Subject card

| Subject name and code | Welding Technologies, PG_00055383 |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Field of study | Mechanical Engineering |  |  |  |  |  |  |
| Date of commencement of studies | October 2022 |  | 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 | 2 |  | Language of instruction |  |  | Polish |  |
| Semester of study | 3 |  | ECTS credits |  |  | 3.0 |  |
| Learning profile | general academic profile |  | Assessment form |  |  | assessment |  |
| Conducting unit | Department of Materials Engineering and Bonding -> Faculty of Mechanical Engineering and ShipTechnology |  |  |  |  |  |  |
| Name and surname of lecturer (lecturers) | Subject supervisor |  | prof. dr hab. inż. Jerzy Łabanowski |  |  |  |  |
|  | Teachers |  | mgr inż. Adrian Wolski dr hab. inż. Dariusz Fydrych dr inż. Aleksandra Świerczyńska dr inż. Jacek Haras prof. dr hab. inż. Jerzy Łabanowski |  |  |  |  |
| Lesson types and methods of instruction | Lesson type |  | Tutorial | Laboratory | Project | Seminar | SUM |
|  | Number of study hours | 15.0 |  | 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 |  | 8.0 |  | 37.0 | 75 |
| Subject objectives | To acquaint students with the basic technologies of joining materials and methods of assessing the properties of the obtained joints |  |  |  |  |  |  |
| Learning outcomes | Course outcome |  | Subject outcome |  |  | Method of verification |  |
|  | [K6_W03] possesses and is able to practically apply the knowledge on the construction, properties and testing methods of construction materials |  | The student knows the basic methods of joining and cutting construction materials. Student knows the methods for assessing the quality of welded joints |  |  | [SW1] Assessment of factual knowledge |  |
|  | [K6_U10] is able to formulate the principles of selecting a material for a construction, ensuring the correct operation of a device |  | The student is able to select the welding methods for a specific material group. The student is able to choose the welding parameters for the structural steel. The student indicates the methods for assessing the quality of welded joints |  |  | [SU3] Assessment of ability to use knowledge gained from the subject |  |
| Subject contents | COURSE CONTENT Classification of welding and joining processes. Outline of welding thermal cycles. Phase transformations in the weld and heat affected zone. Definition of weldability. Basic and supplementary materials for welding. Basics of welding technology specification. Gas welding. Manual arc welding (MMA). Submerged arc welding under flux. TIG welding. Shielding gases. Gas-shielded arc welding MIG / MAG methods. Flux cored arc welding. Pulse arc welding. Laser welding, plasma and electron beam welding. Resistance pressure welding, spot and linear pressure welding, upset and flash welding. Basic parameters of the process. Other methods of pressure welding. Brazing. Thermal cutting methods: oxygen cutting, plasma cutting. Cutting laser beam. Deformation and welding stress and methods for their reduction. Inspection of welded joints, imperfections definitions and methods for their detection. LABORATORY PRACTICAL TRAINING Manual arc welding with coated electrodes, automatic submerged arc welding. Gasshielded arc welding. Pressure resistance welding. Gas welding and cutting. Structure of welded joints. Imperfections of welded joints |  |  |  |  |  |  |
| Prerequisites and co-requisites | Basic knowledge of ferrous and nonferrous metals and alloys |  |  |  |  |  |  |


| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| :---: | :---: | :---: | :---: |
|  | colloquium at the end of the course | 50.0\% | 60.0\% |
|  | Reports of the laboratory exercises | 50.0\% | 40.0\% |
| Recommended reading | Basic literature | 1. Klimpel A.: Technologia spawania i cięcia metali. Wyd. Politechniki Ślaskiej, Gliwice 1997. <br> 2. Walczak W. i inni: Spawalnictwo ćwiczenia laboratoryjne. Wyd. Politechniki Gdańskiej, Gdańsk, 2000. <br> 3. Klimpel A., Mazur M.: Podręcznik spawalnictwa. Wyd. Politechniki Ślaskiej, Gliwice 2004. |  |
|  | Supplementary literature | 1. Ferenc K.: Spawalnictwo <br> 2. Poradnik Inżyniera Spaw <br> 3. Ferenc K., Ferenc J.: Sp Warszawa 2005. | Varszawa 2007. <br> , tom I i II, WNT Warszawa, 2005 <br> gazy osłonowe i palne. WNT |
|  | eResources addresses | Adresy na platformie eNauczanie: |  |


| Example issues/ | Make the distribution of welding processes, taking into account the state of the material in the joints, |
| :--- | :--- |
| example questions/ | adhesives, external factors. |
| tasks being completed | 2. What is the process of welding metals |
| 3. What is the process of soldering |  |
| 4. What is the process of welding of metal |  |
| 5. Compare the welding technology of riveting (pros and cons) |  |
| 6. Make the distribution of welding processes |  |
| 7. Draw a cross-section of the welded joint butt and review its constitution |  |
| 8. Explain determine: binder, weld metal, weld ridge, SWC |  |
| 9. What are some types of welds and welded joints? |  |
| 10. Explain what purpose ukosuje edges of welded parts? |  |
| 11. What are the sources of heat in welding processes? |  |
| 12. What is the electric arc, in what conditions arises, what are the characteristics? |  |
|  | 13. What are the characteristics of static electric arc? |
| 14. What are the sources of welding current? |  |
| 15. What is the gas welding? |  |
| 16. Replace the pros and cons of gas welding |  |
| 17. What are the sources of heat in gas welding? |  |
| 18. Describe the method of arc welding electrode coated (indicated outline diagram) |  |
|  | 19. Replace the advantages and disadvantages of arc welding electrode coated |
| 20. How are built covered electrodes (the role and types of cover) |  |
| 21. Describe the method of submerged arc welding flux (indicated outline diagram) |  |
| 22. Replace the pros and cons of submerged arc welding flux |  |
| 23. What is the role of flux in the submerged arc welding flux |  |

