

1.	Field of study	Physics
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2025/2026 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

7.	General information about the module		
Module name		Set of Diploma Courses I: Interaction of Radiation with Matter	
Module code		W4-FZ-NM-S2-2-22-18	
Number of the ECTS credits		3	
Language of instruction		English	
Purpose and description of the content of education		<p>During the lecture, the student will learn about following aspects:</p> <ol style="list-style-type: none"> 1.Elements of crystallography (crystal lattice concept, symmetry operations, point and space groups, reciprocal lattice) 2.X-ray properties: laboratory production and synchrotron radiation 3.Interaction of X-rays with matter: Compton phenomenon, photoelectric, Rayleigh scattering 4.Geometric conditions of X-ray scattering by crystal: Laue's theory, Ewald's construction, Bragg's equation. 5.Elastic X-ray scattering by electrons, atoms, elementary cells and crystals. The intensity of diffractive radiation. 6.Experimental techniques for studying the structure of crystals (powder and monocrystalline methods) 7.Methods of determining crystalline structure: Fourier and Patterson analysis, direct methods, structure clarification. 8.The Rietveld method for determining structure parameters from diffraction on powder samples <p>In the laboratory classes:</p> <ol style="list-style-type: none"> 1.learn to work on a powder diffractometer 2.perform simple calculations of structure parameters for regular system crystals 3.acquaint himself with the basic programmes for calculating structures <p>Mandatory examination</p>	
List of modules that must be completed before starting this module (if necessary)		not applicable	

8.	Learning outcomes of the module			
Code	Description	Learning outcomes of the programme	Level of competenc (scale 1-5)	
E1	learned the basic concepts of crystallography	KF_W02 KF_W08	3 3	
E2	knows the properties of X-ray radiation, its production and interaction with matter	KF_W02 KF_W08	4 4	

E3	knows the physical basics of X-ray diffraction on a crystal lattice	KF_W02 KF_W08	4 4
E4	can relate the diffraction image with the microscopic structure of crystalline bodies	KF_W02 KF_W08	4 4
E5	knows the basic procedures for determining the structure of crystals on the basis of the obtained experimental results	KF_U03 KF_U04 KF_U06 KF_U08 KF_W02 KF_W08	4 4 4 4 4 4
E6	can carry out measurements on X-ray diffractometers	KF_U03 KF_U04 KF_U06 KF_U08 KF_W02 KF_W08	4 4 4 4 4 4
E7	can use basic crystallographic programs	KF_U03 KF_U04 KF_U06 KF_U08 KF_W02 KF_W08	3 3 3 3 3 3

9. Methods of conducting classes		
Code	Category	Name (description)
a01	Lecture methods / expository methods	Formal lecture/ course-related lecture <i>a systematic course of study involving a synthetic presentation of an academic discipline; its implementation assumes a passive reception of the information provided</i>
a05	Lecture methods / expository methods	Explanation/clarification <i>explication involving the derivation of a predetermined theorem from other, already known ones, in the number of steps specified by the person teaching the course</i>
b07	Problem-solving methods	Activating methods: a case study <i>a comprehensive description of a phenomenon connected with the selected discipline; reflecting the reality, presenting the 'what', 'where' and 'how' of the phenomenon, i.e., all of its key aspects to be discussed in class; used as a reproduction, presentation, discussion or diagnosis of factors that shape the phenomenon or interact with it; an in-depth qualitative analysis and evaluation of a selected phenomenon</i>
e01	Practical methods	Laboratory exercise / experiment

		<i>[also conducted as fieldwork] a method of practical application of knowledge; implemented in three stages: the recognition of a problem induced by the task content, the formulation of the problem and the attempt to solve it accompanied by the assessment of the effects; the goal is to acquire skills, abilities and habits, and to consolidate the acquired knowledge so that it becomes operational; the laboratory method assumes greater independence of learners than carrying out an experiment</i>
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10. Forms of teaching					
Code	Name	Number of hours	Assessment of the learning outcomes of the module	Learning outcomes of the module	Methods of conducting classes
FZ1	lecture	20	exam	E1, E2, E3	a01
FZ2	laboratory classes	10	course work	E6, E7	e01
FZ3	discussion classes	10	course work	E4, E5	a05, b07

11. The student's work, apart from participation in classes, includes in particular:				
Code	Category	Name (description)		Is it part of the BUNA?
a02	Preparation for classes	Literature reading / analysis of source materials <i>reading the literature indicated in the syllabus; reviewing, organizing, analyzing and selecting source materials to be used in class</i>		No
a03	Preparation for classes	Developing practical skills <i>activities involving the repetition, refinement and consolidation of practical skills, including those developed during previous classes or new skills necessary for the implementation of subsequent elements of the curriculum (as preparation for class participation)</i>		Yes
b01	Consulting the curriculum and the organization of classes	Getting acquainted with the syllabus content <i>reading through the syllabus and getting acquainted with its content</i>		No
c02	Preparation for verification of learning outcomes	Studying the literature used in and the materials produced in class <i>exploring the studied content, inquiring, considering, assimilating, interpreting it, or organizing knowledge obtained from the literature, documentation, instructions, scenarios, etc., used in class as well as from the notes or other materials/artifacts made in class</i>		Yes
c03	Preparation for verification of learning outcomes	Implementation of an individual or group assignment necessary for course/phase/ examination completion <i>a set of activities aimed at performing an assigned task, to be executed out of class, as an obligatory phase/element of the verification of the learning outcomes assigned to the course</i>		Yes
d01	Consulting the results of the verification of learning outcomes	Analysis of the corrective feedback provided by the academic teacher on the results of the verification of learning outcomes <i>reading through the academic teacher's comments, assessments and opinions on the implementation of the task aimed at checking the level of the achieved learning outcomes</i>		No

Information on the details of the module implementation in a given academic year can be found in the syllabus available in the USOS system: <https://usosweb.us.edu.pl>.