GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Additive manufacturing, PG_00060350						
Field of study	Materials Engineering						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group	Optional subject group Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	5		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mateusz Cieślik					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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		3.0	17.0	50	
Subject objectives	The course aims to introduce students to the principles, methods, and applications of additive manufacturing technologies in the context of manufacturing environmentally friendly materials and components. Students will learn about 3D design and materials engineering processes, including the possibility of modifying materials using nanostructures and functional composites. Particular emphasis is placed on aspects of sustainable development, such as efficient material management, waste reduction, energy optimization, and the use of renewable and biodegradable materials. The course is practical, encompassing laboratory and project exercises, developing the ability to independently plan, conduct, and evaluate additive manufacturing processes in accordance with the principles of sustainable development.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] Can use information and communication techniques used for the execution of typical engineering tasks, can apply learnt methods and mathematical and physical models to describe and explain chemical phenomena and processes.	The student understands the use of information and communication tools in the design and optimization of 3D printing processes. The student is able to use CAD/ CAM software and tools for preparing 3D models and optimizing the additive printing process. The student is able to use IT tools to visualize and interpret materials research results in the context of sustainable development.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
[K6_U03] Can critically analyze and evaluate the functioning – particularly in the context of materials engineering –existing technical solutions, particularly equipment, objects, systems, processes.	The student is able to critically evaluate the performance and usefulness of additive technologies in the context of materials. The student is able to analyze and compare additive manufacturing processes, identifying their advantages, limitations, and potential for improvement in environmental and material terms. The student is able to evaluate existing 3D printing devices and systems in terms of efficiency, product quality, and minimizing environmental impact.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
[K6_W03] Has knowledge of materials science and can relate the properties of materials with their structure and composition, knows the theoretical description of phenomena occurring in materials subjected to external factors.	The student will understand the fundamentals of materials science in the context of additive manufacturing and the relationship between the structure, composition, and properties of materials. The student will understand the physical and chemical phenomena occurring in materials during 3D printing processes and their impact on the functional properties of the materials. The student will understand the theoretical foundations of sustainable material use in additive manufacturing (efficient material management, waste minimization).	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

Subject contents

Lectures:
1. Definition of additive technologies, advantages and limitations compared to traditional manufacturing methods, 3D printing, laser processing, milling.
2. Discussion of various 3D printing methods, technologies and materials used, advantages and limitations.
3. Possibilities of using materials science in 3D printing, composites with nanomaterials, surface modification.
4. Ecology and sustainability of 3D printing.
5. Preparing files for 3D printing, design performance analysis, model preparation, selecting appropriate printing parameters.
6. 4D printing.
7. Quality control.
8. Economic aspects of 3D printing.

Practical project, practical application of acquired knowledge:
1. Manufacturing composite materials with the addition of nanomaterials to achieve specific functional properties (e.g., electrical conductivity, hydrophobicity, magnetic properties). 2. Printing and testing using the produced printed materials, alternatively modifying the prints (e.g. roughening, creating a membrane, surface functionalization).

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	50.0%	50.0%
Lecture	50.0%	50.0%

Recommended reading

Basic literature	Druk 3D, Liza Wallach Kloski, Helion, 2022
Supplementary literature	Podstawy szybkiego prototypowania : druk 3D : technologia FDM/FFF, Jerzy Bochnia, Tomasz Kozior, Kielce : Politechnika Świętokrzyska, 2024.
eResources addresses	

Example issues/ example questions/ tasks being completed	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.
Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.