COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electromagnetic compatibility [S2Eltech2>KE]

Course

Field of study
Electrical Engineering

Year/Semester
2/3

Area of study (specialization)
Drive Systems in Industry and Electromobility

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
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Fundamentals of electrical engineering, electromagnetism, physics and mathematics. Calculation of electrical circuits and electromagnetic fields distributions. Ability to work in a team and to improving their own competence.

Course objective

Basic knowledge of electromagnetic compatibility (EMC) problems and EMC simulation methods.

Course-related learning outcomes

Knowledge:
1. Student will be able to identify the sources and characteristics of electromagnetic disturbances, disturbances spreading mechanisms and their impact on the equipment and systems and identify the impact of electromagnetic fields on the technical and biological environment.
2. Student will be able to explain the causes of disorders of electrical and propose measures and

equipment that limit their impact.

Skills:
1. Able to analyze the causes, the effects of electromagnetic (e-m) interference, define the source and parameters of e-m disturbances, investigate mechanisms of the spread of the disorders and their effects on devices and systems, calculate the impact of e-m fields on biological technical environment.
2. Student will be able to estimate emissions and electrical resistance to electromagnetic interference, restriction measures the effects of excess emissions and increase resistance to electromagnetic compatibility.
3. Is able to obtain information from literature and other sources, make their interpretation, evaluation, critical analysis, as well as draw conclusions and formulate and comprehensively justify opinions.
4. Can formulate and test tasks related to engineering problems and simple research problems, develop detailed documentation of the results of experiments and interpret the results obtained.

Social competences:
1. Student will gain the following skills to think and act creatively in the field of EMC, is capable of intelligible communication to the public purposes of EMC.
2. Recognizes the importance of knowledge in solving cognitive and practical problems, and understands that in technology knowledge and skills need to be constantly supplemented.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
- assessment of knowledge and skills demonstrated on the written problem credit.
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.

Programme content

Lectures:
Introduction to basic problems of electromagnetic compatibility (EMC), basic and define units. Basic concepts of electromagnetism and signal analysis. Sources, classification and characteristics of electromagnetic disturbances. Coupling mechanisms of disturbances and disturbances effects on electrical and electronic systems. The influence of electromagnetic fields on biological and technical environment. Measures and devices to reduced the effects of disturbances on the technical objects.
Laboratory:
Research and measurements of: electric field, magnetic field, harmonic effects, analysis of electromagnetic interference in the range of radio frequency RF, selection of filters in the shaping of electrical signals.

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 presented issues, including: economic, ecological, legal, social, etc.
Laboratory:
Demonstrations of practical nuances specific to the issues, working in teams.

Bibliography

Basic:
1. Sroka J., Compendium on ElectroMagnetic Compatibility, Oficyna Wydawnicza Politechniki Warszawskiej, 2021, 213 s. ISBN 978-83-8156-277-5.
2. Clayton R. P., Introduction to electromagnetic compatibility, Wiley - Interscience, John Wiley & Sons Inc., New Jersey, 2006.

3. Charoy A., Zakłócenia w urządzeniach elektronicznych. Zasady i porady instalacyjne, cz. 1-4, z serii: Kompatybilność elektromagnetyczna, WNT, Warszawa 1999-2000.
4. Machczyński W., Wprowadzenie do kompatybilności elektromagnetycznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2010.
5. Frąckowiak J., Nawrowski R., Zielińska M., Teoria obwodów. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2017.

Additional:
1. Paul C. R., Introduction to electromagnetic compatibility, Wiley, New York 2006.
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. Bednarek K., Elektromagnetyczne oddziaływania i bilans energetyczny w sieci zasilającej w budynku banku, Przeglad Elektrotechniczny, 90 (2014), nr 12, 188-191.
6. Bednarek K., Kasprzyk L., Kształtowanie jakości energii i niezawodności w systemach zasilania elektrycznego, Przeglad Elektrotechniczny, 92 (2016), nr 12, 9-12.
7. Alfa-Weka: Praktyczny poradnik. Certyfikat CE w zakresie kompatybilności elektromagnetycznej. Normy i zasady bezpieczeństwa w elektrotechnice. Tom 1-3, Alfa-Weka, Warszawa 1998-2001.
8. Więckowski T. W., Pomiary emisyjności urządzeń elektrycznych i elektronicznych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 1997.
9. Krakowski M., Elektrotechnika teoretyczna. Tom 2, PWN, Warszawa 1995.
10. Krakowski M., Analiza liniowych obwodów elektrycznych. Cz. 1. PŁ, Łódź 1974.
11. Kurdziel R., Podstawy elektrotechniki, WNT, Warszawa 1973.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00