GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065836		
Field of study	Materials Engineering, Materials Engineering		
Date of commencement of studies	October 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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Electrochemistry and Surface Physical Chemistry -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mateusz Cieślik	
	Teachers	dr inż. Mateusz Cieślik	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	12.0	30.0	3.0	45

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	45	5.0	50.0	100

Subject objectives

The aim of the course is to familiarize students with additive technologies, particularly 3D printing technologies, the design and manufacturing of objects, and to introduce them to the principles of reverse engineering. The practical aspect of the course is based on applying acquired knowledge in projects. During the tasks, students will obtain prints with specific functional properties.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W06] Knows the theoretical basics the functioning of scientific equipment in the fields of science and scientific disciplines relevant to materials engineering.	The student understands the operating principles and limitations of equipment used in additive manufacturing, including FDM, SLA/DLP, and SLS/SLM systems, and understands the influence of process parameters on material properties and the quality of fabricated structures.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
[K7_W03] Has extended and enhanced knowledge of mathematics, physics, chemistry and other fields, useful when formulating and solving problems within the scope of materials science.	The student has in-depth knowledge of the physical and chemical fundamentals of additive technologies, in particular the mechanisms of sintering, melting, photopolymerization, heat transport and percolation phenomena, and understands their impact on the structure and functional properties.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K7_U06] Can evaluate usefulness and feasibility of using new achievements (techniques and technologies) within the scope of materials science.	The student is able to assess the suitability of additive technologies for the production of functional materials, in particular electrodes, sensors and energy components, and to critically analyze the influence of process parameters on the structural, electrical, mechanical and electrochemical properties of the produced materials.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

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

Lab 1: Introduction to 3D Printing and Additive Manufacturing Technologies. Students will be introduced to the basics of additive manufacturing, the principles of 3D printer operation, occupational safety, and 3D model preparation.
Lab 2: FDM Technology: Designing and Printing Models. Learn the details of FDM technology, preparing models for printing, and calibrating the printer.
Lab 3: SLA Technology: Printing with Photopolymer Resin. Learn the principles of SLA printer operation, model preparation, and print post-processing.
Lab 4: SLS Technology: Printing with Polyamide Powders. Discuss the principles of SLS technology, model preparation, and analyze the advantages/limitations of this method.
Lab 5: Reverse Engineering - 3D Scanning.

Course content – project

Project 1: Student Design (Any technology: FDM, SLA, SLS, 3D scanner). Students will develop their own design from concept to implementation, using their chosen 3D printing or 3D scanning technology. This project allows students to apply their acquired knowledge in practice, develop creativity, and develop teamwork skills.
Project 2: Prototyping electrolyzer components using FDM 3D printing and conductive materials. Project goal: To develop a prototype of water electrolyzer components using 3D printing technology (FDM and SLA), considering the potential of using conductive filament materials. The project aims to demonstrate the potential of 3D printing in the design and production of devices related to hydrogen technologies and to introduce students to the practical aspects of additive printing.

Course content – seminar

Student presentations showing and discussing the progress of research projects.</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>Project</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Laboratory</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Seminar</td><td>50.0%</td><td>10.0%</td></tr>
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<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Nick Kloski, Druk 3D. Praktyczny przewodnik po sprzęcie, oprogramowaniu i usługach, Helion, 2022</td></tr>
<tr><td>Supplementary literature</td><td>Anna Kaziunas France, Świat druku 3D Przewodnik, Helion</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Describe the difference between FDM and SLA in 3D printing. What are their advantages and disadvantages? Compare both methods in the context of prototype production.
2. Explain what G-code is and how it is used in 3D printing. Describe the basic G-code commands and how they affect the printing process.
3. Discuss the different types of materials used in 3D printing. Compare thermoplastic and thermoset materials in terms of their applications and properties. Provide examples of products that can be printed using these materials.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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