GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Plasmonic and photonic nanostructures for detection systems, PG_00071209		
Field of study	Nanotechnology		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Nanomaterials Physics -> 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	prof. dr hab. inż. Barbara Kościelska	
	Teachers	prof. dr hab. inż. Barbara Kościelska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	0.0	15

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	15	1.0	9.0	25

Subject objectives

The aim of the course is to discuss plasmonic and photonic nanostructures and their applications in detection systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] has in-depth, theoretically grounded and detailed knowledge of phenomena, methods, and theories related to nanotechnology, as well as of related and allied fields of science or engineering	The student has in-depth knowledge of plasmonics and photonics and the applications of plasmonic and photonic nanostructures in detection systems.	[SW1] Assessment of factual knowledge
[K7_U01] is able to formulate hypotheses, plan and conduct experimental research, critically analyze results, verify hypotheses, draw conclusions, and formulate well-founded opinions within nanotechnology and related physical and natural sciences. Recognizes economic and non-technical aspects of the activities performed	The student has the ability to learn independently, acquire information on plasmonic and photonic nanostructures in detection systems and the ability to critically analyze the information obtained.	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Introduction to Nanophotonics and Plasmonics

Physical Fundamentals of Plasmons

Plasmonic Nanostructures

Fundamentals of Photonic Structures

Photonic Nanostructures in Detection

Hybrid Plasmonic-Photonic Structures

Nanostructure Fabrication Techniques

Optical Characterization Methods

Detection Systems and Sensors

Current Trends and Development Directions</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of physics and nanotechnology from the scope of first-cycle studies.</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>Written exam</td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>S. A. Maier, Plasmonics: Fundamentals and Applications, Springer, 2007

J. D. Joannopoulos, S. G. Johnson, J. N. Winn, R. D. Meade, Photonic Crystals: Molding the Flow of Light, Princeton University Press, 2nd ed., 2008

A. Paladini et.al. Photonics and Plasmonics: New Challenges for Optical
Nanostructured Materials in Sensing, Chemosensors 2023, 11, 526.

S. Kumar et al. Plasmonic Sensors: A New Frontier in Nanotechnology , Biosensors 2023, 13, 385</td></tr><tr><td>Supplementary literature</td><td>A. G. Brolo, Plasmonics for future biosensors, Nature Photonics, 2012

N. G. Semaltianos, Advances in Photonic and Plasmonic Nanomaterials, Nanomaterials 2025, 15, 55</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Explain what plasmonic nanostructures are.

2. Explain the origin of the photonic gap.

3. Give an example and discuss the operating principle of a biosensor based on plasmon resonance.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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