

FACULTY of Chemistry

SUBJECT CARD**Name of subject in Polish** Zaawansowane Materiały Funkcjonalne**Name of subject in English** Advanced Functional Materials**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-SM2014W, W03ANB-SM2014L, W03ANB-SM2014S**Group of courses** NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		90		30
Number of hours of total student workload (CNPS)	50		150		50
Form of crediting (Examination / crediting with grade)	Exam		crediting with grade		crediting with grade
For group of courses mark (X) final course					
Number of ECTS points	2		6		2
including number of ECTS points for practical classes (P)			6		2
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1,3		4,2		1,4

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. General knowledge of mathematics, physics and chemistry

SUBJECT OBJECTIVES

C1 Extending knowledge about materials used in modern materials engineering.

C2 Acquisition of experience in independent development and presentation of the state of knowledge on the basis of scientific publications

C3 Getting to know measurement methods of advanced materials

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEU_W01 has general knowledge in the field of research carried out in modern material engineering

PEU_W02 has knowledge about the synthesis, properties and research of photorefractive materials

PEU_W03 has knowledge about the synthesis, properties and research of photochromic materials

PEU_W04 has knowledge about the synthesis, properties and research of thermo-, electro- and solvatochromes

PEU_W05 has knowledge about the production, properties and testing of organic and inorganic semiconductors

PEU_W06 has knowledge about the synthesis, properties and research of compounds based on coal

PEU_W07 has knowledge about the synthesis, properties and research of energy storage materials

PEU_W08 has knowledge about the production and testing of optical fibers and photonic crystals

PEU_W09 has knowledge about modern materials used in medicine

PEU_W10 has knowledge about the synthesis, properties and research of metamaterials

PEU_W11 has knowledge about the synthesis, properties and research of magnetic and ferroelectric materials

PEU_W12 has knowledge about the properties and research of superconductors

PEU_W13 has knowledge about the synthesis, properties and testing of porous materials

PEU_W14 has knowledge about the synthesis, properties and research of ceramic materials

PEU_W15 has knowledge about the synthesis, properties and studies of luminescent dyes

relating to skills:

PEU_U01 student is able to independently develop and present the state of knowledge on the basis of scientific publications

PEU_U02 student is able to independently perform material tests with advanced techniques

PEU_U03 student is able to analyze and interpret the obtained results

relating to social competences:

PEU_K01 The student can use scientific literature, accessing source materials and viewing them

PEU_K02 student is ready to critically evaluate his/her knowledge and received content

PROGRAMME CONTENT		
Lecture		Number of hours
Lec 1	Modern materials science	2
Lec 2	Photorefractive materials	2
Lec 3	Photochromic materials	2
Lec 4	Thermoplastic materials, electronic and solvatochromic	2
Lec 5	Organic and inorganic semiconductors	2
Lec 6	Carbon materials	2
Lec 7	Materials for energy storage	2
Lec 8	Fiber optics and photonic crystals	2
Lec 9	Materials in medicine	2
Lec 10	Metamaterials	2
Lec 11	Magnetic and ferroelectric materials	2

Lec 12	Superconductors	2
Lec 13	Porous materials	2
Lec 14	Ceramic materials	2
Lec 15	Luminescent dyes	2
	Total hours	30
Classes		Number of hours
CI 1		
CI 2		
CI 3		
CI 4		
..		
	Total hours	
Laboratory		Number of hours
Lab 1	BHP training. The way the laboratory is run. Locations and their discussion. Requirements for course credits.	6
Lab 2	The luminescent properties of organic dyes	6
Lab 3	Methods for determining the thickness of nanolayers	6
Lab 4	Nanomaterials - size effects	6
Lab 5	OFET - fabrication and characteristics	6
Lab 6	OLED - fabrication and characteristics	6
Lab 7	Characteristics of liquid crystals	6
Lab 8	Measurement of phototropic properties of liquid crystals	6
Lab 9	Two-dimensional thermo-optic analysis	6
Lab 10	Quantum efficiency, comparative method	6
Lab 11	Photochemical synthesis of nanostructured silver suspensions	6
Lab 12	Chemical synthesis of nanostructured gold suspensions	6
Lab 13	Fabrication of nanolayers	6
Lab 14	Repetition of the material	6
Lab 15	Repetition of the material, checking knowledge and passing the course	6
	Total hours	90
Project		Number of hours
Proj 1		
Proj 2		
Proj 3		
Proj 4		
...		
	Total hours	

Seminar		Number of hours
Semin 1	Student presentations on topic Lec 1	2
Semin 2	Student presentations on topic Lec 2	2
Semin 3	Student presentations on topic Lec 3	2
Semin 4	Student presentations on topic Lec 4	2
Semin 5	Student presentations on topic Lec 5	2
Semin 6	Student presentations on topic Lec 6	2
Semin 7	Student presentations on topic Lec 7	2
Semin 8	Student presentations on topic Lec 8	2
Semin 9	Student presentations on topic Lec 9	2
Semin 10	Student presentations on topic Lec 10	2
Semin 11	Student presentations on topic Lec 11	2
Semin 12	Student presentations on topic Lec 12	2
Semin 13	Student presentations on topic Lec 13	2
Semin 14	Student presentations on topic Lec 14	2
Semin 15	Student presentations on topic Lec 15	2
	Total hours	30

TEACHING TOOLS USED

N1. Lecture with multimedia presentation and lecture using the board
 N2. Performing tasks in the laboratory
 N3. Problem discussion
 N4. The tests check (short essays) - used on laboratory
 N5. Reports from exercises laboratory

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 (laboratory)	PEU_U02	quizes

F2 (laboratory)	PEU_U03	reports
P (lecture)	PEU_W01 - PEU_W015	final exam
P (laboratory) = (F1+F2)/2		
P (seminar)	PEU_U01, PEU_U03, PEU_K01- PEU_K02	evaluation of multimedia presentation
PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE:</u> [1] Original articles from Web of Science [2] Internet source <u>SECONDARY LITERATURE:</u> [1] Internal instructions for individual laboratory classes		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
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