GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Advanced welding processes, PG_00064942		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Structural Materials Technology and Welding -> Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Grzegorz Rogalski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	9.0	0.0	9.0	9.0	0.0	27

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	27	5.0	43.0	75

Subject objectives

The aim of the course is to familiarize students with advanced bonding processes. The topics covered include the physical foundations of the processes discussed, the relationships between the basic variables and their influence on the obtained properties of bonded joints, technological guidelines and areas of their implementation

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W11] interprets social, economic, legal (including industrial and intellectual property laws), and other non-technical aspects of engineering activities, and includes them into engineering practice	The student is aware of the impact of non-technical aspects of advanced joining processes on the surrounding industrial environment and knows the risks of their implementation, including those related to the protection of intellectual value.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_W01] explains and describes, on the basis of general knowledge of the scientific disciplines forming the theoretical basis of Mechanics and Mechanical Engineering, the structure and principles of operation of mechanical systems and processes	The student is able to explain and describe advanced joining technologies taking into account information that forms the theoretical foundations of Mechanics and Machine Design, e.g. issues related to the modification of technological and mechanical processes, etc.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	The student has the ability to select a bonding process depending on the requirements for the product.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Subject contents

Course content – lecture

Basic concepts and definitions. Classification of welding processes. Laser welding. Plasma welding. Electron beam welding. Hybrid welding. Solid state bonding. Vacuum brazing. Developments of standard welding processes that allow for increased efficiency and quality of the joints made, e.g. orbital welding, deep penetration welding, tandem welding and others.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="2">Basic knowledge of bonding processes</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td></td><td>60.0%</td><td>25.0%</td></tr>
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</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Pilarczyk J. (red.): Poradnik inżyniera. Spawalnictwo. tom I. Wydawnictwo Naukowe PWN, Warszawa. 2021

Pilarczyk J. (red.): Poradnik inżyniera. Spawalnictwo. tom II Wydawnictwo Naukowe PWN, Warszawa. 2022

Chmielewski T., Zembaty Z.: Projektowanie procesów technologicznych. Spawalnictwo.. Oficyna Wydawnicza Politechniki9 Warszawskiej. 2013

Nowacki J.: Lutowanie w budowie maszyn. wydawnictwo WNT. 2017</td></tr>
<tr><td>Supplementary literature</td><td>Klimpel A.: Technologie laserowe. Spawanie, napawanie, stopowanie, obróbka cieplna i cięcie. Wydawnictwo Politechniki Śląskiej, Gliwice

Klimpel A.: Nowoczesne lasery i technologie laserowe w inżynierii spawalnictwa. Wydawnictwo Politechniki Śląskiej, Gliwice 2023</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Explain the differences between the joining processes, i.e. welding, brazing, soldering, gluing

2. Characterize the vacuum brazing process, provide its stages and description

3. Describe the physical phenomena characteristic of the plasma welding process

4. Explain the influence of the fundamental variables of the laser welding process on the geometry of the weld

5. Describe and explain the principle of operation of the TIG welding process with deep penetration

6. Provide the differences between the MIG/MAG and FCAW welding processes, specify the method of droplet transfer to the liquid metal pool for each method.

7. Provide the parameters of stir welding (FSW) and their influence on the construction of the joint</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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