GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Application of Lasers in Diagnostics and Therapy, PG_00069714		
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	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	6	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Sebastian Bielski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	11.0	0.0	9.0	0.0	0.0	20

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	20	3.0	27.0	50

Subject objectives

The aim of the course is to provide students with knowledge of the construction and principles of operation of lasers, as well as to introduce selected diagnostic and therapeutic applications of lasers in medicine.

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.	The student is able to prepare and present a report on the technical challenges of laser-based diagnostic techniques (including those utilizing nanoparticles), as well as on methods of beam generation and delivery, their functionalization, limitations, safety aspects, and clinical requirements.	[SU5] Assessment of ability to present the results of task
[K6_W01] has knowledge of materials science and understands its key role in the progress of civilization	The student explains the interaction of laser light with material structure, particularly biological tissues, and justifies the role of therapeutic innovations in civilizational progress.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>

Lecture:

Part I: Laser

- Laser safety
- Properties of laser light
- Principle of laser operation: physical fundamentals
- Types of lasers (examples of active media)

Part II: Applications of lasers

- Interaction of light with tissue (photochemical, thermal, ablation)
- Lasers in diagnostics (laser spectroscopy, lasers in tissue imaging)
- Lasers in therapy (photostimulation, photosensitization, photodynamic therapy, surgery, aesthetic procedures, tattoo removal)

Laboratory:

- Measurement of laser beam divergence
- Study of laser beam scattering on the surface of artificial skin
- Measurement of fluorescence spectra of dye solutions

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<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory: reports	100.0%	0.0%
laboratory: oral questioning	50.0%	33.0%
Lecture: final test	50.0%	67.0%

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<tr><td>Recommended reading</td><td>

Basic literature	H. P. Berlien (ed.), G. J. Muller (ed.), Applied laser medicine, Springer Berlin / Heidelberg, Berlin, 2012 K. Nouri (ed.), Lasers in Dermatology and Medicine, Springer London, London, 2012 G. T. Absten, S. N. Joffe, Lasers in medicine: an introductory guide, Springer-Science+Business Media, Springer, New York NY, 2013
Supplementary literature	H. Jelinkova, Lasers for Medical Applications: Diagnostics, Therapy and Surgery, Elsevier Science & Technology, Chantilly, 2013
eResources addresses	

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<tr><td>Example issues/ example questions/ tasks being completed</td><td>

Explain the concept of photodynamic therapy and present examples of its applications.

Picosecond lasers in surgery.

Discuss laser safety classes.

Discuss the concept of fluorescence.

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<tr><td>Work placement</td><td>Not applicable</td></tr>
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