FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in English: Laser and microscopy techniques in the investigation of materials
Main field of study (if applicable): Chemistry and Engineering of Materials
Specialization (if applicable): Advanced nano and biomaterials
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: IMC024014
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)	60				
Form of crediting	crediting with grade				
For group of courses mark (X) final course	X				
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of optical spectroscopy.
2. Fundamentals of solid state physics.
3. Fundamentals of chemistry
4. Fundamentals of biology on the high school level

SUBJECT OBJECTIVES

C1 To provide students with basic issues in the field of microscopy

C2 Familiarize students with modern microscopy techniques
C3 To provide students with a general knowledge on modern applications microscopy.
C4 To provide students with a general knowledge on experimental techniques used for nanostructures investigations.
C5 To provide student with a ability to select appropriate techniques for microscopic analysis.

SUBJECT EDUCATIONAL EFFECTS

related to knowledge:

PEK_W01 student knows the principles of different experimental techniques used for nanostructures analysis.
PEK_W02 student knows modern theories/technologies/ related with microsopy
PEK_W03 student knows and understands the principles of the experimental methods used in materials investigations.

related to social competences:

PEK_K01 student understands the need to inform the public about the need to achieve the goals of sustainable development in technologies for the production of new materials, energy and environmental protection.

PEK_K02 student is able to work in a group, performing various roles including group leader.
PEK_K03 student is aware of the social role of the engineer.
PEK_K04 student is ready to critically evaluate his/her knowledge and received content.

PROGRAMME CONTENT

	Lectures	**Number of hours**
Lec 1	Basics of optical microscopy (basic elements of the microscope, the concept of microscope resolution, bright field microscopy, dark field, polarization etc.)	4
Lec 2	Basic concepts of fluorescence and confocal microscopy (fluorescence microscopy, autofluorescence, fluorescent markers, confocal microscopy)	4
Lec 3	Fluorescence microscopy and life-time microscopy (FRAP, FRET, TIRF, FLIM techniques)	2
Lec 4	Multi-photon microscopy (multi-photon fluorescence, second and third harmonic generation (SHG, THG), CARS microscopy)	2
Lec 5	Multi-photon microscopy (multi-photon fluorescence, second and third harmonic generation (SHG, THG), CARS microscopy)	2
Lec 6	Atomic force microscopy and other microscopic techniques with probe scanning (AFM atomic force microscope, STM tunnel scanning microscope)	2
Lec 7	Near field microscopy (near field scanning scanning microscopy)	2
Lec 8	Super resolution methods of microscopy (STED technique, GSD, STORM statistical microscopy, PALM)	2
Lec 9		2
Lec 10		2
Lec 11		2

TEACHING TOOLS USED

N1. Multimedia presentation
N2. Lectures
N3. Hands-on experiments discussed during lectures.
N4. Scientific reports.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Way of evaluating learning outcomes achievement
F1		
F2		
F3		
P		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

1. M. Sauer, J. Hofkens, J. Enderlein "Handbook of fluorescence spectroscopy and imaging: from single molecules to ensembles." Wiley 2011
2. H. Tanke, B. Herman, "Fluorescence Microscopy" Taylor & Francis Group, 2006
3. B. R. Masters, P. T. C. So "Handbook of Biomedical Nonlinear Optical Microscopy" Oxford University Press 2008
4. P. Eaton, P. West "Atomic force microscopy", Oxford University Press, 2011
5. C. J. Chen "Introduction to scanning tunneling microscopy" Oxford University Press 2008

L. Novotny, B. Hecht "Principles of Nano-Optics" Cambridge University Press 2012

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Dr hab. inż. Katarzyna Matczyszyn, katarzyna.matczyszyn@pwr.edu.pl