COURSE DESCRIPTION CARD - SYLLABUS

Course name
Machine design [S1MiBM2>KoM2]

Course

Field of study
Mechanical 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
15

Other
0

Tutorials
0

Projects/seminars
30

Number of credit points

5,00

Coordinators

Lecturers

Prerequisites

Knowledge: Has basic knowledge of mathematics and physics. Has basic knowledge of engineering graphics, in the field of projection, geometric shaping of technical forms using polyhedra, solids and surfaces. Has structured, theoretically based general knowledge of technical mechanics and strength of materials. Skills: Is able to use analytical, simulation and experimental methods to formulate and solve engineering tasks. Is able to formulate problems and use mathematical methods in the analysis of technical issues. Is able to analyze any system of forces, moments, and balance of plane and spatial systems. Is able to apply the principles of dynamics and determine the energy, work and power of systems. Is able to perform static analysis of beams, columns, frames and trusses. Is able to obtain information from the Internet, library, reading room and other resources. In particular, he is able to properly indicate the sources of necessary information. Is able to determine the quality and usefulness of the retrieved information and data. He is also able to integrate information obtained from various resources, interpret it, draw conclusions and formulate and justify opinions. Social competences: Is able to cooperate and work in a group, taking on various roles in it.

Course objective

1. Providing students with knowledge of machine design, within the scope determined by the program content appropriate for the field of study. 2. Developing students' skills: - calculating and constructing machine elements and assemblies, - documenting and reading technical documentation based on the acquired knowledge of machine engineering graphics, - practical use of knowledge acquired from subjects including: mechanics, strength of materials, machine science, materials science. 3. Developing teamwork skills in students

Course-related learning outcomes

Knowledge:
1. Has knowledge of engineering design of machines and devices in the field of theory of machines and mechanisms, connections in machine construction, methods of analyzing kinematic systems, basics of hydrostatic drive, machine design algorithms, selection of machine elements based on strength and durability criteria, engineering databases under construction machines, technical standards, good practices used in technology and technology. The acquired knowledge allows you to design: machines and mechanical devices, objects and processes, systems from a systemic perspective.
2. Knows the elements of technical drawing, mapping and dimensioning of machine elements, cross-sections, cuts, layouts, presentation of typical elements, standardization in construction records, principles of creating diagrams and assembly drawings, graphic methods of presenting connections of machine elements, marking surface features of elements. Has knowledge of operating CAD systems. This knowledge allows you to create technical drawings of machine elements and read drawings and diagrams of machines, devices and technical systems. It allows you 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, tension, compression, pressure, shear, bending, torsion, complex loads, superposition of load cases, permissible stresses, stress hypotheses, analysis of element stress machines, fatigue strength and fatigue calculations. This knowledge allows you to perform strength analyzes of machine elements.

Skills:
1. Is able to design machines and mechanical devices, taking into account the technology and methods of producing and connecting individual mechanical elements.
2. Is able to present a mechanical structure in a technical drawing using a CAD program. Is able to interpret technical drawings and diagrams of machines, devices and technical systems.
3. Is able to perform strength calculations of mechanical elements, including tension, compression, pressure, shear, bending, torsion and complex loads. Is able to perform basic fatigue calculations.
4. Is able to plan and organize individual and team work

Social competences:
1. Understands the need for lifelong learning; can inspire and organize the learning process of other people.
2. Is able to determine the importance of knowledge in solving cognitive and practical problems and to seek the opinion of experts in case of difficulties in solving the problem independently.
3. Can think and act in a creative and enterprising way.
4. Is aware of the social role of a technical university graduate, understands the need to formulate and provide the public with information and opinions regarding technological achievements.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam from the lecture, final colloquium from exercises, individual final project.
Ratings: 3.0 <50%;60%), 3.5 <60%;70%), 4.0<70%;80%), 4.5<80%;90%), 5.0 < 90%;100%).

Programme content

Lecture: Structure of the machine drive system, functions of gears and clutches, basic drive parameters, types of drives, kinematic diagrams. Division of clutches, review of construction and applications. Clutches: fixed, controlled, flexible, overload. Calculation of couplings and selection rules from catalogues. General division of gears, kinematic diagrams, structure overview, basic parameters.

Principles of gear selection, calculation of gear ratios and torques. Gears: classification, principle of engagement, tooth outline. Helical gears with straight and helical teeth: meshing geometry, kinematics, geometric parameters of wheels, inter-tooth force, basics of construction. Design calculations of spur gears.
Laboratories: Modeling of drive system elements in the CAD system: connections, shafts, gears, pulleys, clutches.
Project: Design of machine drive systems. Design of gear and belt transmissions. Design of screw mechanisms. Selection of clutches and bearings. Shaft and axle design. Selection of commercial parts and components: clutches, brakes, gears, connections.

Course topics

none

Teaching methods

Informative lecture, computer laboratories in the CAD system, design methods used during design classes.

Bibliography

Basic:
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3. J. Żółtowski, Podstawy Konstrukcji Maszyn, Oficyna Wydawnicza Politechniki Warszawskiej, 2002.
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5. A. Dziurski, L. Kania, A. Kasprzycki, E. Mazanek, Przykłady obliczeń z Podstawy Konstrukcji Maszyn, Tom 1 i 2, WNT, Warszawa 2005.
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8. Wałęsa K., Talaśka K., Wilczyński D., Górecki J., Wojtkowiak D., Experimental approach to modeling of the plasticizing operation in the hot plate welding process. Archives of Civil and Mechanical Engineering, 2022, vol. 22, iss. 1, s. 16-1-16-25.
9. Malujda I., Wilczyński D., Talaśka K., Wojtkowiak D., Szulc M., Study of the prototype mechanism of height adjustment of the bed in hospital bed. MATEC Web of Conferences, 2018, vol. 157, s. 02028-1-02028-11, DOI: 10.1051/matecconf/201815702028.

Additional:
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2. Niezgodziński M. E., Niezgodziński T., Wzory, wykresy i tablice wytrzymałościowe, Wydawnictwo Naukowo Techniczne, 1996.
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4. Pahl G., Beitz W., Nauka konstruowania, WNT, Warszawa 1984.
5. Pahl G., Beitz W., Feldhusen J., Grote K.H., Engineering Design, A Systematic Approach, third edition Springer Verlag London Limited 2007.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	77	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	48	2,00