GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00073359		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
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	9.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Biomaterials Technology -> 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 inż. Michał Bartmański	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	125.0	0.0	0.0	155

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=9096

Moodle ID: 9096 Metody modyfikacji powierzchni implantów https://enauczanie.pg.edu.pl/2025/course/view.php?id=9096

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	155	10.0	60.0	225

Subject objectives

The aim of the course is to familiarize the student with basic and modern methods of implant surface modification and their influence on the physicochemical, mechanical, and biological properties of implant materials. The student learns how to select appropriate surface modification and characterization methods depending on implant requirements.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	Evaluates the suitability of modern implant surface modification methods for improving their functional and biological properties.	[SU1] Assessment of task fulfilment
[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	Selects appropriate methods for implant surface modification and characterization to solve specific engineering problems.	[SU4] Assessment of ability to use methods and tools
[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	Characterizes current methods and development trends in implant surface modification technologies.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W02] has structured and well-founded knowledge covering fundamental issues in the field of medical sciences allowing to design medical devices, rehabilitation systems and to formulate research procedures	Explains the influence of implant surface properties on biocompatibility, osseointegration, and interactions with surrounding tissues.	[SW3] Assessment of knowledge contained in written work and projects

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Fundamentals of surface modification of implant materials. Mechanical, chemical, electrochemical, and physical surface modification methods. Anodizing and micro-arc oxidation (MAO), electrophoretic deposition (EPD), laser treatment, sol-gel methods, PVD and CVD coating deposition, and plasma-based modifications. Fabrication of ceramic, polymeric, and composite coatings. Surface functionalization aimed at improving bioactivity, osseointegration, and antibacterial properties.

Course content – laboratory

Practical application of selected surface modification methods for implant materials. Substrate preparation and application of anodizing, MAO, EPD, and other selected methods for producing surface layers and coatings. Selection of technological process parameters and assessment of their influence on the resulting surface modification.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Raport</td><td>56.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>Scientific publications in reputed international scientific journals like Biomaterials, Acta Biomaterialia and related journals.</td></tr><tr><td>Supplementary literature</td><td>-</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>• Preparation and pretreatment of implant material surfaces.
• Electrochemical surface modification methods, including anodizing and MAO/PEO.
• Coating deposition methods, including EPD, sol-gel, PVD, and CVD.
• Physical surface modification methods, including laser and plasma treatment.
• Functional implant coatings: bioactive, osseointegration-enhancing, and antibacterial.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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