UNIWERSYTET IM. ADAMA MICKIEWICZA W POZNANIU

Introduction to neutron 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.21S.03244.23 **Lecture languages** English **Course type** Elective **Block** specialty subjects

Subject coordinator	Aleksandra Pajzderska
Lecturer	Aleksandra Pajzderska

Period	**Activities and hours**	**Number of ECTS points**
Semester 1	• Lecture: 30, Exam	3

Goals

Code	Goal
C1	The main goal of the module is to present principles of neutron scattering techniques and instrumentations, as well as their applications in different areas of research including physics, chemistry, biophysics, soft-matter or nanotechnology.

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge – Student:			
W1	understands and knows neutron scattering method according to the plan of the course.	FEN_K2_W01, FEN_K2_W02, FEN_K2_W03	Written exam
Skills – Student:			
U1	can understand the specialized lecture given in English	FEN_K2_U05	Written exam

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Neutron properties, basic theory of neutron scattering, Elastic (neutron diffraction), quasielastic and inelastic neutron scattering (neutron spectroscopy) Neutron scattering facilities and productions of neutrons Neutron detection, instrumentations and instrument components of spectrometers, diffractometers and reflectometers Methodology of measurements and access to neutron facilities The comparison of neutron scattering with complementary spectroscopic methods, like Xray diffraction, infrared absorption, dielectric and NMR spectroscopy Examples of using neutron methods in condensed physics and soft matter, in particular: in materials for energy conversion and energy storage, ionic and conducting systems, fuel cell, thin films, nanocomposites, porous systems, photovoltaic systems, biological systems, membranes, proteins, etc.	W1, U1	Lecture

Additional information

Activities	Teaching and learning methods and activities
Lecture	Lecture with a multimedia presentation of selected issues

Activities	Credit conditions
Lecture	Written exam

Literature

Obligatory

1. 1. R. Hempelmann, Quasielastic neutron scattering and solid state diffusion, Claredon Press, Oxford, 2009 2. Liyuan, Liang, Rinaldi, Romano, Schober, Helmut, Neutron Applications in Earth, Energy and Environmental Sciences, Springer; 2009 3. G. L. Squires: Introduction to the Theory of Thermal Neutron Scattering, Dover Publications, New York (1996). 4. A. Furrer, J. Mesot, T. Strässle: Neutron Scattering in Condensed Matter Physics, World Scientific, Singapore (2009).

Calculation of ECTS points

Activities	**Activity hours***
Lecture	30
Preparation for classes	20
Preparation for the exam	40
Student workload	**Hours** 90
Number of ECTS points	**ECTS** 3

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
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_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