecture:
- multimedia or object-oriented presentations supported by illustrated examples presented on the board,
- interactive lecture with questions and initiating discussions.
Laboratory classes:
- object-orientedpresentations supported by illustrated examples presented on the board,
- presentations of selected experiments,
- initiating teamwork.

Bibliography

Basic:
1. Markiewicz, H. Urządzenia elektroenergetyczne, WNT, Warszawa, 2006.
2. Markiewicz, H. Bezpieczeństwo w elektroenergetyce, WNT, Warszawa, 2017.
3. Kamińska, A. Urządzenia i stacje elektroenergetyczne, Wydawnictwo Politechniki Poznańskiej, 2000.
4. Maksymiuk, J., Nowicki, J. Aparaty elektryczne i rozdzielnice wysokich i średnich napięć, Wydawnictwo Politechniki Warszawskiej, Warszawa, 2014.
5. Żmuda, K. Elektroenergetyczne układy przesyłowe i rozdzielcze. Wybrane zagadnienia z przykładami, Wydawnictwo Politechniki Śląskiej, 2014.

Additional:
1. Glover, J. D., Sarma, M.S., Overbye, T.J. Power System Analysis and Design, cengage Learning, Inc, Florence, KY, US, 2011
2. Wasiak, I. Elektroenergetyka w zakresie Przesył i rozdział energii elektrycznej, Politechnika Łódzka, 2010.
3. Królikowski, C.,Boruta, Z., Kamińska, A. Technika łączenia obwodów elektroenergetycznych. Przykłady obliczeń, PWN, Warszawa, 1992.
4. Maksymiuk, J. Aparaty elektryczne. Podstawy doboru i eksploatacji. WNT, Warszawa, 1977.
5. Au, A., Maksymiuk, J., Pochanke, Z. Podstawy obliczeń aparatów elektroenergetycznych. WNT, Warszawa, 1982.

Breakdown of average student's workload

	Hours	ECTS
Total workload	142	5,00
Classes requiring direct contact with the teacher	42	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	100	3,50