COURSE DESCRIPTION CARD - SYLLABUS

Course name
Indoor stations and switchboards [N2Elenerg1-UEE>SWiR]

Course

Field of study
Electrical Power Engineering

Year/Semester
2/3

Area of study (specialization)
Electric Energy Exploitation

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
10

Other
0

Tutorials
0

Projects/seminars
10

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of electrical circuits and devices. Knowledge of measuring equipment and its use. The ability to interpret the phenomena accompanying the flow of electricity in devices and power installations. Ability to follow and analyze issues contained in regulations, standards and subject literature. Awareness of the necessity of lifelong learning.

Course objective

Getting to know the structure and basic equipment of power stations. Acquisition of knowledge in the field of thermal and electrodynamic phenomena accompanying the flow of working and fault currents in power devices. Obtaining extended knowledge about the phenomena occurring in metallic and arc high- current short-circuits and methods of limiting their effects. Acquisition of skills related to the design of basic circuits of power stations and switchgears and the selection of their equipment.

Course-related learning outcomes

Knowledge:
student has a well-established knowledge of the work systems of power substations and the purpose, construction and equipment of indoor switchgears of electric power distribution stations. student has

an extensive knowledge of the operation and diagnostics of indoor stations and switchboards. student has a well-established knowledge of the purpose and construction of switchgear. student has limiting their effects.

Skills:
student is able to rationally assess the risk caused by short-circuit currents and arc faults and analyze the solutions of power systems and devices from the point of view of their operating parameters and investment costs. student is able to prepare and verify the technical, economic and environmental power supply design of the selected facility. student is able to interact with designers of other installation systems and users of building structures.

Social competences:
student is aware of the threats occurring in the operated electrical power equipment caused by emergency states and the need to limit them in order to maintain operational safety. student is aware of the responsibility for the safety of users of electrical power devices.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture:
- knowledge acquired as part of the lecture is verified by a written final test 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.
Projects:
- the preparation of materials for the project is evaluated,
- substantive preparation for the implementation of the assigned project is evaluationed,
- project and its defense are evaluated.

Programme content

Lecture:
Issues related to power supply stations for industrial facilities - indoor stations, container stations, etc. Busbar systems in low and medium voltage stations. MV and LV switchgears and their accessories. Prefabricated and insulated switchgears. Switchgear and devices - construction, purpose and rated parameters. Causes and effects of metallic and arc faults in electric power circuits and devices. Methods of determining and limiting short-circuit effects. The effect of an emergency electric arc on electrical equipment, operating personnel and the environment. The issues of arc protection of electrical devices. Methods of elimination of the electric emergency arc and limiting the effects of short-circuit current flow.
Laboratory classes:
Classes discussing the regulations of the laboratory, topics of laboratory classes and OHS training related to the operation of laboratory positions. To perform 6 two-hour laboratory classes in the field of lecture.
Projects:
Assigned to implement the project in the field of indoor stations and distribution takes into account the output data, design diagrams, schematics and technical calculations replacement.

Course topics

none

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.
Projects:
- use of dedicated or developed computer applications as well as graphic programs and catalogs of manufacturers of electrical devices, switchgear, prefabricated switchboards and installation accessories.

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.
6. Kulas S.: Tory prądowe i układy zestykowe, Wydawnictwo Politechniki Warszawskiej, Warszawa, 2008.
7. Koch B., Maksymiuk J.: Łukoodporność rozdzielnic osłoniętych i symulacja zwarć łukowych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2007.
8. Maksymiuk J., Pochanke Z.: Obliczenia i badania diagnostyczne aparatury rozdzielczej, wyd.1, WNT, 2001.
9. Maksymiuk J.: Niezawodność maszyn i urządzeń elektrycznych, Oficyna Wydawnicza PW, 2003.
10. Turowski, J.: Elektrodynamika techniczna, WNT, Warszawa, 2014.
Additional
1. Au A., Maksymiuk J., Pochanke Z. Podstawy obliczeń aparatów elektroenergetycznych. WNT, Warszawa, 1982.
2. Glover, J. D., Sarma, M.S., Overbye, T.J. Power System Analysis and Design, cengage Learning, Inc, Florence, KY, US, 2011
3. Wasiak, I. Elektroenergetyka w zakresie Przesył i rozdział energii elektrycznej, Politechnika Łódzka, 2010.
4. Nowak, K.; Janiszewski, J.; Dombek, G. The possibilities to reduce arc flash exposure with arc fault eliminators. Energies. 2021, vol. 14, no. 7, pp. 1927-1-1927-25.
5. Nowak, K.; Janiszewski, J.; Dombek, G. A multi-sectional arc eliminator for protection of low voltage electrical equipment. Energies, 2020, vol. 13, no. 3, pp. 605-1-605-20.
6. Nowak, K.; Janiszewski, J.; Dombek, G. Thyristor arc eliminator for protection of low voltage electrical equipment. Energies, 2019, vol. 12, no. 14, pp.2749-1-2749-15.
7. Książkiewicz, A.; Dombek, G.; Nowak, K. Change in electric contact resistance of low-voltage relays affected by fault current. Materials, 2019, vol. 12, no. 20, pp. 3926-1-3926-13.
8. Maksymiuk, J. Aparaty elektryczne. Podstawy doboru i eksploatacji. WNT, Warszawa, 1977.
9. Normy przedmiotowe.
10. Publikacje internetowe.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50