

FACULTY of Chemistry					
SUBJECT CARD					
Name of subject in Polish Techniki laserowe i mikroskopowe					
Name of subject in English Laser and microscopy techniques					
Main field of study (if applicable): Advanced Nano and Biomaterials MONABIPHOT					
Specialization (if applicable):					
Profile: academic					
Level and form of studies: 2nd level, full-time					
Kind of subject: obligatory					
Subject code W03ANB-SM2008W					
Group of courses NO					
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	50				
Form of crediting (Examination / crediting with grade)	Crediting with grade				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical classes (P)					
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1,3				

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basics of physics
2. Basics of spectroscopy
3. Basics of chemistry
4. Basics of biology

SUBJECT OBJECTIVES

- C1 Knowledge of basic issues in the field of microscopy
 C2 To familiarize the student with modern microscopic techniques
 C3 Teaching the selection of appropriate microscopic techniques for specific materials

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

- PEU_W01 – Knows the basics of optical microscopy
 PEU_W02 – Knows fluorescence microscopy methods

PEU_W03- Knows fluorescence lifetime microscopy methods
 PEU_W04- Knows multiphoton microscopy methods
 PEU_W05- Knows the basics of electron microscopy
 PEU_W06- Knows scanning probe microscopy techniques (AFM, STM)
 PEU_W07- Knows near-field microscopy techniques
 PEU_W08 - Knows the latest microscopic methods of imaging below the diffraction limit

PROGRAMME CONTENT		
Lecture		Number of hours
Lec 1	Basics of light microscopy (basic elements of microscope, concept of microscope resolution, bright field, dark field, polarizing microscopy, etc.)	2
Lec 2	Basic concepts of fluorescence and confocal microscopy (fluorescence microscopy, autofluorescence, fluorescent labels, confocal microscopy)	2
Lec 3	Fluorescence microscopy methods and lifetime microscopy (FRAP, FRET, TIRF, FLIM techniques)	2
Lec 4	Multiphoton microscopy (multiphoton fluorescence, second and third harmonic generation (SHG, THG), microscopy	2
Lec 5	Electron microscopy (scanning electron microscopy SEM, transmission electron microscopy TEM)	2
Lec 6	Atomic force microscopy and other microscopic techniques with a scanning probe (AFM atomic force microscope, STM scanning tunneling microscope)	2
Lec 7	Near-field microscopy (NSOM scanning near-field microscopy methods)	2
Lec 8	Electron microscopy in practice	2
Lec 9	Scanning microscopy in practice	2
Lec 10	Super-resolution microscopy methods (STED, GSD techniques, STORM statistical microscopy, PALM)	2
Lec 11	Atomic force microscopy in practice	2
Lec 12	Practical examples of microscopy applications and techniques	2
Lec 13	Practical examples of microscopy applications and techniques	2
Lec 14	Practical examples of microscopy applications and techniques	2
Lec 15	Final evaluation of the work	2
		Total hours
		30

TEACHING TOOLS USED

N1. Multimedia lectures
 N2. Own work - independent studies and preparation of a report/presentation

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement

F1	PEU_W01-08	Colloquium
F2	PEU_W01-08	Evaluation of the report/speech
P=(F1+F2)/2		
PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE:</u>		
<p>[1] Peter W. Hawkes, John C. H. Spence "Handbook of Microscopy" Springer, 2019</p> <p>[2] A. Barbacki i in. „Mikroskopia elektronowa” Wydawnictwo Politechniki Poznańskiej, 2007</p> <p>[3] M. Kopaczyńska „Mikroskopia sił atomowych (AFM) - biomedyczne zastosowanie pomiarów w nanoskali” Oficyna Wydawnicza Politechniki Wrocławskiej, 2010</p> <p>[4] http://www.microscopyu.com/</p> <p>[5] http://zeiss-campus.magnet.fsu.edu/</p>		
<u>SECONDARY LITERATURE:</u>		
<p>[1] M. Sauer, J. Hofkens, J. Enderlein "Handbook of fluorescence spectroscopy and imaging: from single molecules to ensembles." Wiley 2011</p> <p>[2] H. Tanke, B. Herman, "Fluorescence Microscopy" Taylor & Francis Group, 2006</p> <p>[3] B. R. Masters, P. T. C. So "Handbook of Biomedical Nonlinear Optical Microscopy" Oxford University Press 2008</p> <p>[4] P. Eaton, P. West "Atomic force microscopy", Oxford University Press, 2011</p> <p>[5] C. J. Chen "Introduction to scanning tunneling microscopy" Oxford University Press 2008</p> <p>[6] L. Novotny, B. Hecht "Principles of Nano-Optics" Cambridge University Press 2012</p>		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
<p>Katarzyna Matczyszyn, katarzyna.matczyszyn@pwr.edu.pl, Andrzej Żak Andrzej.zak@pwr.edu.p, Joanna Olesiak-Bańska joanna.olesiak-banska@pwr.edu.pl</p>		