

**Subject card**

<b>Subject name and code</b>	Nanoparticles in medicine, cosmetology, biotechnology and protection environment, PG_00081431						
<b>Field of study</b>	Environmental Protection						
<b>Date of commencement of studies</b>	October 2024	<b>Academic year of realisation of subject</b>			2026/2027		
<b>Education level</b>	Bachelor's studies	<b>Subject group</b>			Optional subject group		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	3	<b>Language of instruction</b>			Polish		
<b>Semester of study</b>	5	<b>ECTS credits</b>			1.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			credit		
<b>Conducting unit</b>	Laboratory of Photocatalysis -> Department of Environmental Technology -> Faculty of Chemistry -> Rector						
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr inż. Beata Bajorowicz				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	15		2.0		8.0	25
<b>Subject objectives</b>	To familiarize students with selected properties of nanoparticles. To familiarize students with selected methods of producing nanoparticles on a laboratory and industrial scale. To familiarize students with selected applications of nanoparticles in medicine, biotechnology and environmental protection technologies.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[OŚL3_K05] Identifies the level of her/his knowledge and skills, demonstrates the need to update knowledge about the environment and its protection, demonstrates the need for continuous professional training and personal development.	The student understands the role that nanoscience plays in the modern world nanotechnology. The student understands the need for further education.	[SK4] test/exam - oral or written
	[OŚL3_U09] Prepares in Polish/English a short description of research, observation or problem task carried out during classes using appropriate scientific terminology.	The student correctly uses the nomenclature in the field of nanotechnology. The student plans and implements strategies for the synthesis of nanoparticles in order to obtain nanomaterials with specific properties.	[SU4] test/exam - oral or written
	[OŚL3_U08] Correctly concludes based on the available data from various sources.	The student determines the advantages and disadvantages of using nanomaterials. The student assesses the potential impact of nanoparticles on organisms and the environment.	[SU4] test/exam - oral or written
	[OŚL3_W01] Discusses the basic concepts of mathematics, physics, chemistry and biology. Describes physical, chemical and biological phenomena occurring in nature as well as geological, geomorphological and climatic conditions of the functioning of nature.	The student has and uses knowledge of the methods of producing selected types of nanoparticles. The student knows the basic properties of nanoparticles. The student discusses the applications of selected types of nanoparticles in medicine, cosmetology, biotechnology and environmental protection.	[SW4] test/exam - oral or written
Subject contents	Classification and characterization of the main groups of nanomaterials. Metallic nanoparticles: preparation methods, properties and applications. Semiconductor nanoparticles: laboratory and industrial synthesis methods. The use of plant extracts to produce nanoparticles. Nanoparticles used as drug carriers. Nanocarriers of active ingredients in cosmetics. Nanoparticles in medical diagnostics. Photocatalytic properties of semiconductor nanoparticles. Nanoparticles in environmental protection technologies (water treatment processes, sewage treatment and air purification).		
Prerequisites and co-requisites	Basics of general chemistry		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		51.0%	100.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. K. Żelechowska, Nanotechnologia w praktyce, PWN, Warszawa, 2016</li> <li>2. K. J. Kurzydłowski, M. Lewandowska, W. Łojkowski, Świat nanocząstek, PWN, Warszawa, 2022</li> <li>3. L. Cademartiri, G. A. Ozin, Nanochemia: podstawowe koncepcje, PWN, Warszawa, 2011</li> <li>4. K.J. Kurzydłowski, M. Lewandowska, Nanomateriały inżynierskie, konstrukcyjne i funkcjonalne, PWN, Warszawa, 2020</li> <li>5. R.W. Kelsall, I.W. Hamley, M. Geoghegan, Nanotechnologie, PWN, Warszawa, 2012</li> </ol>	
	Supplementary literature	Research articles recommended by lecturers.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. List, describe and compare the types of nanocarriers of active ingredients in cosmetics.</li> <li>2. Describe the hydrothermal method of obtaining semiconductor nanoparticles and explain which synthesis conditions may affect the properties of nanomaterials obtained by this method.</li> <li>3. Explain the mechanism of action of self-cleaning surfaces.</li> <li>4. Describe the use of nanoparticles in photodynamic therapy and as carriers of drugs delivered to the body.</li> <li>5. Describe the use of nanoparticles in creams with a UV filter.</li> </ol>		
Work placement	Not applicable		

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