COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of machine design [S1Mech1>PKM1]

Course

Field of study
Mechatronics

Year/Semester
2/4

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
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

2,00

Coordinators

Lecturers

Prerequisites

Knowledge: Basic knowledge of mathematics and physics. Has basic knowledge of engineering graphics, in the field of projection, geometric shaping of technical forms with the use of polyhedra, solids and surfaces. Has an ordered, theoretically founded general knowledge of technical mechanics and strength of materials. Skills: Can use analytical, simulation and experimental methods to formulate and solve engineering tasks, can formulate problems, use mathematical methods in the analysis of technical issues. He can analyze any system of forces, moments, equilibrium of planar and spatial systems. He can apply the principles of dynamics and determine the energy, work and power of systems. Can perform static analysis of beams, columns, frames and trusses. He is able to obtain information from the Internet, library and reading room and other resources. In particular, he can correctly indicate the sources of the necessary information. Can determine the quality and usefulness of the information and data found. He can also integrate information obtained from various resources, interpret them, as well as draw conclusions and formulate and justify opinions. Social competences: Can interact and work in a group, assuming different roles in it.

Course objective

1. Provide students with knowledge of the basics of machine design, within the scope defined by the program content appropriate for the field of study. 2. Developing students" skills: - calculating and designing elements and assemblies of machines, - documenting and reading technical documentation based on the acquired knowledge in the subject of machine engineering graphics, - practical use of knowledge acquired in the following subjects: mechanics, strength of materials, machine science, materials science. 3. Shaping students" teamwork skills

Course-related learning outcomes

Knowledge:
1. Has knowledge of engineering design of machines and devices in the field of the theory of machines and mechanisms, elements of tribology, connections in machine construction, drives, shafts and axles, couplings and brakes, mechanical transmissions, methods of analysis of kinematic systems, basics of hydrostatic drive, machine design algorithms, selection machine elements based on strength and durability criteria, engineering databases in machine construction, technical standards, good practices used in technology and technologies. The acquired knowledge allows you to design: machines and mechanical devices, objects and processes and systems.
2. He knows the elements of a technical drawing, mapping and dimensioning of machine elements, sections, lines, presenting typical elements, normalization in the machine design, rules for creating assembly diagrams and drawings, graphic methods of presenting connections of machine elements, marking surface features of elements. Has knowledge of the use of CAD systems. This knowledge allows you to create technical drawings of machine elements and to read drawings and diagrams of machines, devices and technical systems. It allows to describe their structure and principles of operation.
3. Has knowledge of the strength of materials, including physical laws relating to the action of forces on materials, load cases, tensile, compression, pressure, shear, bending, torsion, complex loads, superposition of load cases, allowable stresses, stress hypotheses, analysis of the stress of machine elements, fatigue strength and fatigue calculations. This knowledge allows performing strength analyzes of machine elements.

Skills:
1. He can design machines and mechanical devices, taking into account the technology and methods of manufacturing and connecting individual mechanical elements.
2. He can present a mechanical structure on a technical drawing using a CAD program. Is able to interpret technical drawings and diagrams of machines, devices and technical systems.
3. He is able to perform strength calculations of mechanical elements including tension, compression, pressure, shear, bending, torsion and complex loads. Can perform basic fatigue calculations.

Social competences:
1. Can set priorities for the implementation of a task set by himself or others.
2. Understands the need for lifelong learning; can inspire and organize the learning process of other people.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Written exam on the lecture, individual final project.

Programme content

Lecture: Machine shafts, design and calculations. The structure of the machine drive system, functions of gears, clutches, basic drive parameters, types of drives, kinematic diagrams. Classification of couplings, review of structures and applications. Clutches: permanent, controlled, flexible, overload. Calculation of couplings and rules for selection from catalogs. General division of gears, kinematic diagrams, structure overview, basic parameters. Principles of gear selection, calculation of gear ratios and torques. Toothed gears: classification, meshing principle, tooth outline. Helical gears with straight and helical teeth: meshing geometry, kinematics, geometrical parameters of wheels, inter-tooth force, basics of the structure. Design calculations of spur gears. General characteristics of belt transmissions, force and tension in the belt tendons, transmitted power and efficiency of the transmission. Calculation

and selection of design features of belt transmissions. Chain transmissions.
Project: Designing machine drive systems. Design of gear and belt transmissions. Design of screw mechanisms. Selection of couplings and bearings. Design of shafts and axles.

Course topics

none

Teaching methods

Informative lecture with a multimedia presentation, project methods used in design classes.

Bibliography

Basic
1. Praca zbiorowa pod red. Z. Osińskiego, Podstawy konstrukcji maszyn, PWN, W-wa, 1999
2. Praca zbiorowa pod red. M. Dietricha: Podstawy konstrukcji maszyn. Tom 3, WNT, Wa-wa, 1999.
3. J. Żółtowski, Podstawy Konstrukcji Maszyn, Oficyna Wydawnicza Politechniki Warszawskiej, 2002.
4. R. Knosala, A. Gwiazda, A. Baier, P. Gendarz, Podstawy Konstrukcji Maszyn, WNT, Warszawa 2000.
5. A. Dziurski, L. Kania, A. Kasprzycki, E. Mazanek, Przykłady obliczeń z Podstawy Konstrukcji Maszyn, Tom 1 i 2, WNT, Warszawa 2005.
6. Ochęduszko Kazimierz, Koła zębate T. 1, Konstrukcja, Wydawnictwa Naukowo-Techniczne, 2007.
7. Ochęduszko Kazimierz, Koła zębate T. 2. Wykonanie i Montaż, WNT, Wydawnictwa Naukowo-Techniczne, 2007.
Additional
1. Dietrich M., Podstawy konstrukcji maszyn, Wydawnictwo Naukowo Techniczne 1995.
2. Niezgodziński M. E., Niezgodziński T., Wzory, wykresy i tablice wytrzymałościowe, Wydawnictwo Naukowo Techniczne, 1996,
3. Sempruch J., Piątkowski T., Podstawy konstrukcji maszyn z CAD, Piła, Państwowa Wyższa Szkołą zawodowa w Pile, 2006,
4. Bahl G., Beitz W., Nauka konstruowania, WNT, Warszawa 1984.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00