COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biomaterials surface engineering [S2IBio1>IPB]

Course

Field of study
Biomedical Engineering

Year/Semester
1/2

Area of study (specialization)
Bionics and Virtual 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
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge and basic knowledge of biomaterials technology, surface engineering and material engineering.

Course objective

The aim of the course is to acquire knowledge about surface engineering in the field of biomaterials, technology design as well as the construction, production and application of material surface layers.

Course-related learning outcomes

Knowledge:
1. The student has knowledge of the structure and technological properties of biomaterials and the creation of models in surface engineering.
2. The student knows the measurement methods and measurement-quantitative systems used in the construction of materials and surface technology.
3. The student has knowledge of the modeling, analysis of the operation of devices and measuring apparatus in the field of tribology, nanoinduction and X-ray fluorescence.

Skills:

1. Student is able to calculate and develop equations and models for experimental data used in material surface engineering technology.
2. The student knows and is able to characterize the technological and operational properties of materials and biomaterials.

Social competences:
1. Is aware of the role of engineering knowledge and its importance for society and the environment.
2. Can present and make others aware of the importance of analyzes and calculations in public life.
3. The student is able to define the priorities for the implementation of a specific task.
4. The student is open to launching new biomedical technologies, understands the needs of learning and acquiring new knowledge.

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: the basis of a test consisting of questions and short tasks.
The condition for receiving a positive evaluation is obtaining at least 50% of the possible points

Programme content

1. Introduction to the basic issues of materials and biomaterials technology.
2. Characteristics, classification, role and application of biomaterials.
3. Shaping the biological properties of the biomaterial surface.
4. Surface engineering of the surface layer and material layer requirements.
5. The importance of the surface layer in issues of quality and durability of materials.
6. Research and control methods (tribometric, fluorescent, nanoindent).
7. Basic content on biomaterials, research and industrial biotechnology.
8. Shaping the surface properties and modification of biomaterials.
9. Metallic biomaterials.
10. The role of biomaterials in surface engineering.

Course topics

1.Scope of scientific discipline Surface engineering in biomaterials and mechanics
2.Modern methods of manufacturing technological surface layers
3.Mechanical methods of surface modification
4.Chemical and physical methods of surface modification (CVD and PVD)
5. Innovative manufacturing technology of composite materials SPS (Spark Plasma Sintering)
6. Laser surface modification
7. Characterization of surface diagnostic methods:
-spectroscopic methods of surface analysis
-structural diagnostics (AFM, SEM, TEM)
-temperatures and methods of their measurement
-diagnostics of micro-mechanical properties
8 Hard and superhard coatings based on nitrides, borides, carbides and nanocomposites
9. Development directions of surface engineering

Teaching methods

1. Lecture: presentation illustrated with examples given on the board, solving problems.
2. Laboratory exercises: conducting experiments, working in teams, discussion.

Bibliography

Basic
1. Bednarski W., Fiedurka J.; Podstawy biotechnologii przemysłowej; Wydawnictwo Naukowo-Techniczne; Warszawa 2007
2. Blicharski M.; Inżynieria powierzchni; Wydawnictwo Naukowo-Techniczne; Warszawa 2004
3. Chmiel A.; Biotechnologia. Podstawy mikrobiologiczne i biochemiczne; Wydawnictwo Naukowe PWN; Warszawa 1998

4. Jurczyk M.; Jakubowski J.; Bionanomateriały; Wydawnictwo Politechniki Poznańskiej; Poznań 2008.
5. Kula P.; Inżynieria warstwy wierzchniej Wydawnictwo Politechniki Łódzkiej; Łódź 2000
6. Kupczyk M.; Inżynieria powierzchni; Wydawnictwo Politechniki Poznańskiej, Poznań 2004
7. Ledakowicz S.; Inżynieria biochemiczna; Wydawnictwo Naukowo-Techniczne; Warszawa 2011.
Additional
1. Ratledge, C.; Podstawy biotechnologii; red. Kristiansen, B., Kononowicz, A.; tł., Bielecki, S., Chmiel, A.; Wydawnictwo Naukowe PWN; Warszawa 2011
2. Skręta A.; Biomateriały. Materiały pomocnicze; Wydawnictwo Politechniki Rzeszowskiej; Rzeszów 2004

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