GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Bionanomaterials Fabrication Technologies, PG_00069335		
Field of study	Nanotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	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. Marta Prześniak-Welenc	
	Teachers	dr inż. Marta Prześniak-Welenc	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	25.0	0.0	0.0	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 course aims to familiarize students with methods of synthesizing bionanomaterials and the influence of the selected method on the bioactive properties of the resulting material.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U06] can accurately present technological and scientific problems, related to the production and application of nanostructures, to specialists in related fields, and initiate and coordinate interdisciplinary cooperation.	Can effectively present technological and scientific issues related to the design, synthesis, and applications of bionanomaterials to specialists from related disciplines (chemistry, biology, materials engineering, medicine), and to initiate and coordinate interdisciplinary collaboration aimed at developing solutions that meet application requirements and biological safety standards.	[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	Has systematic knowledge of the physical and chemical foundations of nanotechnology, including methods of nanostructure synthesis, their types, properties, and basic characterization techniques, enabling the informed design and selection of technologies for bionanomaterial production.	[SW1] Assessment of factual knowledge
[K6_U09] can design and conduct the process of producing nanostructured materials.	Has the ability to design and implement processes for the fabrication of bionanomaterials, including the selection of appropriate synthesis methods, control of process parameters, and characterization of the obtained materials, while taking into account biocompatibility requirements and the intended application.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K6_U10] can forecast and assess potential negative biological and ecological effects of producing nanostructures on an industrial scale and their practical application.	Can predict and assess potential biological and ecological risks associated with the large-scale production of nanostructures and their practical applications, taking into account the principles of sustainable development and environmental safety.	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
[K6_W05] has knowledge of inorganic and organic chemistry, physical chemistry and chemical thermodynamics.	The student possesses knowledge of the types of bionanomaterials and their applications, as well as the methods for their synthesis, enabling the informed design and selection of appropriate synthesis technologies in relation to specific application requirements.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture
Lecture:

1. Types of bionanomaterials and their applications (fiber-forming polymers nanofibers, polymer nanoparticles, carbon nanomaterials (nanotubes, graphene), metallic nanoparticles (AgNPs, AuNPs, etc.), magnetic nanoparticles, metal oxide nanoparticles (e.g., ZnO), quantum dots).
2. Methods of bionanomaterial synthesis:
 polymer nanofibers
 polymer nanoparticles
 carbon nanomaterials
 quantum dots
 metallic, magnetic, and metal oxide nanoparticles
 other biocompatible nanomaterials

Laboratory: As part of the laboratory work, students will acquire practical skills related to the synthesis of metallic, carbon, and semiconductor nanoparticles, as well as methods for the characterization of the obtained bionanomaterials. Through the analyses performed, students will broaden their knowledge of how the synthesis method influences material properties.

Research tasks carried out during the classes:
 Synthesis and characterization of metallic nanoparticles
 Synthesis and characterization of carbon nanoparticles
 Synthesis and characterization of semiconductor nanoparticles
 Application of the obtained nanoparticles as additives to bionanomaterials

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture - written test</td><td>60.0%</td><td>70.0%</td></tr>
<tr><td>Laboratory - report evaluation</td><td>100.0%</td><td>30.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. Inżynieria Biomedyczna Podstawy i Zastosowania, Biomateriały, Tom 4, red S. Błażewicz, J. Marciniak, Exit, Warszawa 2013

2. Nanotechnologie, red Robert W. Kelsall, PWN, Warszawa 2009

3. Nanomateriału inżynierskie, konstrukcyjne i funkcjonalne, red. K. Kurzydłowski, M. Lewandowska, PWN 2009</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Articles from JCR list.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. List and discuss the types of carbon nanotubes.
2. Explain the principle of carbon nanotube functionalization.
3. List the types of stabilizing agents used in the chemical reduction method.
4. Describe the stages of chemical reduction and explain how the size of the obtained nanoparticles can be controlled.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="3">Not applicable</td></tr>
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