



## Subject card

Subject name and code	Welding Technologies, PG_00055383						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2022/2023		
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 Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jerzy Łabanowski					
	Teachers	prof. dr hab. inż. Jerzy Łabanowski dr inż. Aleksandra Świerczyńska mgr inż. Adrian Wolski dr inż. Jacek Haras					
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	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_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		
	[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		
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. Gas-shielded 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		
	Reports of the laboratory exercises	50.0%			40.0%		
	colloquium at the end of the course	50.0%			60.0%		

Recommended reading	Basic literature	<p>1. Klimpel A.: Technologia spawania i cięcia metali. Wyd. Politechniki Śląskiej, Gliwice 1997.</p> <p>2. Walczak W. i inni: Spawalnictwo ćwiczenia laboratoryjne. Wyd. Politechniki Gdańskiej, Gdańsk, 2000.</p> <p>3. Klimpel A., Mazur M.: Podręcznik spawalnictwa. Wyd. Politechniki Śląskiej, Gliwice 2004.</p>
	Supplementary literature	<p>1. Ferenc K.: Spawalnictwo. WNT Warszawa 2007.</p> <p>2. Poradnik Inżyniera Spawalnictwo, tom I i II, WNT Warszawa, 2005</p> <p>3. Ferenc K., Ferenc J.: Spawalnicze gazy osłonowe i palne. WNT Warszawa 2005.</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>Make the distribution of welding processes, taking into account the state of the material in the joints, adhesives, external factors.</p> <ol style="list-style-type: none"> <li>2. What is the process of welding metals</li> <li>3. What is the process of soldering</li> <li>4. What is the process of welding of metal</li> <li>5. Compare the welding technology of riveting (pros and cons)</li> <li>6. Make the distribution of welding processes</li> <li>7. Draw a cross-section of the welded joint butt and review its constitution</li> <li>8. Explain determine: a binder, weld metal, weld ridge, SWC</li> <li>9. What are some types of welds and welded joints?</li> <li>10. Explain what purpose ukosuje edges of welded parts?</li> <li>11. What are the sources of heat in welding processes?</li> <li>12. What is the electric arc, in what conditions arises, what are the characteristics?</li> <li>13. What are the characteristics of static electric arc?</li> <li>14. What are the sources of welding current?</li> <li>15. What is the gas welding?</li> <li>16. Replace the pros and cons of gas welding</li> <li>17. What are the sources of heat in gas welding?</li> <li>18. Describe the method of arc welding electrode coated (indicated outline diagram)</li> <li>19. Replace the advantages and disadvantages of arc welding electrode coated</li> <li>20. How are built covered electrodes (the role and types of cover)</li> <li>21. Describe the method of submerged arc welding flux (indicated outline diagram)</li> <li>22. Replace the pros and cons of submerged arc welding flux</li> <li>23. What is the role of flux in the submerged arc welding flux</li> <li>24. What are some methods shielded welding shielding gas</li> <li>25. Explain marking methods MMA, GMA, GTA, MIG, MAG</li> <li>26. Describe the method of arc welding electrode tungsten inert gas (TIG) (indicated outline diagram)</li> <li>27. Replace the advantages and disadvantages of TIG welding</li> <li>28. What is the role of argon and helium used in TIG</li> <li>29. Describe the method of arc welding with consumable electrode in inert gas (indicated outline diagram)</li> <li>30. Replace the advantages and disadvantages of MIG / MAG</li> <li>31. In what way can be transmitted metal arc welding, and what is it practical significance?</li> <li>32. What they are cored wires and they have advantages over solid wires?</li> <li>33. What is plasma welding?</li> <li>34. What is the laser welding?</li> <li>35. What is welding electron?</li> <li>36. What is the welding of metals, welding methods that you know?</li> <li>37. Characterize the butt welding short-circuit (spark)</li> <li>38. Characterize the electric welding point and linear</li> <li>39. What is friction welding?</li> <li>40. What is the explosion welding?</li> <li>41. What is the cutting of metals with oxygen?</li> <li>42. What conditions must be met to be able to cut metal with oxygen?</li> <li>43. What is plasma cutting?</li> <li>44. What are some methods to assess the quality of welded joints?</li> <li>45. What inconsistencies and defects can occur in welded joints and how they affect the properties of the connectors?</li> <li>46. What are the non-destructive testing visual (VT), penetrant (PT), magnetic particle (MT), radiographic (RT), ultrasonic (UT).</li> <li>47. What are the destructive testing of welded joints.</li> <li>48. What do you understand by the term weldability of steel?</li> <li>49. What are constantly ranked among the weldable steel?</li> <li>50. What problems may occur during welding, related to its limited weldability?</li> <li>51. What is the structure of a welded joint SWC?</li> <li>52. What is heat input welding?</li> <li>53. How do you estimate the weldability of low-alloy steel?</li> </ol>	
Work placement	Not applicable	