



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Electromagnetic compatibility [S2EiT1>KE]

### Course

Field of study

Electronics and Telecommunications

Year/Semester

2/3

Area of study (specialization)

Networks, Systems and Services

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

0

Tutorials

0

Projects/seminars

0

### Number of credit points

2,00

### Coordinators

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### Lecturers

### Prerequisites

The student starting this course should have knowledge of the basics of the theory of electromagnetic field, propagation of electromagnetic waves, structure and properties of antennas, circuit theory and electrical metrology. They should also have the ability to calculate simple DC and AC circuits, the ability to obtain information from given sources and be ready to work in a team.

### Course objective

Gaining knowledge about wave phenomena occurring in cables and electronic and radio devices, methods of limiting the negative impact of these phenomena on the data transmission system and about legal standards in the field of standardization of electronic and radio devices. Gaining skills related to identifying and limiting sources of problems with electromagnetic compatibility of electronic and radio devices and skills in performing measurements of electromagnetic disturbance signals.

### Course-related learning outcomes

Knowledge:

After completing the course, the student has:

- structured and detailed knowledge of the problems related to electromagnetic radiation

- structured and detailed knowledge of directives and standards in the field of electromagnetic compatibility
- structured and detailed knowledge of the identification and measurement of electromagnetic disturbances in accordance with the currently applicable standards
- ordered and mathematically based detailed knowledge of the mechanisms of disturbances in electronic equipment and methods of reducing electromagnetic disturbances and susceptibility to electromagnetic disturbances

#### Skills:

After completing the course, the student is able to:

- design the electronic system in accordance with the principles of limiting the emission of electromagnetic disturbances,
- plan and carry out measurements of parameters related to the emissivity and electromagnetic susceptibility of electronic devices and interpret the obtained results
- use the harmonized standards in order to correctly assess the compliance of electronic devices with the directives in the field of electromagnetic compatibility,
- assess and propose countermeasures against the harmful effects of electromagnetic disturbances on electronic devices and systems, as well as on humans

#### Social competences:

Student after completing the course:

- knows the limitations of their own knowledge and skills, understands the need for further training,
- is aware of the importance of behaving in a professional manner and obeying professional ethics,
- has a sense of responsibility for the designed telecommunications systems and is aware of potential dangers for other people or society resulting from their inappropriate use, has the ability to estimate the risk resulting from their activities.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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1. The knowledge acquired during the lectures is verified during the final written and / or oral exam depending on the number of students taking the exam. In the case of the oral exam, students receive a set of 20 problem questions before the end of the last lecture. During the oral exam, the student receives 3 questions. Each answer to the question asked is graded on a scale from 2 to 5. The final grade for the oral exam is the arithmetic mean of the marks for individual answers. The pass mark is 2.75 (grade 3.0), then 3.20 (grade 3.5), 3.65 (grade 4.0), 4.10 (grade 4.5), 4.55 (grade 5.0). In the case of the written exam, the passing point is 50% of points (grade 3.0), then 60% (grade 3.5), 70% (grade 4.0), 80% (grade 4.5), 90% (grade 5.0), the list of exam problems is sent by e-mail to students).
2. The knowledge and skills acquired during laboratory exercises are verified on the basis of laboratory exercises reports (the rules for preparing reports are presented during organizational classes), the grade covers the formal compliance of the report with the template, the method of processing the measurement results and answering the questions contained in the instruction.

### Programme content

Introduction to modeling and measurement of electromagnetic disturbances, the impact of electromagnetic disturbances on electronic systems and humans, methods of reducing the emission of electromagnetic disturbances and susceptibility to electromagnetic disturbances, electromagnetic field shielding methods. Basic information about legal regulations and recommendations in the field of electromagnetic compatibility.

### Course topics

The lecture:

1. Types of electromagnetic disturbances, paths of electromagnetic disturbance propagation, physical description of phenomena related to electromagnetic disturbances, analysis of the effects and elementary methods of limiting electromagnetic disturbances and their effects in the area of designing electronic devices and cabling.
2. Directives and standards in the field of electromagnetic compatibility. Methods of measuring

electromagnetic disturbances in accordance with the standards. Technical documentation of devices.  
3. Methods of earthing, ground connection, and wiring; electromagnetic field shielding methods; electromagnetic interference reduction filters; types of shielded cables and wires, methods of powering of devices and lightning protection.

The laboratory exercises:

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1. Electromagnetic field measurements for environmental protection purposes.
2. Propagation measurements, antenna factor.
3. Measurement of cable emissions using near-field probes for a cable feeding a planar PCB transmission line.
4. Measurement of crosstalk in microstrip lines.
5. Analysis of electronic device emissions in accordance with EN 55032 norm.

### Teaching methods

1. Traditional lecture.
2. Laboratory exercises: performing practical tasks in groups (2-4 people) based on written instructions.

### Bibliography

Basic

1. A. Charoy, Zakłócenia w urządzeniach elektronicznych, T1, T2, T3, T4, Warszawa, 1999, 2000.
2. T. W. Więckowski, Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych, Oficyna Politechniki Wrocławskiej, Wrocław, 2001

Additional

1. C. R. Paul, Introduction to electromagnetic compatibility, Wiley, 2006.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	31	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	29	0,00