COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design and physicochemistry of biomedical materials [S2Bioinf1>PFMB]

Course

Field of study
Bioinformatics

Year/Semester
2/4

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
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

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 and modern drug delivery systems

Course-related learning outcomes

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 (K_W01)
- complex physicochemical and biochemical processes, including the principles of appropriate selection of materials, raw materials, apparatus and devices for their implementation and product

characterization (K_W02)
- basics of using biocatalysts and biomaterials in biochemical processes (K_W07)

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 (K_U01)
- perform advanced measurements and laboratory experiments and interpret their results (K_U03)
- under the supervision of a research tutor, plan and perform research tasks using analytical, simulation and experimental methods (K_U06)

Social competences:
A graduate is ready to:
- cooperate and work in team taking various roles (K_K02);
- determining priorities for the implementation of a task defined by oneself or others (K_K03)
- take the responsibility for the assessment of threats resulting from the research techniques used and for creating safe working conditions (K_K06)
- systematically updating his knowledge in the field of biology and computer science and seeing the possibilities of its practical application (K_K08)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture classes:
Written exam 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 classes:
current evaluatoin of student"s knowledge before each class and grading the reports with the results of laboratory experiments.

Programme content

Lecture:
1. Surfactants and biosurfactants.
2. Equilibrium and dynamics of adsorption at the interface.
3. Wettability of materials, contact angle, surface energy.
4. Methods of modifying the surface of solids from the point of view of obtaining materials with the expected performance properties.
5. Qualitative and quantitative characteristics of the modified surfaces: texturometry, SEM microscopy, AFM, methods of testing the release of biologically active substances.
6. Correlations between the chemical structure of the substance and the functional properties of the material.
7. Drug design and modification (QSAR).
8. Relationship between the chemical structure and activity of drugs.
9. Modern delivery systems for biologically active substances.
Laboratory classes:
The laboratory block will include practical exercises on the issues presented during the lectures, in particular: 1) The equilibrium and dynamics of adsorption at the gas / liquid interface for selected amphiphilic biocompounds; 2) The spin coating method to coat the material with a thin layer and the qualitative and quantitative characteristics of the modified surfaces; 3) Obtaining various types of formulations used in modern drug delivery systems and testing the ability to release biologically active substances.

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	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50