



## Subject card

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| Subject name and code                       | , PG_00053425                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                          |                                                                                             |                                     |                                                                      |            |     |
| Field of study                              | Automation, Robotics and Control Systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          |                                                                                             |                                     |                                                                      |            |     |
| Date of commencement of studies             | October 2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          | 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                               | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          | Language of instruction                                                                     |                                     | Polish                                                               |            |     |
| Semester of study                           | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          | ECTS credits                                                                                |                                     | 3.0                                                                  |            |     |
| Learning profile                            | general academic profile                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | Assessment form                                                                             |                                     | assessment                                                           |            |     |
| Conducting unit                             | Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering -> Wydział Politechniki Gdańskiej                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                                                                                             |                                     |                                                                      |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | dr hab. inż. Jarosław Łuszcz                                                                |                                     |                                                                      |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          |                                                                                             |                                     |                                                                      |            |     |
| Lesson types and methods 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                                 |                                                                      | 40.0       | 75  |
| 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                                               |            |     |
|                                             | [K6_U01] can obtain information from literature, databases and other sources; integrate the information obtained, interpret it and draw conclusions, formulate and justify opinions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | obtains information from literature sources and knowledge bases                             |                                     | [SU2] Assessment of ability to analyse information                   |            |     |
|                                             | [K6_U03] can prepare and present a presentation on the problems and results of an engineering task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | prepares presentations of results engineering research                                      |                                     | [SU5] Assessment of ability to present the results of task           |            |     |
|                                             | [K6_W06] knows the structure of computers and microprocessors and the tasks of operating systems, has basic knowledge of the basics of computer software, drivers, microprocessor technology, design of simple algorithms and the operation of information networks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | performs simple engineering tasks in the field of microprocessor technology and IT networks |                                     | [SW3] Assessment of knowledge contained in written work and projects |            |     |
|                                             | [K6_W10] has basic knowledge related to mechatronics and robotics systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | defines basic engineering issues related to mechatronics and robotics systems               |                                     | [SW1] Assessment of factual knowledge                                |            |     |
| Subject contents                            | <p>Lecture:<br/>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)</p> <p>Laboratory:<br/>Testing conducted and radiated emissions of electrical devices.<br/>Testing the effectiveness of anti-interference filtration.<br/>Shielding effectiveness test.</p> |                                                          |                                                                                             |                                     |                                                                      |            |     |

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| Prerequisites and co-requisites                                |                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |
| Assessment methods and criteria                                | Subject passing criteria                                                                                                                         | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Percentage of the final grade |
|                                                                | Task report                                                                                                                                      | 50.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 50.0%                         |
|                                                                | Lecture reports                                                                                                                                  | 50.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 50.0%                         |
| Recommended reading                                            | Basic literature                                                                                                                                 | Spiralski L., Kołodziejski J., Konczakowska A., Hasse L. Zakłócenia w aparaturze elektronicznej. Warszawa: Radioelektronik 1995.<br>Charoy A.: Kompatybilność elektromagnetyczna : zakłócenia w urządzeniach elektronicznych. T. 1, Źródła, sprzężenia, skutki : zasady i porady instalacyjne. Warszawa: WNT 1999.<br>Charoy A.: Kompatybilność elektromagnetyczna: zakłócenia w urządzeniach elektronicznych. T. 2, Uziemienia, masy, oprzewodowanie: zasady i porady instalacyjne. Warszawa: WNT 2000.<br>Charoy A.: Kompatybilność elektromagnetyczna: zakłócenia w urządzeniach elektronicznych. T. 3, Ekrany, filtry, kable i przewody ekranowane: zasady i porady instalacyjne. Warszawa: WNT 2000.<br>Charoy A.: Kompatybilność elektromagnetyczna: zakłócenia w urządzeniach elektronicznych. T. 4, Zasilanie, ochrona odgromowa, środki zaradcze: zasady i porady instalacyjne. Warszawa: WNT 2000.<br>Bogatin E.: Signal and Power Integrity - Simplified. Prentice Hall 2018. |                               |
|                                                                | Supplementary literature                                                                                                                         | Ott H. W. Metody redukcji zakłóceń i szumów w układach elektronicznych. Warszawa: WNT 1979.<br>Howard W. Johnson, Martin Graham: High-speed Signal Propagation: Advanced Black Magic. Pearson 2003.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                               |
|                                                                | eResources addresses                                                                                                                             | Adresy na platformie eNauczanie:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |
| 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                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |

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