



## Subject card

|   |   |   |          |                                     |  |            |     |
|---|---|---|----------|-------------------------------------|--|------------|-----|
| Subject name and code                       | Materials Science and Equipment Design, PG_00047588   |   |          |                                     |  |            |     |
| Field of study                              | Electronics and Telecommunications  |   |          |                                     |  |            |     |
| Date of commencement of studies             | October 2023  | Academic year of realisation of subject   |          |                                     | 2023/2024                                      |            |     |
| Education level                             | first-cycle studies   | Subject group   |          |                                     | Obligatory subject group in the field of study |            |     |
| Mode of study                               | Full-time studies   | Mode of delivery  |          |                                     | at the university                              |            |     |
| Year of study                               | 1   | Language of instruction   |          |                                     | Polish   |            |     |
| Semester of study                           | 2   | ECTS credits  |          |                                     | 2.0  |            |     |
| Learning profile                            | general academic profile  | Assessment form   |          |                                     | assessment                                     |            |     |
| Conducting unit                             | Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics   |   |          |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor  | dr hab. inż. Marcin Gnyba   |          |                                     |  |            |     |
|   | Teachers  | dr hab. inż. Marcin Gnyba<br>dr inż. Mateusz Ficek<br>dr hab. inż. Paweł Wierzba<br>dr inż. Adam Mazikowski<br>Iwona Kaczmarzyk |          |                                     |  |            |     |
| 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  |          | 2.0                                 |  | 18.0       | 50  |
| Subject objectives                          | Subject necessary for proper formation of the graduate profile. The student acquires knowledge of the construction materials used in electronics and construction of basic electronic components. Together he acquires skills of the selection of materials and components as well as measuring their parameters. |   |          |                                     |  |            |     |

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|---|---|---|---------------------------------------|
| Learning outcomes   | Course outcome  | Subject outcome   | Method of verification                |
|   | [K6_W03] Knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum  | 1. Student classifies dielectrics, magnetics, conductors and resistive materials.<br>2. Student describes construction and properties of RLC components.<br>3. The student describes the influence of the temperature and frequency of the signal on electronic materials and RLC elements.   | [SW1] Assessment of factual knowledge |
|   | [K6_W02] Knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study   | 1. Student describes selected interactions between EM radiation and materials.<br>2. Student describes properties and parameters of dielectrics, magnetics, conductors and resistive materials.   | [SW1] Assessment of factual knowledge |
| [K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions | 1. The student is able to perform a measurement task on the basis of workplace training.<br>2. The student is able to use the signal generator, multimeter, RLC meter, oscilloscope and thermostat in a basic degree<br>3. Student analyses correlation between molecular composition of materials and their macroscopic properties.  | [SU1] Assessment of task fulfilment<br>[SU2] Assessment of ability to analyse information<br>[SU4] Assessment of ability to use methods and tools   |                                       |
| Subject contents  | 1. Macroscopic and microscopic approach to solid state materials; crystalline and amorphous materials. 2. Thin films and bulk materials. Alloys, ceramics, polymers and composite materials. 3. Electromagnetic spectrum and conventional designations. Magnetization of matter; electrical conductivity; matter polarization. 4. Magnetic material classifications: ferromagnetism, ferrimagnetism, paramagnetism. Soft and hard magnetic materials. 5. Magnetic alloys and magnetic ceramics (ferrites) - selected matters of manufacturing technology 6. Magnetic components and their equivalent circuits. 7. Examples of magnetic materials and their applications: magnetic recording materials, cores of the coils and transformers, sensors, high energy magnets; trends of development. 8. Dielectric materials and insulation; electronic polarization; dielectric loss. 9. Linear and nonlinear dielectrics: ferroelectricity, piezoelectricity and pyroelectricity. 11. Dielectric materials examples and applications. |   |                                       |
| Prerequisites and co-requisites   | No requirements   |   |                                       |
| Assessment methods and criteria   | Subject passing criteria  | Passing threshold   | Percentage of the final grade         |
|   | Practical exercise  | 50.0%   | 40.0%                                 |
|   | Midterm colloquium  | 50.0%   | 60.0%                                 |
| Recommended reading   | Basic literature  | M.Blicharski, "Wstęp do inżynierii materiałowej", WNT, Warszawa 1998<br>Z. Celiński, "Materiałoznawstwo elektrotechniczne", Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1998<br>H. Rawa, "Podstawy Elektromagnetyzmu", Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996<br>Michel K., Sapiński T., "Rysunek techniczny elektryczny", WNT, Warszawa 1987<br>S.O. Kasap, "Principles of Electronic Materials and Devices", McGraw-Hill, Second Edition 1996.<br>Dokumentacja laboratoryjna oprogramowania, pliki pomocnicze w formacie *.pdf<br>User Manuals, Tutorials, data sheets<br>Oleksiuk W., Paprocki K., "Konstrukcja mechanicznych zespołów sprzętu elektronicznego", WKiŁ, Warszawa 1997<br>Burcan J., "Podstawy rysunku technicznego". WNT, Warszawa 2006<br>Instrukcja laboratoryjna użytkownika pakietu programów PADS. Katedra Aparatury Pomiarowej, 2001 i 2005<br>Spiralski L., Konczakowska A., "Podstawy technologii i konstrukcji urządzeń i systemów elektronicznych", Skrypt WSM, Gdynia 1997.<br>K. Radecki, "Materiały i elementy elektroniczne bierne", Wydawnictwa Politechniki Warszawskiej, Warszawa 1991 |                                       |
|   | Supplementary literature  | No requirements   |                                       |
|   | eResources addresses  | Adresy na platformie eNauczenie:<br>Inżynieria Materiałowa i Konstrukcja Urządzeń 2024 - Moodle ID: 37801<br><a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=37801">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=37801</a>  |                                       |
| Example issues/<br>example questions/<br>tasks being completed  | 1 Measurement of nominal and residual parameters of the electronic components.<br>2 Determination of temperature parameters of materials and components.<br>3 Determine the relationship between the composition of the material and its electrical and magnetic parameters.  |   |                                       |
| Work placement  | Not applicable  |   |                                       |