COURSE DESCRIPTION CARD - SYLLABUS

Course name
Ortopedic and rehabilitation engineering

Course

Field of study
Biomedical engineering
Area of study (specialization)
-
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
15
Laboratory classes
0
Other (e.g. online)
0
Tutorials
0
Projects/seminars
30

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr inż. Mateusz Kukla

e-mail: mateusz.kukla@put.poznan.pl

Institute of Machine Design, Faculty of Mechanical Engineering, Poznan University of Technology

Piotrowo 3 St., 424 BM, 61-139 Poznań

+48 61 224 45 14

Responsible for the course/lecturer:
dr inż. Bartosz Wieczorek

e-mail: bartosz.wieczorek@put.poznan.pl

Institute of Machine Design, Faculty of Mechanical Engineering, Poznan University of Technology

Piotrowo 3 St., 609 BM, 61-139 Poznań

+48 61 665 2042

Prerequisites

The student starting the course has a basic knowledge of subjects such as Fundamentals of Machine Design, Mechanics, Technical Drawing and Computer Graphics. The student should be able to use the MS Office suite, any CAD software, obtain information from indicated sources, and independently search for information sources. The student should be ready to cooperate as part of a team and be aware of the need for self-education.

Course objective

The aim of the course is to familiarize students with the subject of designing assistive technology devices. The course will also discuss the biomechanical models used for this purpose and the applicable legal standards.

Course-related learning outcomes

Knowledge

Has basic knowledge of engineering design and engineering graphics, allowing to design objects and processes, systems in terms of systems, machine elements; formulate and analyze problems; look for solution concepts; apply engineering calculations, select and evaluate solution variants; use modeling, optimization and knowledge bases in engineering design, computer-aided design process, technical drawing; read drawings and diagrams of machines, devices and technical systems; describe their structure and principles of operation.

Has basic knowledge of engineering design and engineering graphics, allowing to describe and apply the processes and systems of operation, reliability and safety, elements of technical diagnostics of machines related to the operational properties of materials; use the basics of computer-aided design of CAD in connection with computer-aided material design CAMS and technological CAM.

Has a basic knowledge of the development trends of computer-aided engineering design, thanks to which he can describe and present the methods of recording the structure, rules of mapping and dimensioning, projection, simplification in the notation of the geometric form and dimension system, read assembly drawings, finite element methods (FEM) and boundary (MEB), selected numerical optimization methods, the use of FEM and MEB in computer aided design, the use of computer graphics in the process of creating technical documentation, CAD / CAM systems.

He knows the basic methods of techniques and tools in the field of engineering biomechanics, thanks to which he can describe the structure and mechanical and physical properties of human osteoarticular structures, factors and parameters of body posture, the basis of the strength of tissue materials - biomechanical aspects of overloading tissue structures, structure and biomechanics of the spine; is able to present the stabilizers used in the treatment of spine diseases, selected issues of the anatomy and biomechanics of the hip joint, the structure and elements of the anatomy of the knee joint, studies of stresses and deformations in the knee and hip joints; has knowledge of hip and knee arthroplasty, external stabilization of long bones; can characterize the construction of external stabilizers, the construction of selected stabilizers, the structure and biomechanics of the temporomandibular joint, selected issues of tribology of joints, experimental methods of biomechanics [K_W26 (P6S_WG)].

Skills

Can obtain information from literature, databases and other properly selected sources (also in English or another foreign language recognized as the language of international communication) from biomedical engineering; in particular, can describe the issues of biochemistry and biophysics and combine them with technical issues and engineering design, can integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions.

Can use information and communication techniques appropriate to the implementation of tasks typical for engineering activities.

Can formulate and solve engineering tasks to use analytical, simulation and experimental methods. Can formulate problems and use mathematical methods and the laws of physics in the analysis of technical issues; can explain the role of chemical changes in industrial processes.

Can evaluate the usefulness of routine methods and tools for solving a simple practical engineering task, characteristic for biomedical engineering, and can select and apply the appropriate method and tools.

Social competences

Understands the need for lifelong learning; can inspire and organize the learning process of other people.

Is aware of the social role of a technical university graduate and understands the need to formulate and convey to the society, in particular through the mass media, information and opinions on the achievements of technology and other aspects of engineering activities; makes efforts to provide such information and opinions in a commonly understandable manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture (exam): written completion of tasks and questions from the program content.

Project: A project task carried out in groups.

passing threshold: 60%

Programme content

Lecture 1 - Assistive Techniques - introduction The course will present the most commonly used assistive technology devices and outlined engineering issues related to their construction.

Lecture 2 - Basics of design and legal standards Design problem definition. Formulating a design task based on anthropometric data and applicable legal standards.

Lecture 3 - Wheelchair part. 1 Discussion of the problems of constructing wheelchairs. Models, materials, legal norms, types, the latest trends.

Lecture 4 - Wheelchair part. 2 Discussion of advanced solutions in wheelchairs. Electric drive, hybrid drive, functionality extension modules.

Lecture 5 - Technical aids in standing and learning to walk Discussion of the issues of constructing standing frames and handrails. Models, materials, legal norms, types, the latest trends.

Lecture 6 - Technical means of passive locomotion Discussion of the problems of constructing beds and stretchers. Models, materials, legal norms, types, the latest trends.

Lecture 7 - Prostheses of upper and lower limbs Discussion of the problems of constructing and manufacturing prostheses of upper and lower limbs. Materials, legal standards, manufacturing technique.

Lecture 8 - Modular structures in terms of designing assistive devices Principles of designing modular structures. Ways of using modular structures oriented to the needs of people with disabilities. The possibility of functional development of the structure through the use of various modules.

Projects:

Project 1 - Distribution of project tasks During the classes, students will be given design tasks, the subject of which will be the requirement to replace specific functions of the organism by a technical device.

Project 2 - Development of the functional structure of the designed device During the classes, students will formulate their design task and develop the functional structure of the designed technical device

Project 3 - Formulation of the morphological matrix On the basis of the developed functional structure, students will formulate a morphological matrix of possible technical solutions that perform particular functions.

Project 4 - Multi-criteria assessment During the classes, students will carry out a multi-criteria assessment of the concepts of structures they have developed collected in morphological matrices. During the course, they will develop evaluation criteria and assign them appropriate weights.

Project 5 - Preliminary construction concept, part 1 In class, students will use CAD software to create a conceptual model of their technical solution.

Project 6 - Preliminary construction concept, part 1 In class, students will use CAD software to create a conceptual model of their technical solution.

Project 7 - The use of anthropometric dimensions in the selection of design features During the classes, students will use anthropometric atlases to verify the concepts they have developed. The aim of the course is to use anthropometric dimensions in the process of selecting regulatory systems.

Project 8 - Consultation classes During the classes, students will present their solutions which will be discussed by the whole group. The aim of the course is to introduce feedback to the design process. This will allow the student carrying out the project to obtain the opinion of potential users and, on this basis, to modify his structure.

Teaching methods

Lecture: multimedia presentation, examples given on the blackboard

Project: consultation with students on the project task being carried out

Bibliography

Basic

red. Torbicz W. 2015 Tom 3. Biomechanika i inżynieria rehabilitacyjna, Akademicka Oficyna Wydawnicza EXIT

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Branowski, B. K. 1999. Metody twórczego rozwiązywania problemów inżynierskich. Wydaw. Wielkopolska Korporacja Techniczna NOT.

Branowski B., Zabłocki M. 2006. Kreacja i kontaminacja zasad konstrukcji w projektowaniu dla osób nepełnosprawnych, Ergonomia produktu. Ergonomiczne zasady projektowania produktów pod red. J. Jabłońskiego, Wyd. Politechniki Poznańskiej, Poznań

Nowak E. - 2000. Anthropometry for design, International Encyclopedia of Ergonomics and Human Factors, Tom 2 pod red. W. Karwowskiego, Wyd. Teylor & Francis, London

Pahl G., Beitz W. 1984. Nauka konstruowania, Wyd. Naukowo-techniczne, Warszawa

Additional

Cooley, M. 1999. Human-centered design. Information design, 59-81.

Gendarz P. - 2012: Parametryczny zapis uporządkowanych rodzin konstrukcji maszyn, Wyd. Politechniki Śląskiej, Gliwice

Pahl G., Beitz W. 1988. Engineering Design, Wyd. The Design Council, London

Pheasant S. 1986 Bodyspace: Anthropometry, Ergonomics and Design, Wyd. Teylor & Francis, London

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	47	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	28	1,0

[1] delete or add other activities as appropriate