GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00066143		
Field of study	Materials Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Agnieszka Witkowska	
	Teachers	dr hab. inż. Agnieszka Witkowska dr inż. Leszek Wicikowski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	13.0	0.0	15.0	0.0	0.0	28

E-learning hours included: 0.0

Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18287

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	28	2.0	20.0	50

Subject objectives

The aim of the course is to discuss the theoretical and practical issues of spectroscopy and presentation of the various types of spectroscopic methods, the ways to collect and interpret spectra.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] has knowledge of physics and chemistry, useful for formulating and solving simple problems within the scope of materials science	The student acquires knowledge of physics that allows him to solve simple tasks and problems in the field of spectroscopy and optical properties of materials.	[SW1] Assessment of factual knowledge
[K6_U02] Can operate typical laboratory equipment and analyze material tests	Students perform laboratory exercises in molecular and photoemission spectroscopy, learn how to properly prepare samples, how to perform measurements, and then independently analyze and develop measurement results.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K6_W06] Knows selected methods, techniques, tools and materials used in solving simple engineering problems within the scope of materials engineering.	During lectures and laboratory exercises, student become acquainted with modern spectroscopic devices and methods used in the study of structural and physicochemical properties of materials.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

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

1. Introduction to spectroscopy, types of spectroscopy
2. Theoretical description of electromagnetic radiation (EM);
3. Matter (atom, molecule, solid state);
4. Spectrum and ways of its registration;
5. Vibrational spectroscopy;
6. IR and Raman spectroscopy;
7. Electron spectroscopy, UV-Visspectroscopy;
8. Photoelectron spectroscopy (PES);

Laboratory:
1. Photoelectron spectroscopy: sample preparation, recording and analysis of XPS spectra (classes in the specialist XPS spectroscopy laboratory and in the computer laboratory)
2. Infrared spectroscopy, FTIR: sample preparation, recording and analysis of spectra (classes in the specialist molecular spectroscopy laboratory)
3. UV-Vis spectroscopy: sample preparation, recording and analysis of spectra (classes in the specialist molecular spectroscopy laboratory)
4. Spectrofluorimetry: sample preparation, recording and analysis of spectra (classes in the specialist molecular spectroscopy laboratory)</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Course subjects in classical and modern physics, physics of materials, inorganic chemistry and experimental methods in materials engineering.</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>50.0%</td><td>60.0%</td></tr>
<tr><td>Performance of laboratory exercises and report preparation</td><td>100.0%</td><td>40.0%</td></tr>
<tr><td>Solving tasks and problems</td><td>0.0%</td><td>0.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>[1] J.Sadlej, Molecular Spectroscopy, WNT, Warszawa (in Polish)

[2] D.L.Pavia i in., Introduction to Spectroscopy, Brooks/Cole</td></tr>
<tr><td>Supplementary literature</td><td>[3] C.D.Wagner i in. Handbook of photoelectron spectroscopy, Perkin-Elmer Corporation</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Metody spektroskopowe - IM 2025 - Moodle ID: 27206
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27206</td></tr>
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Example issues/ example questions/ tasks being completed	1. What is a spectroscopy? Describe the types of spectroscopy due to the kind of radiation used. 2. What is a spectrum? Specify and describe the main parameters that characterize the spectral line shape. 3. List and describe the main causes of spectral lines broadening. 4. Define: transmittance, absorbance and absorption coefficient. 5. Formulate and explain Beer-Lambert law and define attenuation length. 6. Raman spectroscopy: describe the origin and the idea of the phenomenon and shape of Raman spectrum. 7. Explain the main cause of the line broadening observed in UV-Vis spectrum. 8. What is the auxochrome and how it can change the UV-Vis spectrum? 9. Explain hyperchromic and hypochromic effect, bathochromic and hypsochromic shift. 10. Photoelectron spectroscopy (PES, ESCA): describe the main idea of the technique and present the phenomena which accompanying the effect of the core electron photoexcitation (secondary effects, multi-electron effects). 11. Why photoelectron spectroscopy is a surface sensitive technique?
Work placement	Not applicable

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