



## Subject card

|   |   |  |  |                                     |  |            |     |
|---|---|--|--|-------------------------------------|--|------------|-----|
| Subject name and code                       | , PG_00056104   |  |  |                                     |  |            |     |
| Field of study                              | Mechanical and Medical Engineering  |  |  |                                     |  |            |     |
| Date of commencement of studies             | October 2022  |  | Academic year of realisation of subject  |                                     | 2024/2025  |            |     |
| 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   |                                     | 2.0  |            |     |
| Learning profile                            | general academic profile  |  | Assessment form  |                                     | assessment   |            |     |
| Conducting unit                             | Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology  |  |  |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor  |  | dr inż. Magdalena Jażdżewska   |                                     |  |            |     |
|   | Teachers  |  | dr inż. Magdalena Jażdżewska   |                                     |  |            |     |
| 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   |  | 0.0                                 |  | 0.0        | 30  |
| Subject objectives                          | Getting to know the technologies of surface layers and coatings.  |  |  |                                     |  |            |     |
| Learning outcomes                           | Course outcome  |  | Subject outcome  |                                     | Method of verification   |            |     |
|   | [K6_W13] he/she has knowledge related to application of engineering approaches in medicine or application of medical devices and rehabilitation devices   |  | The student has knowledge of selected issues related to the application of mechanical engineering in medicine              |                                     | [SW1] Assessment of factual knowledge  |            |     |
|   | [K6_U07] he/she is able to identify the problem and list simple engineering tasks to solve this problem in practice, he/she is able to critically analyze the proposed technical solutions and conclude whether these solutions can be implemented to solve problems related to design of mechanical devices and mechanical-medical devices |  | The student is able to assess the usefulness of the known methods for solving a simple engineering task.                   |                                     | [SU4] Assessment of ability to use methods and tools<br>[SU2] Assessment of ability to analyse information               |            |     |
|   | [K6_K01] he/she knows his/her proficiencies and his/her limitations in performing professional tasks, he/she is aware of needing to improve his/her skills through the whole life, he/she has entrepreneurship and innovation skills, he/she is aware of engineering skills from the society point of view                                  |  | The student is aware of his competences and limitations in the performance of professional tasks.                          |                                     | [SK4] Assessment of communication skills, including language correctness<br>[SK3] Assessment of ability to organize work |            |     |
|   | [K6_W04] he/she has skills in the field mechanical testing of materials used in engineering and mechanical-medical area   |  | The student has knowledge of the structure, properties and testing methods of coatings in the field of medical engineering |                                     | [SW1] Assessment of factual knowledge  |            |     |
|   | [K6_W07] he/she is able to design, manufacture and utilize machine parts and technical devices, he/she can prepare a technical documentation  |  | The student has knowledge of the methods of obtaining coatings, types of coatings, properties and basic research methods.  |                                     | [SW1] Assessment of factual knowledge  |            |     |

|  |   |   |                               |
|--|---|---|-------------------------------|
| Subject contents   | LECTURE: Classification of methods and techniques for producing surface layers. Chemical and electrolytic methods of producing metal coatings. Selected technologies of steel impregnation with non-metals and metals. Gas, arc, plasma and detonation spraying. Fluorescent treatment techniques and their application. Fabrication of surface layers by laser processing, CVD, PVD and PLD. Test methods for surface layers.<br><br>LABORATORY: Production of coatings using the electrolytic method. Microscopic analysis of the obtained layers and coatings. Assessment of selected properties of the obtained layers and coatings.  |   |                               |
| Prerequisites and co-requisites                                | Basic knowledge of materials science.   |   |                               |
| Assessment methods and criteria                                | Subject passing criteria  | Passing threshold   | Percentage of the final grade |
|  | Test of the lecture   | 50.0%   | 60.0%                         |
|  | Practical exercises   | 50.0%   | 40.0%                         |
| Recommended reading  | Basic literature  | 1. Burakowski T., Wierzchoń T.: Inżynieria powierzchni metali. WNT Warszawa 1995.<br><br>2. Praca zbiorowa pod redakcją Stanisława Tkaczyka.: Powłoki ochronne. Gliwice 1994.<br><br>3. Kula P.: Inżynieria warstwy wierzchniej. Wyd. Politechniki Łódzkiej, Łódź 2000.<br><br>4. Kusiński J.: Lasery i ich zastosowanie w inżynierii materiałowej. Kraków, Wyd. Naukowe Akapit 2000.<br><br>5. Klimpel A.: Napawanie i natryskiwanie cieplne. Technologie. WNT Warszawa 2000<br><br>6. Głowacka M., Łabanowski J.: Inżynieria Powierzchni Wybrane Zagadnienia, WPWSZ Elbląg 2014 |                               |
|  | Supplementary literature  | 1. Dobrzański L.A.: Podstawy nauki o materiałach i metaloznawstwo. Materiały inżynierskie i podstawy projektowania materiałowego. WNT. 2002.  |                               |
|  | eResources addresses  | Adresy na platformie eNauczanie:<br>Techniki inżynierii powierzchni W, L, IMM, sem. 06, Ist., sem. letni 2024/25 - Moodle ID: 45172<br><a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=45172">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=45172</a>  |                               |
| Example issues/<br>example questions/<br>tasks being completed | 1. Basic concepts of Surface Engineering: surface layer, top layer, protective coating<br><br>2. Classification of coatings and their requirements according to the type of material from which it is made according to the intended use according to the type of protection<br><br>3. Methods of producing surface layers: substrate preparation, mechanical, thermo-mechanical, thermal, thermo-chemical, electrochemical, chemical and physical methods.<br><br>4. Galvanic coatings: types of coatings and their requirements, factors affecting the structure of the coating, coating technology, advantages of the galvanic method, typical electrolytic coatings used in the technology (Zn, Cr, Ni, Fe, composite)<br><br>5. Immersion coatings: characteristics, operations; tin coatings - properties, application; galvanizing - methods, properties, application; aluminizing - types, properties, application<br><br>6. Thermally sprayed coatings: description of the method, preparation of the substrate surface, stages of spray metallization, coating materials, properties and application of sprayed coatings, types of spraying - characteristics, important parameters<br><br>7. Methods of testing surface layers |   |                               |
| Work placement   | Not applicable  |   |                               |

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