



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Biomaterials

### Course

Field of study

Chemical and process engineering

Area of study (specialization)

Bioprocesses and biomaterials engineering

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

2

### Lecturers

Responsible for the course/lecturer:

dr inż. Katarzyna Adamska

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### 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:

Knowledge acquired during the lecture is verified based on the final test. Passing threshold: 50% of points.

Skills acquired as part of the laboratory are verified on the basis of oral and written control of the student's knowledge before the start of the laboratory and a written report of the exercises.

#### Programme content

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, synthesis, 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.

## 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

- Świczko-Żurek B. Biomateriały. Skrypt Politechniki Gdańskiej. Gdańsk. 2009.



### Breakdown of average student's workload

	Hours	ECTS
Total workload	80	2,0
Classes requiring direct contact with the teacher	60 (30l+30lab)	1,5
Student's own work (literature studies, preparation for laboratory classes, preparation for the final test of the lecture) <sup>1</sup>	20	0,5

<sup>1</sup> delete or add other activities as appropriate