



## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                                                                                   |                                     |                                                                             |            |     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Electromagnetic Compatibility of Electrical Equipment (EMC), PG_00041815                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                   |                                     |                                                                             |            |     |
| Field of study                              | KOMPATYBILNOŚĆ ELEKTROMAGNETYCZNA URZĄDZEŃ ELEKTRYCZNYCH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                   |                                     |                                                                             |            |     |
| Date of commencement of studies             | October 2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | Academic year of realisation of subject                                           |                                     | 2025/2026                                                                   |            |     |
| Education level                             | first-cycle studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          | Subject group                                                                     |                                     |                                                                             |            |     |
| 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                                                                      |                                     | 4.0                                                                         |            |     |
| Learning profile                            | general academic profile                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          | Assessment form                                                                   |                                     | assessment                                                                  |            |     |
| Conducting unit                             | Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                   |                                     |                                                                             |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                          | dr hab. inż. Jarosław Łuszcz                                                      |                                     |                                                                             |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                   |                                     |                                                                             |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Lecture                                                  | Tutorial                                                                          | Laboratory                          | Project                                                                     | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 30.0                                                     | 0.0                                                                               | 30.0                                | 0.0                                                                         | 0.0        | 60  |
|                                             | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 60                                                       |                                                                                   | 5.0                                 |                                                                             | 35.0       | 100 |
| Subject objectives                          | Providing knowledge about problems related to electromagnetic interference in electrical devices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                   |                                     |                                                                             |            |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          | Subject outcome                                                                   |                                     | Method of verification                                                      |            |     |
|                                             | K6_W10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | uses the principles of processing, use and rational use of electrical energy,     |                                     | [SW1] Ocena wiedzy faktograficznej                                          |            |     |
|                                             | K6_K01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | selects sources of specialist knowledge that expand the scope of program content. |                                     | [SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce   |            |     |
|                                             | K6_K05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | organize work in accordance with the principles of safety rules.                  |                                     | [SK3] Ocena umiejętności organizacji pracy                                  |            |     |
|                                             | K6_U09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | selects equipment for various compatibility tests                                 |                                     | [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu |            |     |
| Subject contents                            | Course content – lecture<br>LECTURE<br>Sources and propagation of conducted and radiated disturbances.<br>Electromagnetic emission and immunity of electrical devices.<br>Specificity of electromagnetic compatibility of power electronic devices.<br>Certification tests of electrical devices.<br>Methods of reducing electromagnetic interference<br>Basic anti-interference elements.<br>Principles of designing electromagnetically compatible devices and installations.<br>Analysis of typical problems related to EMC of electrical devices.<br>Problems related to EMC in adjustable speed drive systems.<br>Influence of electrical devices on the environment, living organisms and humans. |                                                          |                                                                                   |                                     |                                                                             |            |     |
|                                             | LABORATORY<br>Measurements of conducted and radiated electromagnetic disturbance emissions.<br>Measurements of device resistance to impulse disturbances.<br>Measurements of device resistance to high-frequency disturbances.<br>Measurements of the effectiveness of anti-interference filters.<br>Measurements of the effectiveness of electromagnetic shielding.<br>Presentation of examples of mutual interference between electronic devices.                                                                                                                                                                                                                                                     |                                                          |                                                                                   |                                     |                                                                             |            |     |
| Prerequisites and co-requisites             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                                                                                   |                                     |                                                                             |            |     |

|                                                                |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |
|----------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Assessment methods and criteria                                | Subject passing criteria                                             | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Percentage of the final grade |
|                                                                | Task realisation                                                     | 60.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100.0%                        |
| Recommended reading                                            | Basic literature                                                     | Charoy, Alain i in. Kompatybilność elektromagnetyczna: Zakłócenia w urządzeniach elektronicznych. Tom 1, 2, 3 i 4. Warszawa: Wydawnictwa Naukowo-Techniczne, 1999.<br>L. Hasse, J. Kołodziejski, Z. Karkowski, A. Konczakowska, L. Spiralski: Zakłócenia w aparaturze elektronicznej. Warszawa: "Radioelektronik ", 1995.<br>T. Więckowski, <i>Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych</i> . Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej, 2001.<br>Borecki, Michał i in. <i>Kompatybilność elektromagnetyczna: pomiary i badania</i> . Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej, 2021.<br>Kempski, Adam Józef, Elektromagnetyczne zaburzenia przewodzone w układach napędów przekształtnikowych. Zielona Góra: Oficyna Wydawnicza Uniwersytetu Zielonogórskiego, 2005.                                                                                                                                                                                                                                                                                                                                                                                                       |                               |
|                                                                | Supplementary literature                                             | Łuszcz, Jarosław. High Frequency Conducted Emission in AC Motor Drives Fed By Frequency Converters: Sources and Propagation Paths. John Wiley and Sons, Inc., Hoboken, N.J: 2018.<br>Sevgi, Levent. A Practical Guide to EMC Engineering / Levent Sevgi. Boston: Artech House, 2017.<br>Keller, Reto B. Design for Electromagnetic Compatibility--In a Nutshell: Theory and Practice / by Reto B. Keller. 1st ed. 2023. Cham: Springer Nature, 2023.<br><br>Smolenski, Robert. Conducted Electromagnetic Interference (EMI) in Smart Grids. 1st ed. 2012. London: Springer, 2012.<br>Sroka, Jan, Compendium on Electromagnetic Compatibility. First edition. Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej, 2021.<br>Łuszcz, Jarosław, Motor Cable Influence on the Conducted EMI Emission of the Converter Fed AC Motor Drive. p. 77-95. (Book chapter 4) - Queensland University of Technology, Bentham Science Publisher, Australia 2011.<br>Ott, Henry W. Electromagnetic Compatibility Engineering. Rev. ed. Hoboken, N.J: John Wiley & Sons, 2009.<br>Zare Firuz Ed., Electromagnetic Interference Issues in Power Electronics and Power Systems. Editor. 1st ed. Sharjah, United Arab Emirates: Bentham Science Publishers, 2011. |                               |
|                                                                | eResources addresses                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |
| Example issues/<br>example questions/<br>tasks being completed | Assessment of electromagnetic compatibility of an electrical device. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |
| Practical activites within the subject                         | Not applicable                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |

Document generated electronically. Does not require a seal or signature.