GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|---|---|---|---|
| Subject name and code | Electromagnetic Compatibility of Medical Equipment, PG_00068223 | | | | | | |
| Field of study | Biomedical Engineering | | | | | | |
| Date of commencement of studies | October 2025 | | Academic year of realisation of subject | 2027/2028 | | | |
| Education level | first-cycle studies | | Subject group | Optional subject group<br>Subject group related to scientific research in the field of study | | | |
| Mode of study | Full-time studies | | Mode of delivery | at the university | | | |
| Year of study | 3 | | Language of instruction | Polish | | | |
| Semester of study | 6 | | ECTS credits | 2.0 | | | |
| Learning profile | general academic profile | | Assessment form | assessment | | | |
| Conducting unit | Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Adam Bujnowski | | | | | |
| | Teachers | | | | | | |
| Lesson types | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 15.0 | 0.0 | 15.0 | 0.0 | 0.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | | Participation in consultation hours | Self-study | | SUM |
| | Number of study hours | 30 | | 3.0 | 17.0 | | 50 |
| Subject objectives | The aim of the course is to familiarize students with the basic issues related to electromagnetic compatibility. The sources of interference, coupling methods and typical types of interference will be discussed. The basic standards in the field of EMC and typical construction techniques that allow for the elimination of interference, coupling or their influence on the behavior of equipment will be indicated. | | | | | | |

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems | The student identifies the risk and analyzes the consequences of not meeting EMC standards. | [SK5] Assessment of ability to solve problems that arise in practice |
| [K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study | The student knows the basic issues related to interference sources and coupling methods. The student knows the basic normative acts in the field of compatibility. The student knows the basic rules for designing equipment to ensure EM compatibility. | [SW3] Assessment of knowledge contained in written work and projects |
| [K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n | The student analyzes and identifies compatibility problems. The student uses analytical tools to assess the risk of electromagnetic compatibility problems. | [SU3] Assessment of ability to use knowledge gained from the subject |

## Subject contents

Course content – lecture

Basic concepts - electromagnetic compatibility
Legal conditions, standards and recommendations
Propagation of electromagnetic waves
Interference - types and methods of interference. Types of couplings in electronic equipment
Testing of immunity to fast transient states
Testing of immunity to electromagnetic discharges
Testing of immunity to electrostatic discharges
Testing of immunity to short pulses and electrical discharges
Testing of immunity to network dips and sags
Methods of testing emission in electronic equipment, anechoic chambers
Apparatus used in testing electromagnetic compatibility
Typical techniques for improving electromagnetic compatibility

## Prerequisites and co-requisites

Circuit theroy basics

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Test wiedzy | 50.0% | 50.0% |
| Ocena realizacji zadania | 50.0% | 50.0% |

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| Recommended reading | Basic literature | Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T1 . Źródła, sprzężenia, skutki WNT 1999<br><br>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T2. uziemienia, masy, oprzewodowanie WNT 2000<br><br>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T3. Ekrany, filtry, kable i przewody ekranowane, WNT 2000<br><br>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T4 Zasilanie,ochrona odgromowa, środki zaradcze. WNT 2000<br><br>Hasse i inni Zakłócenia w aparaturze elektronicznej, Radioelektronik, 1995<br><br>Seria norm PN-IEC 61000 dotyczących kompatybilności elektromagnetycznej (aktualny stan normalizacyjny dostępny na stronie internetowej: www.pkn.pl).<br><br>Dyrektywy UE dotyczące Kompatybilności Elektromagnetycznej (89/336/EEC) dostępne na stronie internetowej: www.oznaczenie-ce.pl. |
| | Supplementary literature | Więckowski Tadeusz Wiesław: Badania kompatybilnoci elektromagnetycznej urz'dze& elektrycznych i elektronicznych; Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001.<br><br>Więckowski Tadeusz Wiesław: Pomiar emisyjności urządzeń elektrycznych i elektronicznych; Wrocław: Politechnika Wrocławska, 1997 |
| | eResources addresses | |
| Example issues/ example questions/ tasks being completed | Indicate techniques for improving EMC in PCB design<br>Indicate techniques for preventing interference transfer<br>Discuss selected sources of interference<br>Design a circuit that eliminates overvoltages in the signal line<br>Discuss the importance of galvanic separation and provide typical solutions<br>Discuss basic shielding techniques | |
| Practical activites within the subject | Not applicable | |

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