COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electromagnetic compatibility [S1Elmob1>KE]

Course

Field of study
Electromobility

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

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

Mastering the knowledge of the basic problems of electromagnetic compatibility (EMC), with particular emphasis on the specifics of compatibility in vehicles.

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 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. Is able to think creatively and act in the area of electromagnetic compatibility. Is aware of the importance of taking into account the electromagnetic compatibility of electrical devices in shaping the proper management of energy and raw materials in the processes of operating electrical equipment, as well as promoting and implementing pro-ecological activities. It is capable of intelligently transmitting the objectives of electromagnetic compatibility to the public.
2. Is aware of the need to improve their qualifications and the need to use modern tools to support the work of an engineer.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
- assessment of knowledge and skills demonstrated in the written or oral problem-specific exam.
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

The program includes an introduction to the topic of electromagnetic compatibility (EMC), including basic definitions and signal analyses, as well as the classification of sources of disturbances, methods of their propagation and reduction in electrical and electronic systems.

Course topics

Lectures:
General issues of electromagnetic compatibility (EMC). Properties of electromagnetic fields (EMF) and their influence on matter and living organisms. Zones around EMF sources and properties of fields in particular zones. Practical examples of EMF interactions in the environment of characterologically different sources of their production. Physical quantities and units in the consideration of electromagnetic compatibility. Mechanisms of the emergence and spread of disturbances and their influence on devices and systems (electromagnetic couplings). Sources, classification and parameters of electromagnetic disturbances. Identification and methods of limiting the impact of disturbances. Research in the field of emissivity and resistance of devices. Mechanisms and effects of the influence of electromagnetic fields on humans (direct, indirect and secondary threats). The impact of the electromagnetic field on the technical environment and living organisms as well as the normative and legal status in this regard. EU directives and standards in the field of electromagnetic compatibility (objectives, definitions, basic concepts, criteria for assessing disturbances, required tests, measuring equipment in the field of EMC). Electromagnetic compatibility related to motor vehicles and their components.
Laboratory:
Research and measurements in the field of: electric field, magnetic field, the impact of harmonic disturbances, the penetration of disturbances into electrical circuits (the presence of couplings), the 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 realised issues, working in teams.

Bibliography

Basic:
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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.
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5. Bednarek K, Zagadnienia kompatybilności elektromagnetycznej w motoryzacji, Zeszyty Naukowe, Elektryka nr 100, Politechnika Łódzka, Łódź, październik 2003, s. 183-192.
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11. Alfa-Weka: Praktyczny poradnik. Certyfikat CE w zakresie kompatybilności elektromagnetycznej. Normy i zasady bezpieczeństwa w elektrotechnice. Tom 1-3, Alfa-Weka, Warszawa 1998-2001.
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Breakdown of average student's workload

	Hours	ECTS
Total workload	110	4,00
Classes requiring direct contact with the teacher	47	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	63	2,50