COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biomaterials [S2IChiP1-IBiB>Biom]

Course

Field of study
Chemical and Process Engineering

Year/Semester
1/1

Area of study (specialization)
Bioprocesses and Biomaterials Engineering

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
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

dr inż. Katarzyna Adamska
katarzyna.adamska@put.poznan.pl

Lecturers

Prerequisites

Student has knowledge about inorganic, organic and physical chemistry. Student uses basic laboratory techniques in the synthesis, modification, isolation and purification of compounds and materials; knows how to use instrumental methods in the characterization of materials. Student has knowledge of English to a degree enabling analysis of scientific literature.

Course objective

The aim of the course is to familiarize students with the basic information about modern materials used in medical sciences. During the program, issues related to ceramic, metallic, polymer, composite and natural biomaterials will be discussed. Students will acquire knowledge related to biomaterial / environmental interaction phenomena and factors affecting biomaterial / tissue interaction. The aim of the course is also to expand knowledge of modern materials used in orthopedics, cardiology, ophthalmology, dentistry and other fields of biomedical sciences.

Course-related learning outcomes

Knowledge:
1. student has knowledge of the types, properties and applications of biomaterials. [k_w03, k_w11]

2. student has knowledge of techniques and methods for characterizing biomaterials. [k_w04, k_w07]

Skills:
1. student can describe the methods, techniques and tools used to solve simple problems related to the preparation and examination of biomaterials. [k_u09, k_u11, k_u18, k_u19, k_u20]
2. student has the skills to use specialized vocabulary in english. [k_u03]

Social competences:
1. student understands the need for self-education and improvement own professional competences. [k_k01]
2. student is aware of compliance with the principles of engineering ethics in a broad sense. [k_k02, k_k05]
3. student is able to work in a group, taking on different roles in it. [k_k03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The knowledge acquired during the lecture is verified on the basis of the final exam consisting of 15 test closed questions and 5 open questions. Passing threshold: 50% of correct answers. Multiple-choice test questions.
A stationary exam or an on-line exam via e-courses, if the classes will be conducted online.
In the field of laboratory classes:
Establishing a final grade on the basis of partial grades obtained during the semester: written tests from the material included in the exercises and the given theoretical issues; the presence and performance of all laboratory exercises, grades from reports prepared after each exercise.
Online form: Establishing a final grade on the basis of partial grades obtained during the semester; a written test (closed question) from the material contained in the exercises, online presence, completion of all laboratory exercises provided in the study, preparation of reports on the basis of the presented videos from a given exercise.

Programme content

The program includes:
1) Basic definitions and concepts, functions, and classification of biomaterials,
2) Types of biomaterials, taking into account their chemical structure, properties, functions, and applications,
3) Methods and techniques used to determine mechanical parameters, surface characteristics, and properties of biomaterials,
4) Issues related to the interaction between the biomaterial and the biological environment.

Course topics

1. Lecture:
• Introduction to the science of biomaterials, basic definitions and concepts, functions of biomaterials, classification of biomaterials.
• Mechanical parameters determined for biomaterials.
• Bioceramics: types - ways of interaction with bone, forms, sytnesis, properties, applications
• Bio-glasses: types, preparation, bioactivity - bio-glass / bone binding, application.
• Glass-ceramic materials: types, composition, application.
• Metals and their alloys in medical applications.
• Composites: structure, types of matrix and strengthening phase, their functions, applications in tissue regeneration.
• Polymer biomaterials - synthetic, biodegradable, natural - types, application.
• Microscopic methods in biomaterial research.
• Methods for sterilizing of biomaterials.
• Biomaterial / biological environment interaction: factors, surface properties affecting protein adsorption, biomaterial / internal environment interface, cell adhesion - integrins, factors affecting biomaterial / tissue interaction, reactions after implantation.
• Biological assessment of biocompatibility of biomaterials - types of tests, in vitro and in vivo methods

in biocompatibility studies.
2. Laboratory:
• Dental biomaterials - obtaining samples of commercial dental biomaterials and testing their properties, such as density, water sorption, solubility and hygroscopic expansion. Determination of depth of curing.
• Preparation of a ceramic / polymer scaffold and determination of its porosity.
• Biocomposites - synthesis, determination of the surface properties.
• Infrared spectroscopy in the characterization of biomaterials.
• Testing the compressive strength of selected biomaterials.
• Determination of the contact angle of selected biomaterials.
• Use of alginates in drug release.

Teaching methods

1. Lecture: multimedia presentation.
2. Laboratory: theory contained in the tutorials, practical exercises.

Bibliography

Basic
1. Marciniak J. Biomateriały. Wydaw. Politechniki Śląskiej. Gliwice 2002.
2. Biocybernetyka i Inżynieria Biomedyczna 2000. Tom 4. Biomateriały pod red. Nałęcz M, Błażewicz S., Stoch L. Akademicka Oficyna Wydawnicza EXIT. Warszawa 2003.
3. A. Voelkel, K. Adamska, Biomateriały, WPP, Poznań 2011..
Additional
Świeczko-Żurek B. Biomateriały. Skrypt Politechniki Gdańskiej. Gdańsk. 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
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)	65	2,50