COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of machine design [S1IBio1>PKM]

Course

Field of study
Biomedical Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
15

Number of credit points

4,00

Coordinators

Lecturers

Prerequisites

Basic in the field of: engineering graphics, material strength, manufacturing techniques, mechanics, metrology and other areas of education in the field of study.

Course objective

Understanding the basics of an engineer's construction knowledge, acquiring construction skills, acquiring the ability to apply basic sciences, strength, materials science and manufacturing techniques to shape objects, learning the general principles of building assemblies and machine components.

Course-related learning outcomes

Knowledge:
1. The student is able to characterize the subject and the design process.
2. The student is able to formulate and analyze construction problems.
3. Has an ordered, theoretically founded general knowledge that allows to define the requirements for construction materials and determine their permissible stresses.
4. The student has knowledge of the use of engineering materials for selected elements of parts of machines and biomedical devices.
5. The student should: determine the loads on the structure, shape its form on this basis, determine the strength conditions.

6. Has an ordered, theoretically founded general knowledge that allows to analyze the statics of beams and determine the support values.
7. The student has the knowledge to determine the techniques of shaping structural elements of machines and biomedical devices .
8. The student is able to characterize selected connections, present the construction of machine parts, has knowledge of the principles of operation of selected mechanisms.
9. Has basic knowledge of engineering design and construction notation, allowing to design objects, machine elements; formulate and analyze problems; look for solution concepts; apply engineering calculations.

Skills:
1. The student is able to perform strength analyzes of machine elements and mechanical systems.
2. The student is able to use analytical methods to shape selected parts of biomedical machines and devices.
3. The student is able to present the designed objects taking into account the principles of notation of construction and engineering graphics.
4. Can identify and formulate the specificity of simple engineering tasks of a practical nature.
5. Can design simple devices (eg rehabilitation) or objects (screws) [K_U20] in accordance with the given specification.
6. The student is able to obtain information from the literature, databases, standards and catalogs regarding materials and machine parts used in the construction.

Social competences:
1. Understands the need for lifelong learning.
2. The student is aware of the influence and responsibility of the designer for the developed design solutions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: pass on the basis of a written test at the end of the semester in general and specific knowledge, assessed on a point scale, to pass the exam it is required to collect at least 50% of the total number of points.
Classes: passing based on tests on solving simple construction tasks. The condition for receiving a positive evaluation is obtaining at least 50% of the possible points
Project: credit on the basis of systematic presentation of progress (50%) and the final version of the project and their oral justification (70%).

Programme content

-Lecture:
1. Design and construction - object, subject, process, need.
2. Structure modeling - machine as a technical system, design tasks, types of structures, structure features, structure evaluation criteria, examples.
3. Principles of construction - unambiguous, simple, reliable, optimal loads, optimal construction material. Loads in machines - definitions, division, time distributions, effects of occurrence.
4. Systematics of connections in machine building. Welded joints - applications, weldability of materials, types of welds, calculations. Riveted joints - applications, rules of forming joints, calculations.
5. Bolted connections - applications, thread features, normalization, connection loads, material connections, calculations, connection protection. Other types of connections - welded, glued, soldered, rolled.
6. Shafts and axles - purpose, construction, principles of shaping, calculations.
7. Shaft-hub connections - shape connections - key, spline - shaping, calculations; friction joints - fits in joints, distribution of forces, calculations.
8. Bearings - rolling and slide bearings - application, construction, division, friction models, calculations.
9. Drive systems - characteristics, types, structure, kinematics.
10. Tooth transmissions - geometry, loads, strength calculations.
11. Transmission - belt transmissions - geometry, loads, stresses.
12. Couplings - types, functions, materials used, basics of calculations.
Exercises:

1. Analysis of loads and stresses in statically determinate systems.
2. Calculations of beams.
3. Calculations of welded joints.
4. Calculations of bolted connections.
5. Geometric calculations of toothed and belt transmissions
6. Calculations of shafts, shaft-hub connections and rolling bearings.
Design:
1. Design of a bending beam with consideration of the influence of the material on the design effects.
2. Design of objects of the connector, catch etc. class with the use of welded and bolted connections.
3. Design of the structure of the drive system and its parts.

Teaching methods

1. Lecture: presentation illustrated with examples given on the board, solving problems.
2. Exercises: problem solving, discussion.
3. Project: solving practical problems, discussion.

Bibliography

Basic:
11. Podstawy konstrukcji maszyn, praca zb. pod red. Zb. Osińskiego, PWN, W-wa, 1999.
2. Podstawy konstrukcji napędów maszyn, praca zb. pod red. B. Branowskiego, Wydawnictwo Politechniki Poznańskiej, Poznań, 2007.
3. Podstawy konstrukcji maszyn, praca zb. pod red. M. Dietricha, WNT, W-wa, 1999.
4. Poradnik inżyniera mechanika. WNT, Warszawa 1970.

Additional:
1. G. Pahl, W. Beitz.: Nauka konstruowania, WNT, W-wa, 1984.
2. L. Kurmaz, O. Kurmaz: Podstawy konstruowania węzłów i części maszyn, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	38	1,50