



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Biomaterials surface treatment

Course

Field of study

Biomedical engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

4/7

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture

15

Tutorials

Laboratory classes

15

Projects/seminars

Other (e.g. online)

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

prof. dr hab. inż. Jarosław Jakubowicz

Responsible for the course/lecturer:

Prerequisites

Students should have basic knowledge of materials science, biomaterials and chemistry. They should also have the ability to think logically and obtain information from various sources, as well as be ready to cooperate within the team. In addition, they should understand the need to learn and acquire new knowledge



Course objective

Provide students with information about the importance of the surface layer of biomaterials and methods of the surface layer formation on biomaterials and products made of them

Course-related learning outcomes

Knowledge

1) Students have knowledge about structure of the surface layer and the methods of its formation in relation to biomaterials.

Skills

- 1) Students are able to propose a modification of the surface layer of biomaterials
- 2) Students are able to characterize the properties of the biomaterials surface

Social competences

- 1) Students can work together in a team.
- 2) Students are aware of the role of biomaterials surface treatment in modern economy and for societies.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

- 1) Knowledge acquired during the lectures is verified at the final test lasting 45 minutes. There are two credit deadlines to which every student is entitled. In addition, students can improve their grades in additional term. Final test consists of 3-5 questions. The pass threshold is 50% of the points.
- 2) Skills acquired as part of the laboratory classes are checked on an ongoing basis during each class in the form of an oral or written answer to the questions asked and assessed on the basis of reports from each laboratory exercise. Each laboratory exercise requires a positive evaluation. At the end of the semester, after completing compulsory exercises, there is a possibility to pass a corrective exam of selected exercises.

Programme content

Lecture:

1. Characteristics and importance of the surface layer.
2. Properties and importance of the surface layer of biomaterials.
3. Types of surfaces of metal implants.
4. Methods of biomaterials surface treatment:
 - a) electrochemical methods: anodic oxidation and etching, cathodic deposition
 - b) physical methods: PVD and related,
 - c) chemical methods: CVD and related,
 - d) mechanical methods.
5. Methods used for biomaterials surface layer characterization.

Laboratory classes:

1. Anodic oxidation of titanium and its alloys - process.
2. Analysis of anodically oxidized layers - SEM, AFM, XRD.



3. Electrochemical deposition of a bioceramic coating on titanium - process.
4. Thermal spraying of bioceramic coating on titanium - process.
5. Analysis of bioceramic coatings - SEM, AFM, XRD.

Teaching methods

- 1) Lecture: multimedia presentation, illustrated with examples on the board.
- 2) Laboratory exercises: performing the tasks given by the teacher - practical exercises (surface modification); characterization of the surface layer (SEM, AFM, XRD).

Bibliography

Basic

1. J. Jakubowicz, Obróbka powierzchniowa biomateriałów tytanowych, Wydawnictwo Politechniki Poznańskiej, Poznań 2019
2. J. Jakubowicz, Elektrochemicznie modyfikowana powierzchnia bionanomateriałów tytanowych, Wydawnictwo Politechniki Poznańskiej, Poznań 2012
3. T. Hryniewicz, Wstęp do obróbki powierzchniowej biomateriałów metalowych, Politechnika Koszalińska, Koszalin 2007

Additional

1. M. Jurczyk, J. Jakubowicz, Bionanomateriały, Wyd. Politechniki Poznańskiej, Poznań 2008
2. J. Marciniak, Biomateriały, Wyd. Politechniki Śląskiej, Gliwice 2002
3. Biomateriały, Tom 4, Biocybernetyka i Inżynieria Biomedyczna 2000, pod red. M. Nałęcza, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	3,0
Classes requiring direct contact with the teacher	30	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) ¹	30	1,0

¹ delete or add other activities as appropriate