GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Additive technologies, PG_00063396		
Field of study	Nanotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mateusz Cieślik	
	Teachers	Patryk Rybicki dr inż. Mateusz Cieślik	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	0.0	20.0	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	2.0	18.0	50

Subject objectives	The aim of the "Additive Technologies" course is to introduce students to the principles and methods of reverse engineering, designing and manufacturing objects using various additive technologies, particularly 3D printing. The practical nature of the course involves students in the process of manufacturing composites modified with various nanomaterials and assessing the effective properties of the materials.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] can plan and conduct experiments, critically analyze their results, draw conclusions and formulate opinions. Has laboratory experience.	The student knows the basic principles of additive technologies and their applications in materials engineering and composite production, understands the methods of selecting nanomaterials for composite modification and knows their impact on the mechanical and physicochemical properties of materials.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_U07] can conduct preliminary economic analysis of proposed solutions and undertaken engineering activities within the scope of nanotechnology.	The student will understand the basic criteria for the economic evaluation of manufacturing processes using additive technologies, including material costs, equipment operation costs, and lead time. The student will understand the relationship between the selection of 3D printing technology, the type of nanomaterials, and the profitability of the manufacturing process.	[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
[K6_U09] can design and conduct the process of producing nanostructured materials.	The student is able to design a process for manufacturing nanostructured materials using additive technologies, including preparing an appropriate 3D model and selecting process parameters. The student is able to independently implement the process of manufacturing composite materials with nanostructures and then evaluate their functional properties. The student is able to adapt engineering methods and tools to the specific needs of working with nanomaterials.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents

Course content – lecture

Lectures:
1. Definition of additive technologies, advantages and limitations compared to traditional manufacturing methods, 3D printing, laser processing, milling (1h)
2. Discussion of various 3D printing methods, technologies and materials used, advantages and limitations (4h)
3. Possibilities of using nanotechnology in 3D printing, composites with nanomaterials, surface modification (1h)
4. Recycling and the ecology of 3D printing (2h)
5. Preparing files for 3D printing, analyzing design performance, preparing a model, selecting appropriate printing parameters (2h)

Practical project, applying acquired knowledge in practice:
1. Manufacturing composite materials with the addition of nanomaterials to achieve specific functional properties (e.g., electrical conductivity, hydrophobicity, magnetic properties) (10h).

2. Printing and testing using the generated printed materials, alternatively modifying prints (e.g., roughening, creating a membrane, surface functionalization). (10h)

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture	50.0%	50.0%
Project	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.
Practical activites within the subject	Not applicable

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