



## Subject card

|   |   |  |                                     |            |  |         |     |
|---|---|--|-------------------------------------|------------|--|---------|-----|
| Subject name and code                       | Modelling of heat and plastic treatment processes of materials, PG_00057383   |  |                                     |            |  |         |     |
| Field of study                              | Mechanical Engineering  |  |                                     |            |  |         |     |
| Date of commencement of studies             | February 2024   | Academic year of realisation of subject                  |                                     |            | 2024/2025  |         |     |
| Education level                             | second-cycle studies  | Subject group  |                                     |            | Optional subject group<br>Subject group related to scientific research 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   |                                     |            | 4.0  |         |     |
| Learning profile                            | general academic profile  | Assessment form  |                                     |            | exam   |         |     |
| Conducting unit                             | Zakład Materiałoznawstwa I Technologii Materiałowych -> Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology  |  |                                     |            |  |         |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor  | dr inż. Krzysztof Krzysztofowicz                         |                                     |            |  |         |     |
|   | Teachers  |  |                                     |            |  |         |     |
| Lesson types and methods of instruction     | Lesson type   | Lecture  | Tutorial                            | Laboratory | Project  | Seminar | SUM |
|   | Number of study hours   | 30.0   | 0.0                                 | 15.0       | 15.0   | 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   | 8.0                                 |            | 32.0   | 100     |     |
| Subject objectives                          | The aim of the course is to familiarize students with the basic issues related to heat treatment and plastic working of construction materials.   |  |                                     |            |  |         |     |
| Learning outcomes                           | Course outcome  | Subject outcome  |                                     |            | Method of verification   |         |     |
|   | [K7_W10] possesses knowledge on the methods of technical and economic analysis of industrial systems and optimization of manufacturing systems; is familiar with the general principles of initiating and developing forms of individual entrepreneurship, particularly for innovative projects using the knowledge | has knoweldge and knows rules                            |                                     |            | [SW3] Assessment of knowledge contained in written work and projects                         |         |     |
|   | [K7_U07] is able to perform a preliminary economic analysis of the undertaken engineering actions within the range of design, production and operation of machines and technical devices  | is able to make a preliminary analysis                   |                                     |            | [SU5] Assessment of ability to present the results of task                                   |         |     |
|   | [K7_W04] possesses specialized knowledge on design, construction, properties and testing methods of construction materials  | hes specialist knowledge                                 |                                     |            | [SW3] Assessment of knowledge contained in written work and projects                         |         |     |

| Subject contents   | <p>Lecture: Design and modeling of thermo-chemical treatment processes in relation to plastics iron-based metal. Diffusion saturation with non-metallic elements. Nitriding conventional and ionic, selective nitriding. Conventional carburizing, high temperature and ionic. Diffusion saturation with metallic elements. Machining defects thermochemical. Basics of plastic working. Plastic deformation of metals. The influence of plastic deformation on the properties of metals. Classification of plastic working processes. Rolling of metals. Rolling of sections. Rolling of pipes. Forging and ironing. Forging and pressing machines. Open-die forging. Die forging. Classification of forgings. Drawing and extrusion. Characteristics of drawing and extrusion processes. Drawing machines. Extrusion presses. Technology for drawing bars, wires and pipes. Technology of extrusion processes. Classification of pressing processes. Metal cutting. Metal bending. Multiple and simultaneous pressing</p> <p>Project: Design of the OC process, Design of the plastic forming process</p> <p>Laboratory: Hardening, tempering, thermo-chemical treatment, plastic forming processes</p> |   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
|--|---|---|--|--------------------------|-------------------|-------------------------------|------|-------|-------|-----------------------|-------|-------|---------|-------|-------|
| Prerequisites and co-requisites                                |   |   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Assessment methods and criteria                                | <table border="1"> <thead> <tr> <th data-bbox="451 595 794 629">Subject passing criteria</th> <th data-bbox="794 595 1137 629">Passing threshold</th> <th data-bbox="1137 595 1487 629">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 629 794 663">Exam</td> <td data-bbox="794 629 1137 663">50.0%</td> <td data-bbox="1137 629 1487 663">30.0%</td> </tr> <tr> <td data-bbox="451 663 794 696">Laboratory - activity</td> <td data-bbox="794 663 1137 696">50.0%</td> <td data-bbox="1137 663 1487 696">30.0%</td> </tr> <tr> <td data-bbox="451 696 794 730">Project</td> <td data-bbox="794 696 1137 730">50.0%</td> <td data-bbox="1137 696 1487 730">40.0%</td> </tr> </tbody> </table>   |   |  | Subject passing criteria | Passing threshold | Percentage of the final grade | Exam | 50.0% | 30.0% | Laboratory - activity | 50.0% | 30.0% | Project | 50.0% | 40.0% |
| Subject passing criteria                                       | Passing threshold   | Percentage of the final grade   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Exam   | 50.0%   | 30.0%   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Laboratory - activity  | 50.0%   | 30.0%   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Project  | 50.0%   | 40.0%   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Recommended reading  | <p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>   | <p>1. Burakowski T., Roliński E., Wierzchoń T.: Inżynieria powierzchni metali. WPW, Warszawa 1992.</p> <p>2. Jarzębski M.Z.: Dyfuzja w metalach. Śląsk. Katowice 1976.</p> <p>3. Praca zbiorowa.: Metaloznawstwo. Skrypt Politechniki Gdańskiej, Gdańsk 1991.</p> <p>4. Poradnik inżyniera. Obróbka cieplna stopów żelaza. WNT, Warszawa 1977.</p> <p>1. Askeland. D, Phules P.: The science and engineering of materials. Thomson 2008</p> <p>Adresy na platformie eNauczanie:</p> |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Example issues/<br>example questions/<br>tasks being completed | <p>1. Quenching and tempering process</p> <p>2. Annealing</p> <p>3. Design of the heat treatment process 4. Design of the plastic forming process</p>   |   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |
| Work placement   | Not applicable  |   |  |                          |                   |                               |      |       |       |                       |       |       |         |       |       |