COURSE DESCRIPTION CARD - SYLLABUS

Course name
Vibrational and rotational spectroscopy of biomaterials [S1FT2>SOiRB]

Course

Field of study
Technical Physics

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge of general physics as well as basic knowledge of molecular physics, optics, spectroscopy, quantum physics, and atomic physics. Ability to acquire information from specified sources. Ability to solve simple engineering problems based on acquired knowledge. Willingness to collaborate within a team environment.

Course objective

Transmitting knowledge to students about vibrational and rotational spectroscopy. Acquiring knowledge about research methods for materials utilizing vibrational and rotational spectroscopy. Presenting to students the scope of applications of vibrational and rotational spectroscopy in biomaterial research and their significance in contemporary materials engineering. Developing students' skills in analyzing results and determining the properties of biomaterials based on data obtained from spectroscopic techniques.

Course-related learning outcomes

Knowledge:
has knowledge in the field of metrology, understands methods of measuring physical quantities, and analyzing measurement results [K1_W05]

is familiar with selected computer programs supporting calculations [K1_W07]
possesses knowledge related to selected issues of material properties analysis [K1_W11]

Skills:
can correctly utilize standard analytical tools to solve detailed physical and technical problems [K1_U08]
can gather information from literature, databases, and other sources, interpret them, draw conclusions, formulate, and justify opinions [K1_U02]

Social competences:
can responsibly work on assigned tasks, both independently and in a group [K1_K06]
is aware of and understands the importance of non-technical aspects and consequences of engineering activities [K1_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Evaluation based on a written midterm exam:
2.0 - 0%-50%
3.0 - 50.1%-60.0%
3.5 - 60.1%-70.0%
4.0 - 70.1%-80.0%
4.5 - 80.1%-90.0%
5.0 - 90.1% and above
Laboratory: Evaluation based on student's performance during classes and on reports prepared by the student

Programme content

1. General Characteristics of Biomaterials
2. Infrared Absorption Spectroscopy and Raman Spectroscopy
3. Elements of Group Theory. Number and types of molecular vibrations.
4. Apparatus, Raman and Infrared Absorption Spectrometers, FTIR Spectrometers, Confocal Microscopy, Integration of Spectroscopic Techniques with Other Techniques (SEM, STM, AFM, etc.).
5. Measurement Techniques in Raman Spectroscopy, Raman Imaging.
6. Measurement Techniques in Infrared Absorption Spectroscopy, FTIR Imaging.
7. Analysis of Measurement Data. Compound Identification. Evaluation of Biomaterial Properties Based on Spectra.
8. Application of Rotational and Vibrational Spectroscopy in Biomaterial Engineering.

Course topics

Lecture:
1. General Characteristics of Biomaterials
2. Infrared Absorption Spectroscopy and Raman Spectroscopy
3. Elements of Group Theory. Number and types of molecular vibrations.
4. Apparatus, Raman and Infrared Absorption Spectrometers, FTIR Spectrometers, Confocal Microscopy, Integration of Spectroscopic Techniques with Other Techniques (SEM, STM, AFM, etc.).
5. Measurement Techniques in Raman Spectroscopy, Raman Imaging.
6. Measurement Techniques in Infrared Absorption Spectroscopy, FTIR Imaging.
7. Application of Rotational and Vibrational Spectroscopy in Biomaterial Engineering.

Laboratory:
1. Analysis of Measurement Data. Compound Identification. Evaluation of Biomaterial Properties Based on Spectra.

Teaching methods

1. Lecture: Multimedia presentation, discussion.
2. Laboratory: Data analysis using computer software, preparation of reports, discussion.

Bibliography

Basic:
1. K. Małek, Oscillatory Spectroscopy, PWN, Warsaw, 2016
2. Z. Kęcki, Fundamentals of Molecular Spectroscopy, PWN, Warsaw, 1992
3. H. Barańska, A. Łabuzińska, J. Trepiński, Laser Spectrometry; Analytical Applications, PWN, Warsaw, 1981

Additional:
1. A. Z. Hrynkiewicz, E. Rokita, Physical Methods of Research in Biology, Medicine, and Environmental Protection, PWN, Warsaw, 1999
2. J. Twardowski, P. Anzenbachen, Raman and Infrared Spectroscopy in Biology, PWN, Warsaw, 1988
3. A.G. Whittaker,, A.R. Mount, M.R. Heal, Physical Chemistry, PWN, Warsaw, 2006
4. G. Turrel, J. Corset, Raman Microscopy - Development and Applications, Elsevier Ltd., San Diego, California, 1996.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	0	0,00