Introduction to fluorescence spectroscopy

Educational subject description sheet

Basic information

Study programme Fizyka (Physics of Advanced Materials for Energy Processing) **Speciality** - **Organizational unit** Faculty of Physics **Study level** Second-cycle programme **Study form** Full-time **Education profile** General academic	**Didactic cycle** 2023/24 **Subject code** 04FENS.22S.03256.23 **Lecture languages** English **Course type** Elective **Block** specialty subjects

Subject coordinator	Wojciech Giera
Lecturer	Wojciech Giera

Period	**Activities and hours**	**Number of ECTS points**
Semester 2	• Laboratories: 15, Graded credit	2

Goals

Code	Goal
C1	The main purpose of this course is to familiarize students with the phenomena of absorption and emission of light by molecules as well as the basics of the steady-state fluorescence spectroscopy.

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge – Student:			
W1	have a basic knowledge of processes, concepts and theories related to the phenomenon of fluorescence	FEN_K2_W01	Written colloquium, Report
W2	know the terminology associated with the phenomenon of fluorescence	FEN_K2_W01	Written colloquium, Report
W3	is able to explain the regularities associated with the phenomenon of fluorescence using the language of mathematics	FEN_K2_W01, FEN_K2_W02	Written colloquium, Report
Skills – Student:			
U1	is able to perform quantitative analysis for problems related to the phenomenon of fluorescence and formulate qualitative conclusions on this basis	FEN_K2_U01, FEN_K2_U03	Written colloquium, Report
U2	is able to plan and perform simple fluorescence measurements and analyze their results	FEN_K2_U01, FEN_K2_U03, FEN_K2_U06	Report
U3	is able to easily present facts (research results, discoveries, current state of knowledge, etc.) related to the phenomenon of fluorescence	FEN_K2_U02, FEN_K2_U04, FEN_K2_U05	Report

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Phenomenon of fluorescence: Jablonski diagram, absorption of light and Beer-Lambert law, spectral characteristics of fluorescence (Stokes shift, emission spectra vs. excitation wavelength, mirror-image rule), fluorescence anisotropy.	W1, W2, W3, U1, U2, U3	Laboratories
2.	Construction and operation of a typical spectrofluorometer.	W1, W2, U2, U3	Laboratories
3.	Fluorescence lifetimes and quantum yields, Strickler-Berg equation, steady-state vs. time-resolved fluorescence.	W1, W2, W3, U1, U2, U3	Laboratories
4.	Resonance energy transfer, fluorescence quenching.	W1, W2, W3, U1, U2, U3	Laboratories

Additional information

Activities	Teaching and learning methods and activities
Laboratories	Lecture with a multimedia presentation of selected issues, Discussion, Problem-based learning, Solving tasks (e.g. computational, artistic, practical), Laboratory method

Activities	Credit conditions
Laboratories	The assessment is based on the total number of points obtained from the colloquium and reports: Very good (bdb; 5,0): 91%-100% of the total score Good plus (+db; 4,5): 81%-90% of the total score Good (db; 4,0): 71%-80% of the total score Satisfactory plus (+dst; 3,5): 61%-70% of the total score Satisfactory (dst; 3,0): 51%-60% of the total score Unsatisfactory (ndst; 2,0): 0%- 50% of the total score

Literature

Obligatory

1. Principles of Fluorescence Spectroscopy, Joseph R. Lakowicz, Springer, 2006

Calculation of ECTS points

Activities	Activity hours*
Laboratories	15
Report preparation	15
Preparation for the assessment	15
Other	5
Student workload	**Hours** 50
Number of ECTS points	**ECTS** 2

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
FEN_K2_U01	The graduate can use their knowledge to formulate and solve complex and unusual problems in the field of physical sciences; select and apply appropriate methods and tools necessary to solve a given problem (including advanced IT techniques), as well as adapt existing methods and tools or develop completely new ones
FEN_K2_U02	The graduate can find the necessary information in the professional literature, databases and other sources, in particular in scientific journals basic to physics, and perform critical analysis, synthesis and creative interpretation of the collected information
FEN_K2_U03	The graduate can formulate and test hypotheses related to simple research problems in physics (plan and perform observations, experiments, theoretical calculations or computer simulations and critically evaluate and discuss the results obtained)
FEN_K2_U04	The graduate can prepare, for various audiences, oral presentations and written studies presenting specialized topics in the field of physical sciences in a communicative way, as well as debate on such topics
FEN_K2_U05	The graduate can use English in accordance with the requirements set out for level B2+ of the Common European Framework of Reference for Languages, as well as specialist English terminology in the field of physical sciences
FEN_K2_U06	The graduate can interact with others as part of teamwork and take a leading role in such work; manage team work
FEN_K2_W01	The graduate knows and understands in-depth selected facts, phenomena, concepts and theories specific to physics and complex relationships between them (constituting advanced general knowledge in the field of physical sciences and representing both key and other selected issues in the field of advanced detailed knowledge in this discipline)
FEN_K2_W02	The graduate knows and understands in-depth selected research methods and tools as well as mathematical models used in physics