1.	**Field of study**	**Materials Science and Engineering**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2025/2026 (summer 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	**Specialised subject 2. Modern microscopic and spectral methods**
Module code	IM2A_ PS2_MIKRS
Number of the ECTS credits	4
Language of instruction	Polish
Purpose and description of the content of education	The module Modern microscopic and spectral methods shall enable that students are knowledgeable about microscopic methods for materials structure examination and also their possibilities and limitations. Students shall learn the theory of microscopic and diffraction images origination as well as of spectral methods for chemical composition determination. Owing to that students shall achieve skills of microscopic images interpretation and hence acquiring information about the structure, defects, phase and chemical composition of materials The understanding of relationships and correlations between engineering materials properties and their structure shall result in deepening the skill to shape the structure and properties of engineering materials for technical and medical applications.
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)
IM2A_PS2 _MIKRS_1	Understanding physical and geometrical properties of electron scattering on atoms, learning the principle of electron microscopes operation, acquiring the notion of theoretical and practical resolution, understanding the notion of reciprocal lattice.	IM2A_W01 IM2A_W05	3 3
IM2A_PS2 _MIKRS_2	Learning various diffraction types in electron microscopy and their use in the analysis of crystals structure.	IM2A_W02 IM2A_W05	3 3
IM2A_PS2 _MIKRS_3	Understanding the origination of contrast in electron microscopy, the difference between a diffraction and phase contrast as well as principles of high-resolution image origination. Learning examples of materials testing capacities.	IM2A_W05	3
IM2A_PS2 _MIKRS_4	Learning basics of spectrometry in electron microscopy and of chemical composition determination.	IM2A_W05	3

9. Methods of conducting classes

Code	Category	Name (description)
a01	Lecture methods / expository methods	Formal lecture/ course-related lecture

		a systematic course of study involving a synthetic presentation of an academic discipline; its implementation assumes a passive reception of the information provided
a05	Lecture methods / expository methods	Explanation/clarification *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*
b01	Problem-solving methods	Problem-based lecture *an analysis of a selected scientific or practical problem accompanied by its assessment and an attempt to provide a solution to the issues presented in the lecture as well as the indication of the consequences of the proposed solution*
c07	Demonstration methods	Screen presentation *a presentation of synthetic image content using computer graphics, e.g., a series of slides or other multimedia forms, usually accompanied by a commentary; typical components of a screen presentation include text organized into bulleted points, charts, images and animations, sometimes sound effects or music; a multimedia illustration of course content presented in the form of a projected image*
d01	Programmed learning methods	Working with a computer *e.g., Webquest; implementation of educational tasks using electronic and digital devices, computer programs and Internet applications; the academic teacher acts as a consultant; students' work is carried out step by step according to the plan laid own by the person teaching the course and following his instructions, and proceeds towards producing the indicated results within the set deadline*
d02	Programmed learning methods	Working with a programmed textbook *working with a textbook containing instructional material covering part of or the entire curriculum of the module as well as a formula for studying the content; includes working with a subject textbook, an atlas, a catalogue, a problem book, etc.*
f01	Methods of self-learning	Self-education *a method which involves independent acquisition of knowledge, skills and social competences, extending their scope and quality; complementary to the learning process taking place in class; taking on the task of developing and adjusting qualifications on one's own; self-study*
f02	Methods of self-learning	Individual work with a text *searching for and acquiring new information using textbooks and other written sources (including their digital versions); searching for texts, selecting fragments for analysis/interpretation, using other texts to solve a problem related to the studied issue*
f03	Methods of self-learning	Conceptual work *a (mainly intellectual) activity carried out independently (or in a selected group) resulting in the creation of a concept, idea or project; creating a plan based on a vision; developing a general outline of a project; producing a simplified sketch of the variant versions of a procedure/product/work*

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
IM2A_PS2_MIKRS_fs_1	lecture	30	exam	IM2A_PS2_MIKRS_1, IM2A_PS2_MIKRS_2, IM2A_PS2_MIKRS_3, IM2A_PS2_MIKRS_4	a01, b01, c07
IM2A_PS2_MIKRS_fs_2	laboratory classes	30	course work	IM2A_PS2_MIKRS_1, IM2A_PS2_MIKRS_2, IM2A_PS2_MIKRS_3,	a05, d01, d02, f01, f02, f03

				IM2A_PS2_MIKRS_4	

11.	The student's work, apart from participation in classes, includes in particular:		
Code	**Category**	**Name (description)**	**Is it part of the BUNA?**
a01	Preparation for classes	Search for materials and review activities necessary for class participation *reviewing literature, documentation, tools and materials as well as the specifics of the syllabus and the range of activities indicated in it as required for full participation in classes*	No
a02	Preparation for classes	Literature reading / analysis of source materials *reading the literature indicated in the syllabus; reviewing, organizing, analyzing and selecting source materials to be used in class*	No
a03	Preparation for classes	Developing practical skills *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)*	No
c01	Preparation for verification of learning outcomes	Determining the stages of task implementation contributing to the verification of learning outcomes *devising a task implementation strategy embracing the division of content, the range of activities, implementation time and/or the method(s) of obtaining the necessary materials and tools, etc.*	No
c03	Preparation for verification of learning outcomes	Implementation of an individual or group assignment necessary for course/phase/ examination completion *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*	No
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 *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*	Yes
d02	Consulting the results of the verification of learning outcomes	Development of a corrective action plan as well as supplementary/corrective tasks *reviewing and selecting tasks and activities enabling the elimination of errors indicated by the academic teacher, their verification or correction resulting in completing the task with at least the minimum passing grade*	Yes

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.