University of Gdańsk

Subject card

Subject name and code	Application of lasers in biotechnology and medicine, PG_00196956						
Field of study	Biotechnology						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2028/2029			
Education level	Bachelor's studies		Subject group	Obligatory subject group in the field of study 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	5		ECTS credits	2.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Piotr Bojarski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	0.0	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		5.0		25.0	50
Subject objectives	Students will acquire advanced knowledge of the potential applications of lasers in biotechnology and medicine. They will understand the processes occurring in tissues and cells when illuminated with laser light, depending on the type and parameters of the laser used. In particular, they will understand the processes occurring at the cellular level when illuminated with a laser beam. They should be able to assess the usefulness of laser light versus conventional lighting in biotechnological experiments.						

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<tr><td>Learning outcomes</td><td>
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<tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr>
<tr><td>[BIOTECHL3_W09] The graduate possesses structured and advanced knowledge of the terminology and concepts used in biological and medical sciences and related disciplines.</td><td>The student knows the types of lasers used in medicine and biotechnology, their technical parameters and practical applications, understands the mechanisms of cellular response to laser light, including the processes of repair, apoptosis and oxidative stress, and knows the applications of lasers in molecular biology, e.g., flow cytometry, laser microscopy, and cell manipulation.</td><td>[SW3] text preparation/written work
[SW5] implementation of a problem task</td></tr>
<tr><td>[BIOTECHL3_W06] The graduate possesses structured and advanced knowledge of exact and natural sciences necessary to understand biological phenomena and processes, in particular cellular processes at the molecular level.</td><td>The student has advanced knowledge of the physical properties of laser light, including wavelength, power, coherence and their biological significance, knows the mechanisms of interaction of laser radiation with biological tissues – photothermal, photochemical, photoablative, photomechanical, knows the issues of biophysics and photobiology necessary to understand the effects of lasers at the molecular and cellular level.</td><td>[SW3] text preparation/written work
[SW5] implementation of a problem task</td></tr>
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<tr><td>Subject contents</td><td>1. An overview of lasers used in biotechnology and medicine. 2. Mechanisms of laser radiation interaction with tissues. 3. An overview of laser applications in general surgery, ophthalmology, neurosurgery, dermatology, vascular recanalization, lithotripsy, and laser biostimulation. 4. Laser biostimulation of plant cells. 5. Optical methods for the early detection and localization of tumors. 6. Photodynamic diagnosis and therapy of tumors. 7. Applications of photodynamic therapy in microbiology. 8. Lasers in Doppler blood flow meters. 9. Lasers in cytometry. 10. Laser desorption/ionization in the determination of protein molecular weight. 11. Micromanipulation using laser microscopy and optical tweezers in biotechnology. 12. Lasers in fluorescence techniques used in biotechnology.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></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 test</td><td>51.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td></td></tr>
<tr><td>Supplementary literature</td><td></td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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