

1.	Field of study	Materials Science and Engineering
2.	Academic year of entry	2018/2019 (summer term)
3.	Level of qualifications/degree	second-cycle studies
4.	Degree profile	general academic
5.	Mode of study	full-time

Module: Specialised subject 2. Modern microscopic and spectral methods

Module code: IM2A_PS2_MIKRS

1. Number of the ECTS credits: 4

2. Learning outcomes of the module			
code	description	learning outcomes of the programme	level of competence (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_U01 IM2A_W13	5 5
IM2A_PS2_MIKRS_2	Learning various diffraction types in electron microscopy and their use in the analysis of crystals structure.	IM2A_W05 IM2A_W13	5 5
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_U01 IM2A_U07	5 5
IM2A_PS2_MIKRS_4	Learning basics of spectrometry in electron microscopy and of chemical composition determination.	IM2A_W13	5

3. Module description	
Description	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.
Prerequisites	It is required to achieve effects of education of physics, chemistry, crystallography, and materials science modules.

4. Assessment of the learning outcomes of the module			
code	type	description	learning outcomes of the module
IM2A_PS2_MIKRS_w_1	Written examination	Verification of the knowledge based on the lectures content, recommended literature and attended classes.	IM2A_PS2_MIKRS_1, IM2A_PS2_MIKRS_2, IM2A_PS2_MIKRS_3, IM2A_PS2_MIKRS_4
IM2A_PS2_MIKRS_w_2	Written test	Checking the acquired skills to use electron microscopy methods.	IM2A_PS2_MIKRS_1, IM2A_PS2_MIKRS_2, IM2A_PS2_MIKRS_3, IM2A_PS2_MIKRS_4
IM2A_PS2_MIKRS_w_3	Test	Assessment of mastering the basic knowledge necessary for individual performance of a practical exercise.	IM2A_PS2_MIKRS_1, IM2A_PS2_MIKRS_2
IM2A_PS2_MIKRS_w_4	Report	Assessment of the skill to understand mechanisms of microscope images origination and to interpret them by a correct formulation of conclusions.	IM2A_PS2_MIKRS_3, IM2A_PS2_MIKRS_4

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
IM2A_PS2_MIKRS_fs_1	lecture	The lecture shall enable understanding the issues related to electron microscopy in engineering materials testing. The lecture is delivered with the use of multimedia, demonstrations and the „Materials science” software.	30	The work with the recommended literature comprising independent acquisition of knowledge related to basic issues.	30	IM2A_PS2_MIKRS_w_
IM2A_PS2_MIKRS_fs_2	laboratory classes	Applying the acquired theoretical knowledge in practice: resolving electron diffraction patterns, microscope operation, diffraction contrast analysis.	30	Preparation to classes through independent studying of recommended issues.	30	IM2A_PS2_MIKRS_w_ IM2A_PS2_MIKRS_w_ IM2A_PS2_MIKRS_w_