



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Prosthesis wear

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### Course

Field of study

Biomedical engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/6

Profile of study

general academic

Course offered in

polish

Requirements

elective

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### Number of hours

Lecture

15

Tutorials

Laboratory classes

Projects/seminars

15

Other (e.g. online)

### Number of credit points

3

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### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Rafał Talar

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Responsible for the course/lecturer:

dr hab. n. med. Piotr Rogala

mgr inż. Adam Patalas

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### Prerequisites



Basic knowledge of biomechanics, biomaterials and medical implants, logical thinking, the use of information obtained from literature, the Internet and manufacturing companies, understanding the need to learn and acquire new knowledge

### Course objective

Increasing competence in causes wear, and reliability of medical objects, prevention and control of wear processes, medical devices impact human and the environment, technical facilities of the device in the following stages of their existence.

### Course-related learning outcomes

#### Knowledge

Characteristics of wear mechanisms, the definition of terminology in the field of limb prosthesis. Definition of basic concepts of reliability of objects, attributes of phenomena occurring on the surface of solids contact. The essence of the wear processes of parts and assemblies of medical devices, classification, composition, properties and intended use of lubricants or stagnation. Sources of damage in the life cycle of medical devices, including the human factor.

#### Skills

Know the sources of information concerning operational problems. Can assess the impact of the complexity of medical devices on their reliability. Knows the essence of the wear processes of dentures, can use appropriate construction materials, understands the influence of phenomena occurring during the contact of solids on the operation of kinematic nodes. Know the rules of the role of natural lubricants and artificial, understand man's role in the formation of damage and unfitness. Can identify the causes of wear of elements used in medicine based on symptoms and wear intensity.

#### Social competences

Understands the need for lifelong learning; can inspire and organize the learning process of other people. Is aware of the importance and understanding of non-technical aspects and effects of engineering activities.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Exam based on a written test consisting of 30 test questions on a 0/1 scale. Passing for a minimum of 51%.

Project: Course passing based on partial grades and a planned experiment.

### Programme content

#### Lectures:

Introduction to the exploitation of technical facilities. The phases of the existence of a technical object. Principles of the use of medical devices. Exploitation strategies. Prosthesis using.

Properties of solids and liquids. Solid contact zone phenomena. Friction and adhesion of metals. Non-metallic friction. Extreme friction.



Lubrication types concerning common cases. Lubrication in biological systems - joints. Properties and characteristics of solid, liquid and gaseous lubricants. Classification, selection and purpose of lubricants. The relationship between lubrication and efficiency. Degradation, ageing of lubricants during storage and use.

Tribological and tribo - chemical wear processes - essence and symptoms. Types of corrosion, occurrence and methods of prevention.

The reasons for the occurrence of damages and their sources in the subsequent technical object existence stages. Human participation in the chain of events leading to states of unfitness of technical facilities and catastrophes.

Basic concepts of reliability: reliability function, failure intensity, reliability models, structural reliability, reliability of technological devices. Maintenance of medical device.

Project:

Each group will be realized project including designing and planning the experiment allows estimation of the wear of the medical device it's mechanism of wear. The project aims to analyze the current methods of wear assessment, forecasting the planning of the wear of medical devices and methods of testing the wear of medical devices at the pre-certification stage. Project will be carried out in compliance with the currently applicable regulations, in particular ISO 13485 regarding the management of medical devices.

In order to plan the experiment, the project groups will work with the standards, in particular: ISO 14242, ISO 14243, ISO 5832, ISO 5833, ISO 7206, ASTM F451, ASTM G99, ASTM G133.

## Bibliography

Basic

1. S.C. Cowin: Bone Mechanics Handbook, 2001 by CRC Press
2. Y.H. An, R.A Draughn: Mechanical testing of bone and the bone-implant interface, CRC Press, 2000
3. St. Legutko: Eksploatacja maszyn, Wyd. Politechniki Poznańskiej, Poznań 2007.
4. St. Nosal: Tribologia, Wyd. Politechniki Poznańskiej, Poznań 2012.
5. S. Ścieszka, M. Żołnierz: Eksploatacja maszyn, Wyd. Politechniki Śląskiej, Gliwice 2012.

Additional

1. Praca zbiorowa: ?Podstawy racjonalnej eksploatacji maszyn?, Wyd. Instytutu Technologii Eksploatacji, Radom, 1996.
2. W. Neville, P.Sachs: Practical Plant Failure Analysis, CRC Press, Boca Raton 2007.
3. H. Bloch, F. Geitner: Practical Machinery Management for Process Plants Vol.1,2,3, Gulf Professional Publishing, Houston 1999



### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	40	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	35	1,5

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