Brillouin scattering

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.28S.03280.23 **Lecture languages** English **Course type** Elective **Block** specialty subjects

Subject coordinator	Aleksandra Trzaskowska
Lecturer	Aleksandra Trzaskowska

Period	**Activities and hours**	**Number of ECTS points**
Semester 4	• Laboratories: 15, Graded credit	2

Goals

Code	Goal
C1	Familiarizing students with the structure of solids, types of waves occurring in solids.
C2	Transfer of knowledge in the field of research methodology for materials in the condensed phase.
C3	Making students aware of the importance of materials occurring in the solid state, their scope of applicability and possible directions of development.
C4	Mastering by students the ability to apply the laws of physics to solve problems in the field condensed phase physics.

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge – Student:			
W1	Student knows the Coulomb and magnetic interactions and their applications in spectroscopy.	FEN_K2_W01, FEN_K2_W02	Report
W2	Student knows Brillouin scattering -theory and experimental setup	FEN_K2_W02, FEN_K2_W03	Report
W3	Student knows the ideas of fabrication nanostructures and their limitations	FEN_K2_W02, FEN_K2_W04	Report
W4	Student acquires the knowledge of phonon, magnon and their interaction in experiment.	FEN_K2_W01	Report
Skills – Student:			
U1	The student has the necessary knowledge to analyze the measurement results.	FEN_K2_U01, FEN_K2_U03	Project
U2	The student is able to obtain information from available literature and databases and other sources. In addition, he can use the information obtained so to analyze the experimental results and draw simple conclusions.	FEN_K2_U02, FEN_K2_U03	Project
Social competences – Student:			
K1	The student is ready for solving physical problems independently as well as in collaboration team.	FEN_K2_K01, FEN_K2_K02	Project, Report
K2	The student is aware of the importance of condensed matter physics in society and its impact to individual sectors of the economy.	FEN_K2_K03, FEN_K2_K05	Project, Report

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Dynamic in solid state	W1	Laboratories
2.	Fabrication of the samples - 1D, 2D 3D nanostructures	W3	Laboratories
3.	Kind of waves in solid state physics - surface acoustic waves and spin waves	W4, U2	Laboratories
4.	Brillouin spectroscopy - theory and exeriment	W2, U2	Laboratories
5.	Phonons, magnons and their interaction - exerimantal part	W4, U1, K1, K2	Laboratories

Additional information

Activities	Teaching and learning methods and activities
Laboratories	Lecture with a multimedia presentation of selected issues, Laboratory method

Activities	Credit conditions
Laboratories	Occupational health and safety - formative assessment The final grade is the average of the grades obtained from individual exercises, and each of the exercises must be passed with a positive grade. The assessment criteria grading system: excellent (A; 5,0): achievement by the student of the assumed learning outcomes of at least 90.1% very good (B; 4,5): achievement by the student of the assumed learning outcomes of at least 80.1% to 90% good (C; 4,0): achievement by the student of the assumed learning outcomes of at least 70.1% to 80% satisfactory (D; 3,5): achievement by the student of the assumed learning outcomes of at least 60.1% to 70% sufficient (E; 3,0): achievement by the student of the assumed learning outcomes in range 50.0% - 60.0% fail (F; 2,0): failure to achieve the assumed learning outcomes by the student – below 50.0%

Literature

Obligatory

1. 1. D. Strancil , Spin waves theory and application
2. 2. Scientific literature

Calculation of ECTS points

Activities	Activity hours*
Laboratories	15
Preparation for classes	5
Reading the indicated literature	15
Report preparation	10
Preparation of a project	5

Student workload	**Hours** 50
Number of ECTS points	**ECTS** 2

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
FEN_K2_K01	The graduate is ready to critically evaluate own knowledge and received content
FEN_K2_K02	The graduate is ready to recognize the importance of knowledge in solving cognitive and practical problems and seeking expert opinion (also from other scientific disciplines) to overcome difficulties during independent problem solving
FEN_K2_K03	The graduate is ready to fulfill social obligations, inspire and organize activities for the benefit of the social environment and initiate activities in the public interest
FEN_K2_K05	The graduate is ready to responsibly perform professional roles, incorporating changing social needs, including advancing the achievements of the profession and maintaining its ethos, as well as the observance and development of the principles of professional ethics and actions to comply with these principles
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_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
FEN_K2_W03	The graduate knows and understands in-depth selected computational methods and information technology tools and techniques used to solve complex problems in physics
FEN_K2_W04	The graduate knows and understands main development trends in the discipline of physical sciences