Zał. nr 5 do ZW 78/2023

Attachment no. 4. to the Program of Studies

FACULTY of Chemistry

SUBJECT CARD

Name of subject in Polish ……Zaawansowana spektroskopia…….
Name of subject in English ……Modern Spectroscopy…….
Main field of study (if applicable): …Chemistry…….
Specialization (if applicable): …… Advanced Nano and Biomaterials - MONABIPHOT
Profile: academic ~~/ practical~~*
Level and form of studies: - 2nd level, full-time
Kind of subject: obligatory
Subject code W03ANB-SM2002W
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. General chemistry
2. Fundamentals of physics
3. Fundamentals of physical chemistry

SUBJECT OBJECTIVES

C1 To provide students with a general knowledge on the modern spectroscopy
C2 To provide students with a knowledge on spectroscopic setups and techniques
C3 To provide students with a trends in materials characterization using spectroscopic techniques

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
P7U_W01student knows the basic definitions of spectroscopy, especially optical spectroscopy
P7U_W02 student knows the light sources applied in spectroscopy
P7U_W03 student knows the modern setups applied in spectroscopic measurements

P7U_W04 student knows the time-resolved spectroscopies and techniques such as TCSPC
P7U_W05 student knows advanced time-resolved spectroscopies and techniques such as pump-probe
P7U_W06 student knows the selected aspects of nonlinear optical spectroscopy
P7U_W07 student knows the spectroscopic techniques such as Hyper-Rayleigh
P7U_W08 student knows the Hyper-Raman spectroscopy
P7U_W09 student knows the infrared spectroscopies
P7U_W10 student knows new techniques such as CARS and SERS
P7U_W11 student knows techniques of Raman and IR microspectroscopy
P7U_W12 student knows techniques of chiral materials investigations
P7U_W13 student knows new modulation spectroscopy techniques
P7U_W14 student knows new trends in spectroscopy

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1	**Introduction to modern spectroscopy.** Definitions.	2
Lec 2	**Light sources in laser spectroscopy.**	2
Lec 3	**Modern spectroscopy setups.**	2
Lec 4	**Time-resolved techniques part 1.** Techniques like TCSPC.	2
Lec 5	**Time-resolved techniques part 2.** Techniques like pump-probe.	2
Lec 6	**Nonlinear spectroscopy part 1.** Multiphoton absorption**,** z-scan technique, saturable absorption spectroscopy.	2
Lec 7	**Nonlinear spectroscopy part 2.** Hyper-Rayleigh spectroscopy.	2
Lec 8	**Nonlinear spectroscopy part 3.** Hyper-Raman spectroscopy.	2
Lec 9	**Modern infra-red spectroscopy.** Ultrafast spectroscopy, 2D-IR	2
Lec 10	**Raman scattering spectroscopy**. Resonant spectroscopy, micro-Raman, SERS, CARS	2
Lec 11	**Raman and IR imaging techniques.**	2
Lec 12	**Chiral spectroscopy – circular dichroism.**	2
Lec 13	**Modulation spectroscopy.** Examples of light-, magnetic field, electric field stimulated spectroscopies.	2
Lec 14	**New trends in modern spectroscopy.**	2
Lec 15	**Colloquium**	2

TEACHING TOOLS USED

N1. Multimedia presentation
N2. Discussions during the lectures

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

P	P7U_W1-W14	test

PRIMARY LITERATURE:

[1] H.Abramczyk, Spektroskopia laserowa, skrypt PWr, 2011

[2] W. Demtröder, Spektroskopia laserowa. Wydawn. Naukowe PWN, 1993

ADDITIONAL LITERATURE:

[3] A. Corney, Atomic and laser spectroscopy. Oxford Classic Texts in the Physical Sciences, 2006

[4] S. Svanberg, Atomic and Molecular Spectroscopy. Springer, 2004

[5] J.M. Hollas, Modern Spectroscopy, 2004

[6] Joseph R. Lakowicz, Principles of Fluorescence Spectroscopy , Springer, 2006

[7] Max Diem, Introduction to Modern Vibrational Spectroscopy Wiley, 1993

Michael D. Fayer ed., Ultrafast Infrared Vibrational Spectroscopy, CRC press 2013.

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

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