COURSE DESCRIPTION CARD - SYLLABUS

Course name

Elective course B: Power lines and electromagnetic compatibility

Course

Field of study

Power Engineering

Year/Semester

3/6

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

15

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Wydział Automatyki, Robotyki i Elektrotechniki

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Responsible for the course/lecturer:

Prerequisites

Basic knowledge of electrical engineering, electronics and energy. Knowledge of laws and physical and electrotechnical phenomena. Linking physical phenomena with the principles of functioning of technical devices and their technical parameters. Ability to apply computational methods in the field of electrical engineering, electronics and electromagnetic field theory. Awareness of the importance and need to use electrical and electronic components and devices in the work of an engineer. Ability to broaden your competences.

Course objective

Understanding selected theoretical and practical problems related to electromagnetic interactions of

power lines and with the electromagnetic compatibility of electrical devices and systems. Presentation in the form of a presentation of the prepared project-issue.

Course-related learning outcomes

Knowledge

1. Has basic knowledge of the impact of electromagnetic fields on the environment and the mechanisms of penetration of electromagnetic disturbances to electrical and electronic circuits.

2. Knows and understands the fundamental dilemmas of modern civilization related to the reliability of electricity generation, supply and processing.

3. Understands the importance of energy security issues, especially the threats and ways to increase the level of energy security.

4. Knows methods of simulation of basic phenomena and quantities characteristic of electrical systems.

Skills

1. Is able to assess the impact of electrical, electronic and energy systems on the environment.

2. Is able to use known mathematical models and computer simulations to analyze and evaluate the functioning of electrical components and systems.

3. Is able to plan and carry out simulation and measurements of basic quantities characteristic of electrical systems; can present the results obtained in numerical and graphic form, interpret them and draw the right conclusions.

Social competences

1. Knows the aspects and effects of the power engineering engineer, including its impact on the environment and the associated responsibility for the decisions taken.

2. Understands the importance of knowledge in solving problems, has a need to improve professional, personal and social competences.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

Assessment of knowledge and skills demonstrated during the course of problematic, realized in the form of written or oral.

Laboratory:

- test and favoring knowledge necessary for the accomplishment of problems in the area of laboratory tasks,

- evaluation of the reports of laboratory tests,

- evaluation of the completed technical report (paper) on electromagnetic compatibility.

Projects:

- assessment of the presentation of the prepared project-issue in terms of substantive content, readability and presentation method,

- rewarding the increase in the ability to use known principles and methods,

- assessment of knowledge and skills related to the implementation of the prepared project-issue,

- rewarding activity and participation in the discussion related to the presented project-issue.

Programme content

Lecture:

Basic concepts of electromagnetism and signal analysis. Impact of electromagnetic fields (in particular power lines) on the technical and biological environment. Introduction and general issues of electromagnetic compatibility (EMC), basic terms and units. Sources, classification and parameters of electromagnetic disturbances. Mechanisms of the spread of disturbances (coupling) and their impact on devices and systems. Measures and devices limiting the impact of disturbances on technical facilities.

Laboratory:

Research and measurements of: electric field, magnetic field, harmonic effects. Methods of penetration of disturbances into electrical circuits (couplings). Selection of filters in shaping electrical signals.

Projects:

Understanding selected theoretical and practical problems related to the impact of electromagnetic fields on biological objects and the compatibility of devices and technical objects, as well as methods of simulation of basic phenomena and quantities characteristic of electrical systems. Technical aspects of performing compatibility tests.

Teaching methods

Lecture:

Lecture with multimedia presentation (including: drawings, photographs, animations, sound, films) supplemented with examples given on the board; Presenting a new topic preceded by a reminder of related content, known to students from other subjects; taking into account various aspects of the issues presented, including: economic, environmental, legal, social, etc .

Laboratory:

Physical connection of circuits and realisation of research. Demonstrations of practical nuances specific to the issues, working in teams.

Projects:

Analysis / discussion of various methods (including unconventional) to solve the problem in the area of the topic under consideration, analysis / discussion of various aspects of the problems solved, including: economic, ecological, legal, social, etc., detailed review of project documentation by the project leader and discussions on comments, multimedia show, case study, team work.

Bibliography

Basic

1. Charoy A., Zakłócenia w urządzeniach elektronicznych. Zasady i porady instalacyjne, cz. 1-4, z serii: Kompatybilność elektromagnetyczna, WNT, Warszawa 1999-2000.

2. Machczyński W.: Wprowadzenie do kompatybilności elektromagnetycznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2010.

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5. Kurdziel R., Podstawy elektrotechniki, WNT, Warszawa 1973.

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7. Markiewicz H.: Instalacje elektryczne, WNT, Warszawa 2012.

8. Niestępski S., Parol M., Pasternakiewicz J., Wiśniewski T.: Instalacje elektryczne. Budowa projektowanie i eksploatacja, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011.

9. PN-EN 61000-4-2:2011 - wersja polska - Kompatybilność elektromagnetyczna (EMC) -- Część 4-2: Metody badań i pomiarów -- Badanie odporności na wyładowania elektrostatyczne.

10. PN-EN 61000-4-4:2013-05 - wersja ang. - Kompatybilność elektromagnetyczna (EMC) -- Część 4-4: Metody badań i pomiarów -- Badanie odporności na serie szybkich elektrycznych stanów przejściowych.

11. PN-EN 61000-4-6:2014-04 - wersja ang. - Kompatybilność elektromagnetyczna (EMC) -- Część 4-6: Metody badań i pomiarów -- Odporność na zaburzenia przewodzone, indukowane przez pola o częstotliwości radiowej.

12. PN-EN 61000-4-5:2014-10 - wersja ang. - Kompatybilność elektromagnetyczna (EMC) -- Część 4-5: Metody badań i pomiarów -- Badanie odporności na udary.

Additional

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2. Kaiser K. L.: Electromagnetic compatibility handbook, CRC Press, Boca Raton 2005.

3. Perez R.: Handbook of electromagnetic compatibility, Academic Press, New York 1995.

4. Tesche F. M., Ianoz M. V., Karlson T.: EMC analysis methods and computational models, Wiley, New York 1997.

5. Krakowski M.: Elektrotechnika teoretyczna. Tom 2, PWN, Warszawa 1995.

6. Bednarek K., Wzrost bezpieczeństwa energetycznego poprzez poprawę jakości i pewności zasilania elektrycznego, rozdział w książce: Bezpieczeństwo energetyczne. Rynki surowców i energii – teraźniejszość i przyszłość, tom 2. Technologia – Prawo – Ochrona środowiska, praca zbiorowa pod redakcją P. Kwiatkiewicza, Fundacja na rzecz Czystej Energii, Poznań 2014, s. 85-104.

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11. Garbarczyk Z., Kozłowski C., Nowicki M., Pachocki K.: Zagrożenia elektromagnetyczne. Bezpieczeństwo i ochrona człowieka w środowisku pracy. Część 11, Centralny Instytut Ochrony Pracy, Warszawa 1998.

12. Bednarek K., Generation of local overheating of contact connections in heavy-current equipment caused by electromagnetic effects exerted on ferromagnetic connecting parts, Przegląd Elektrotechniczny, No 12 (89), 2013, p. 238-241.

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15. Machczyński W., Typańska D, Electromagnetic compatibility of smart installations, Poznan University of Technology Academic Journals, Tom 81, ISSN 1897-0737, 2015, str.95-100.

16. Szymenderski J., Typańska D., Immunity of fixed installation to electrostatic discharge, Poznan University of Technology Academic Journals, Tom 85, ISSN 1897-0737, 2016, str.106-116.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, project preparation) [1]	25	1,0

[1] delete or add other activities as appropriate