COURSE DESCRIPTION CARD - SYLLABUS

Course name

Multifunctional materials

Course

Field of study	Year/Semester
Technical Physics	1/2
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
Second-cycle studies	Polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
20		
Tutorials	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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Prerequisites

Knowledge of thermodynamics and molecular physics in the field of experimental physics. The ability to solve elementary problems in physics based on the acquired knowledge, the ability to obtain information from indicated sources. Understanding the need to expand your competences, readiness to cooperate within the team.

Course objective

1. Providing students with basic knowledge of molecular processes and phenomena occurring on the nanometric scale, techniques for producing monolayers and photophysical properties of molecular materials that make up these layers, as well as the properties of multicomponent layers and supramolecular systems

2. Developing students' skills in solving basic problems, planning and using materials for selected applications and performing simple experiments and analyzing the results based on the acquired knowledge

3. Shaping students' teamwork skills

Course-related learning outcomes

Knowledge

1. Student knows the challenges, achievements and limitations of selected, advanced physics problems which can be used in modern technologies. [K2_W02]

2. Student has detailed knowledge of selected issues related to functional, technological and construction materials. [K2_W05]

3. Student has well-established, detailed knowledge related to selected issues of analysis of the properties of functional materials in the nano, micro and macro scale. [K2_W09]

4. Student knows and understands the processes of constructing and producing functional systems. [K2_W10]

Skills

1. Student can choose new advanced materials with appropriate physicochemical and design properties for standard and non-standard laboratory and engineering applications. [K2_U13]

2. Student is able to plan and carry out research leading to the characterization of functional materials, selected quantum processes in atomic and molecular systems and the condensed phase; can analyze, documents and develop research results. [K2_U14]

Social competences

1. Student understands the need and knows the possibilities of constantly updating and supplementing knowledge and the need to improve professional and social competences. [K2_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

W02, W05, W09, W10	Written/oral exam	50.1%-70.0% (3)
		70.1%-90.0% (4)
		from 90.1% (5)
U13, U14	Written/oral exam	50.1%-70.0% (3)
		70.1%-90.0% (4)
		from 90.1% (5)
K04	Written/oral exam	50.1%-70.0% (3)

70.1%-90.0% (4)

from 90.1% (5)

Programme content

1. Basic processes ocurring in interface, effects associated with curved boundary surfaces, condensation and nucleation, wetting.

2. Atomic and molecular adsorption at the interface. Physical phenomena occurring during the formation of monolayers and intra and inter molecular interactions. The importance of materials in technological processes such as washing, physical modification of surfaces or molecular microelectronics. The use of organic compounds in the production of light-emitting diodes (OLED) and in modern photomedicine. Techniques for the preparation of Gibbs and Langmuir monomolecular layers and SAM.

3. Application of nanosystems in technology and medicine.

4. Photosensitizers and organic markers.

5. Mechanisms of photosensitization, photodynamic therapy and diagnostics.

6. Photodynamic potential and triplet states.

7. Modelling of the biological membrane.

8. Quantum dots in photomedicine.

Teaching methods

Lecture: multimedia presentation, presentation illustrated with examples given on the board.

Bibliography

Basic

1. E.T. Dutkiewicz, Fizykochemia powierzchni, WNT, Warszawa 1998.

2. A.W. Adamson i A.P. Gast, Physical chemistry of surface, Willey, NY 1997.

3. A. Chyla, Warstwy Langmuira-Blodgett i ich zastosowanie w elektronice molekularnej, Oficyna Wydawnicza PWr., Wrocław 2004.

4. A. Graczyk, Fotodynamiczna metoda rozpoznawania i leczenia nowotworów, Dom Wydawniczy Bellona, Warszawa, 1999.

5. G. Bartosz, Druga twarz tlenu, PWN, 2004.

Additional

1. H-J. Butt, K. Graf, M. Kappl, Physics and chemistry of interface, Willey, Weinheim 2003.

2. G.T. Barnes, I.R. Gentle, Interfacial science: an introduction, Oxford Univ. Press, Oxford 2011.

Breakdown of average student's workload

	Hours	ECTS
Total workload	34	2,0
Classes requiring direct contact with the teacher	24	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	10	1,0

[1] delete or add other activities as appropriate