COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of medical bioengineering

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 studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars
30

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr hab. inż. dr med. Ryszard Uklejewski, prof. nzw UKW, e-mail: uklejew@ukw.edu.pl

Responsible for the course/lecturer:
dr inż. Mariusz Winiecki, winiecki@ukw.edu.pl

Prerequisites

No initial knowledge required (it is the introductory subject to “Bioprocess and medical biomaterials engineering”).

Course objective

The student should acquire the knowledge on fundamentals of medical bioengineering, notably on fundamentals on medical biomaterials engineering and design of the treatment protocols for natural biomaterials and engineering biomaterial/tissue system.

Course-related learning outcomes

Knowledge

1. Student characterizes the anatomy of basic human body systems and tissue biostructure, in particular organs of the musculoskeletal system and bioelectrochemical sources of electrical signals of cells and tissues – [K_W02, K_W12].

2. Student characterizes biomaterials as divided into natural biomaterials (biological tissue) and artificial (biosubstitutes) and is able to characterize processes of the preparation of bio-organic biomaterials and methods of testing – [K_W03, K_W08].

Skills

1. Student is able to identify the properties of biostructure of tissue - [K_U01, K_U03].

2. Student is able to design and implement the processes of preparation of natural biomaterials and bio-substitute material/tissue systems - [K_U01, K_U03, K_U05].

Social competences

1. Student works in a group and sets priorities for the implementation of the task specified by himself or other - [K_K01, K_K02, K_K03].

2. Student is aware of the interdisciplinary nature of biomedical engineering as a field of knowledge dealing with the design, production and optimization of materials for medicine and the necessary cooperation between engineer and doctor in this field - [K_K02, K_K05].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Current control of preparation to design exercises, valuation of the tests concerning designing treatment protocols for natural biomaterials and engineering biomaterial/tissue system, valuation of the final examination.

Programme content

There are lectured: 1) the history of medical bioengineering (biomedical engineering) as a technical science with division to primary sections; anatomy of fundamental systems of human organism: musculoskeletal system, cardiovascular system, neurohormonal system; 2) the fundamentals of biomaterials engineering with division to natural biomaterials (biologic tissues) and artificial (biosubstitutes); fundamentals of bioengineering materials include the knowledge concerning the structure of the biomaterials, the properties and requirements of biosubstitute materials. Most of all, there are lectured biomaterials for human motor system organs and circulatory system. There is also presented the characteristics of tissues biostructures, in particular the biostructure organs of musculoskeletal system (cortical and trabecular bone tissue, cartilaginous tissue, connective tissue, ligaments and tendons, muscle tissue; biomechanical, bioelectrical and biomechatronic properties of tissues of musculoskeletal system). There is lectured the classification and characteristics of primary groups of engineering biosubstitute materials – metallic biomaterials, ceramic biomaterials, polymeric biomaterials, carbon biomaterials and composite biomaterials. There are reviewed the bioelectrochemical generators of electrical signals of cells and tissues, passive electrical properties of tissues.

Teaching methods

Lectures, fundamentals of designing (design of the treatment protocols for natural biomaterials and engineering biomaterial/tissue system)

Bibliography

Basic

1. Uklejewski R. (red.), Winiecki M.: Podstawy bioinżynierii medycznej dla specjalności Inżynieria bioprocesów i biomateriałów. Materiały dydaktyczne. Wydawnictwo Politechniki Poznańskiej, Poznań, 2011.

2. Pawlicki G.: Podstawy inżynierii medycznej. Oficyna Wydawnicza Politechniki Warszawskiej, 1997.

3. Jaroszyk A.: Biofizyka, PZWL, Warszawa 2002.

4. Marciniak J.: Biomateriały. Wyd. Politechniki Śląskiej, Gliwice 2013.

5. Sokołowska-Pituchowa J.: Anatomia człowieka. PZWL, Wyd. VII, Warszawa 2003.

6. Sawicki W.: Histologia, PZWL, Wyd. IV, Warszawa 2006.

Additional

1. Nałęcz M. (red.): Biocybernetyka i inżynieria biomedyczna, t.1-9. Wydawnictwo Exit, Warszawa 2000-2004.

2. Bronzino J.D. (red.): The Biomedical Engineering Handbook. CRC Press & IEEE Press, 1995 (II wyd. 2000).

3. Ostrowski K.: Histologia, Wyd. PZWL, Warszawa 2001.

4. Bochenek A.: Anatomia człowieka. PZWL, Warszawa (wielokrotne wydania)

5. Będziński R.: Biomechanika inżynierska, Wyd. Politechniki Wrocławskiej, 1997.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	60	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate