COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design and physicochemistry of biomedical materials [S2Bioinf2>PFMB]

Course

Field of study
Bioinformatics

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, organic chemistry, physical chemistry of chemical and biochemical processes; knowledge of cell biology; basic knowledge of laboratory equipment and safety rules in a chemical laboratory.

Course objective

The aim of course is to gain the knowledge and skills in the field of obtaining and comprehensive characterization of materials with potential application in biomedical engineering.

Course-related learning outcomes

Knowledge:
Knowledge:
A graduate knows and understands:
- complex biological phenomena and processes, and bases their interpretation in research and practical

activities on a strict and consistent approach using empirical data
- complex physicochemical and biochemical processes, including the principles of appropriate selection of materials, raw materials, apparatus and devices for their implementation and product characterization
- basics of using biocatalysts and biomaterials in biochemical processes

Skills:
A graduate is able to:
- fluently use and integrate information obtained from literature and electronic sources, in Polish and English, interpret and critically evaluate it
- perform advanced measurements and laboratory experiments and interpret their results
- under the supervision of a research tutor, plan and perform research tasks using analytical, simulation and experimental methods

Social competences:
A graduate is ready to:
- lifelong learning, inspiring and organizing the learning process of others, including seeking expert opinions and critically evaluating the collected content
- responsible performance of professional roles, including maintaining the ethos of the profession, adhering to the principles of professional ethics and working to ensure compliance with these principles
- setting priorities for the implementation of tasks defined by oneself or others and taking actions aimed at completing tasks in an entrepreneurial manner
- taking responsibility for assessing the risks associated with applied research techniques and creating conditions for safe work

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture classes:
Written pass graded in the range 0-100 pts and the following scale is assumed:
3 (50,1-60,0%); 3.5 (60,1-70%); 4 (70,1-80,0%); 4.5 (80,1-90%); 5 (90,1-100%)
Laboratory: Ongoing verification of knowledge before each exercise in the form of a written test, as well as assessment of laboratory reports based on experimental measurements obtained. Grading scale: 3 (50.1 - 60.0%), 3.5 (60.1 - 70.0%), 4 (70.1 - 80.0%), 4.5 (80.1 - 90.0%), 5 (from 90.1%). Reports based on the experimental results must be submitted within 7 days of completing the exercise and assessed in the form of a pass. A student receives a passing grade for the laboratory after receiving positive marks from the written tests and completing all reports.

Programme content

The course content includes issues related to the design and comprehensive characterization of materials for biomedical engineering.

Course topics

Lecture:
1. Biomedical materials, implants, biomatrices.
2. Classification and characteristics of surface modification methods for biomaterials.
3. Nano- and multilayer biomaterials with desired properties.
4. Surfactants, biosurfactants, adsorption equilibrium and kinetics.
5. Wettability of materials, contact angle, surface energy.
6. Correlations between the chemical structure of substances and the material's functional properties.
Laboratory: The laboratory block will include practical exercises related to the topics presented in the lectures, specifically: 1)Studies of adsorption equilibrium and dynamics at the gas/liquid interface for selected amphiphilic bio-compounds; 2)Applications of the spin coating method for coating materials with a thin layer; 3) Qualitative and quantitative characterization of solid surfaces.

Teaching methods

Lecture: Presentation and discussion
Laboratory classes: practical excercices made by students in separation laboratory.

Bibliography

Basic:
1. P. W. Atkins, Chemia fizyczna, Wyd. Nauk. PWN, Warszawa 2003.
2. R. Zieliński, Surfaktanty: budowa, właściwości,zastosowania , Wyd. Uniwersyt. Ekonom., Poznań 2017.
3. E. T. Dutkiewicz, Fizykochemia powierzchni, WNT Warszawa 1998.

Additional:
1. R. B. Silverman, Chemia organiczna w projektowaniu leków, WNT Warszawa 2004
2. K. Pigoń, Z. Ruziewicz, Chemia fizyczna cz.1 i cz.2, Wyd. Naukowe PWN, Warszawa.
3. M. Rojewska, A. Biadasz, M. Kotkowiak, A. Olejnik, A. Dudkowiak, K. Prochaska, Adsorption properties of biologically active derivatives of quaternary ammonium surfactants and their mixtures at aqueous/air interface. I. Equilibrium surface tension, surfactant aggregation and wettability, Colloids and Surfaces B: Biointerfaces 110, 387-394, 2013.
4. M. Rojewska, M. Skrzypiec, K. Prochaska, Surface properties and morphology of mixed POSS-DPPC monolayers at the air/water interface, Colloids and Surfaces B: Biointerfaces, 150, 334-343, 2017.
5. M. Rojewska, A. Bartkowiak, B. Strzemiecka, A. Jamrozik, A Voelkel, K. Prochaska, Surface properties and surface free energy of cellulosic etc mucoadhesive polymers, Carbohydrate Polymers, 171, 152-162, 2017.
6. A. Bartkowiak, M.Rojewska, K. Hyla, J. Zembrzuska, K. Prochaska, Surface and swelling properties of mucoadhesive blends and their ability to release fluconazole in a mucin environment, Colloids and Surfaces B: Biointerfaces, 172, 586-593 (2018).

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00