GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Contemporary applications of spectroscopic techniques, PG_00040974		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional 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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Dampc	
	Teachers		

Lesson types and methods of instruction

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	2.0	8.0	25

Subject objectives

Main goal of the lecture is to present state-of-the-art, widely used spectroscopy techniques. It is crucial to understand the physical processes involved, technique strong points and practical applications in science, medicine, engineering.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	Possess knowledge on specific spektrometry techniques used in diagnostics and research.	[SW1] Assessment of factual knowledge
[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	Possess knowledge on the technical parameters of spektrometers and can select spectrometer to a specific phenomenon/process investigated.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_U53] can apply advanced equipment used in biomedical diagnostics	Possess knowledge on specific spektrometry techniques used in diagnostics and research.	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>1. Introduction to molecular physics: rotational excitation of molecules, vibrational excitation of molecules, electronic excitation of atoms and molecules, rotational spectra, spectra of vibrational excitation durng the electronic transition, ionization.

2. Molecular processes control by electron beam: introduction to electron spectroscopy, cross sections, excitations, resonant electron attachment, examples.

3. Molecular clusters: generation of cluster beams, vibrational spectroscopy of clusters, negative ion clusters, superfluid helium droplets as environment for cluster spectroscopy and cold chemistry.

4. Femtosecond spectroscopy: introduction to technique, femtosecond photoelectron spectroscopy, dynamics of non-adiabatic precesses, foemtosecond coincidence spectroscopy, femtosecond spectroscopy of anions - relaxation processes, metalic clusters, desorption, modern lasers.</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>Lecture</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>Z. Kęcki, Podstawy spektroskopii molekularnej, Wydawnictwo Naukowe PWN, Warszawa 1992.

H. Haken, H. C. Wolf, Fizyka molekularna z elementami chemii kwantowej, Wydawnictwo Naukowe
PWN, Warszawa 1998.

H. Haken, H. C. Wolf, Atomy i kwanty, Wydawnictwo Naukowe
PWN, Warszawa 2002.

C. N. Banwell, Fundamentals of molecular spectroscopy, McGraw-Hill, London 1983.</td></tr>
<tr><td>Supplementary literature</td><td>C. Kittel Wstęp do fizyki ciała stałego, Wydawnictwo Naukowe PWN, Warszawa 1999.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Dissociative electron attachment for selective bond breaking.

2. Cold chemistry - creation of molecules under cold, space conditions and reproduction of this environment in laboratory conditions.

3. Dynamics of molecular processes in biocomplexes with abundant water.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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