COURSE DESCRIPTION CARD - SYLLABUS

Course name
ADVANCED, FUNCTIONAL MATERIALS

Course

Proposed by Discipline
Chemical sciences

Year/Semester
II/3, III/5

Type of studies
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Tutorials	Projects/seminars
4		

Number of credit points

1

Lecturers

Responsible for the course/lecturer:
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Prerequisites

Knowledge: the PhD student has knowledge in chemistry, physics, mathematics and material engineering, obtained at the first and second degree of studies, in the fields of chemical technology, material engineering, technical physics, pharmacy or other related fields. The PhD student can describe the basic processes for the production of advanced functional nano- and biomaterials and knows issues in the field of materials science in terms of their modification and potential applications.

Skills: the PhD student is able to define the assumptions of the technology for production of selected materials and is able to assess their properties (physicochemical, structural, morphological). Independently he can formulate and verify research hypotheses, organizes his own workshop using modern research methods. The PhD student is also able to plan and conduct research and scientific experiments as well as analyze, interpret and critically evaluate and present research results.

Social competencies: the PhD student understands the need to deepen, update and popularize knowledge about the achievements of science and technology. He has the ability to work in a team and is open to implementing advanced technologies, in particular those dedicated to medical or

pharmaceutical applications. The PhD student is able to independently develop knowledge in the subject and is able to communicate with other specialists in this area.

Course objective

The aim of the course is to acquire by PhD students knowledge of nano- and biomaterials, methods of their synthesis and modification in order to obtain hybrid combinations with specific physicochemical and functional properties and to familiarize PhD students with the latest research methods used to characterize synthesized materials.

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows and understands:
1) global achievements, covering theoretical basis as well as general and selected specific issues, that are specific to material sciences, has in-depth knowledge of phenomena and processes, and data development and presentation of research results, [P8S_WG/SzD_W01]
2) the key developmental trends in methods of obtaining functional nano- and biomaterials with defined physicochemical and functional properties, [P8S_WG/SzD_W02]
3) the scientific research methodology for synthesis and modification of nano- and biomaterials, [P8S_WG/SzD_W03]
4) principles of promoting scientific activity results, also in an open access mode. [P8S_WG/SzD_W04]

Skills

A PhD student who graduated from doctoral school can:
1) able to use the knowledge from different branches of science to creatively identify, formulate and to innovatively solve complex problems or to execute research tasks in particular: define the aim and subject of scientific research, form a research hypothesis, develop research methods, techniques and tools and use them creatively, draw conclusions on the basis of research results, [P8S_UW/SzD_U01]
2) able to critically analyze and asses scientific research results, work of experts and other creative activities together with their contribution into knowledge development, [P8S_UW/SzD_U02]
3) able to design new nanoparticles, hybrid inorganic-organic combinations and nanocomposites with the use of biopolymers and examine their properties. Is able to assess the application possibilities of synthesized materials. [P8S_UW/SzD_U01/SzD_U02]

Social competences

A PhD student who graduated from doctoral school is ready to:
1) critically assess the achievements within a materials science and engineering. Understands the need to deepen, update and popularize knowledge about the achievements of science and technology, [P8S_KK/SzD_K01]
2) critically evaluate their own contribution to the development of a materials science and engineering discipline. Has the ability to work in a team, is open to cooperation with other people, including other domestic and foreign scientific institutions, [P8S_KK/SzD_K02]
3) acknowledge the importance of knowledge in solving cognitive and practical problems. [P8S_KK/SzD_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01, W02, W03, W04	written exam	summary note: 3.0 – 50.1%-70.0%, 4.0 – 70.1%-90.0%, 5.0 – from 90.1%
U01, U02	ssessment of student activity during lectures, assessment of team work and solving of scientific problems	3.0 – basic participation in classes without additional involvement, 4.0 – active participation in classes supported by the desire to obtain additional knowledge, 5.0 – independent search for additional theoretical knowledge, ambitious approach to the problem subject
K01, K02, K03	assessment of student activity during lectures, assessment of team work and solving of scientific problems	3.0 – basic participation in classes without additional involvement, 4.0 – active participation in classes supported by the desire to obtain additional knowledge, 5.0 – independent search for additional theoretical knowledge, ambitious approach to the problem subject

Programme content

1. State of art in the field of synthesis, characteristics and applications of advanced functional inorganic and hybrid materials.
2. Materials manufacturing technologies (precipitation processes, sol-gel reactions, emulsion, solvo- and hydrothermal, microwave, biomimetics).
3. Directions for modification of nano- and biomaterials.

4. Application directions of nano- and biomaterials.
5. Biomaterials as sources of a new generation of nanocomposites.
6. Advanced methods for assessing.

Teaching methods

Lecture: multimedia presentation including illustrations and examples.

Bibliography

Basic

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Breakdown of average student's workload

	Hours	ECTS
Total workload	18	1.0
Classes requiring direct contact with the teacher	10	0.5
Student's own work (literature studies, preparation for tutorials, project preparation) [1]	8	0.5

[1] delete or add other activities as appropriate