



## Subject card

|   |  |   |          |                                     |  |            |     |
|---|--|---|----------|-------------------------------------|--|------------|-----|
| Subject name and code                       | Electromagnetic Interference in Automation Systems, PG_00036794  |   |          |                                     |  |            |     |
| Field of study                              | Automation, Robotics and Control Systems   |   |          |                                     |  |            |     |
| Date of commencement of studies             | February 2022  | Academic year of realisation of subject   |          |                                     | 2022/2023  |            |     |
| Education level                             | second-cycle studies   | Subject group   |          |                                     |  |            |     |
| Mode of study                               | Full-time studies  | Mode of delivery  |          |                                     | at the university  |            |     |
| Year of study                               | 2  | Language of instruction   |          |                                     | Polish   |            |     |
| Semester of study                           | 3  | ECTS credits  |          |                                     | 2.0  |            |     |
| Learning profile                            | general academic profile   | Assessment form   |          |                                     | assessment   |            |     |
| Conducting unit                             | Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering   |   |          |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor   | dr hab. inż. Jarosław Łuszcz  |          |                                     |  |            |     |
|   | Teachers   |   |          |                                     |  |            |     |
| Lesson type and method of instruction       | 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  |          | 5.0                                 |  | 15.0       | 50  |
| Subject objectives                          | Understanding the basic physical phenomena related to the disturbances in the control and automation systems.  |   |          |                                     |  |            |     |
| Learning outcomes                           | Course outcome   | Subject outcome   |          |                                     | Method of verification   |            |     |
|   | K7_U07   | Ability to use analytical and simulation methods to solve engineering tasks.  |          |                                     | [SU3] Assessment of ability to use knowledge gained from the subject |            |     |
|   | K7_W06   | Knowledge of the sources of knowledge specialized expanding scope of program content.   |          |                                     | [SW1] Assessment of factual knowledge                                |            |     |
|   | K7_U03   | Ability to prepare and present presentation concerning problems and results of the task implementation engineering  |          |                                     | [SU5] Assessment of ability to present the results of task           |            |     |
|   | K7_U04   | Ability to obtain information from literature   |          |                                     | [SU2] Assessment of ability to analyse information                   |            |     |
|   | K7_W11   | Getting to know computer tools for designing automation systems.  |          |                                     | [SW1] Assessment of factual knowledge                                |            |     |
| Subject contents                            | Sources and propagation of conducted and radiated disturbances. Electromagnetic emission and immunity of automation systems. Inductive and capacitive parasitic couplings. Characteristics of power and signal circuits in the field of EMC. Interference protection in analog, digital and mixed circuits. Typical causes of disturbances in control and automation systems. Interference reduction methods (filtration, decoupling, shielding). The role of grounding, shielding and equipotentialization in reducing interference. Crosstalk in signal transmission paths. Attenuation of interference in analog signal transmission paths (0-10V, 4-20mA). Attenuation of interference in digital signal transmission paths (RS232, RS485, Ethernet) |   |          |                                     |  |            |     |
| Prerequisites and co-requisites             |  |   |          |                                     |  |            |     |
| Assessment methods and criteria             | Subject passing criteria   | Passing threshold   |          |                                     | Percentage of the final grade  |            |     |
|   | Lecture reports  | 50.0%   |          |                                     | 50.0%  |            |     |
|   | Task report  | 50.0%   |          |                                     | 50.0%  |            |     |
| Recommended reading                         | Basic literature   | Spiralski L., Kołodziejki J., Konczakowska A., Hasse L. Zakłócenia w aparaturze elektronicznej.<br>Charoy A.: Electromagnetic compatibility. Interference in electronic devices. Volume 1-4.<br>Bogtin E.: Signal and Power Integrity - Simplified. |          |                                     |  |            |     |

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|  | Supplementary literature   | Ott H. W. Metody redukcji zakłóceń i szumów w układach elektronicznych.<br>Howard W. Johnson, Martin Graham: High-speed Signal Propagation: Advanced Black Magic. |
|  | eResources addresses   |   |
| Example issues/<br>example questions/<br>tasks being completed | Analysis of digital signal transmission interference in serial interfaces.<br>Analysis of the transmission interference of 20 mA analog signals. |   |
| Work placement   | Not applicable   |   |