# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Product construction and design [S1ZiIP2>KiPW]

## Course

Field of study
Management and Production Engineering

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
30

Laboratory classes
0

Other
0

Tutorials
15

Projects/seminars
15

## 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 organized, 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, use mathematical methods in the analysis of technical problems. Is able to conduct an analysis of any system of forces, moments, equilibrium of flat and spatial systems. Is able to apply the principles of dynamics and determine the energy, work and power of systems. Is able to perform a static analysis of beams, columns, frames and trusses. Is able to obtain information from the Internet, library and reading room and from other resources. In particular, is able to correctly indicate the sources of necessary information. Is able to determine the quality and usefulness of the information and data found. Is also able to integrate information obtained from various resources, interpret it, as well as draw conclusions and formulate and justify opinions. Social competences: Is able to cooperate and work in a group, assuming different roles.

## Course objective

1. Providing students with knowledge of machine design, within the scope defined by the program content appropriate for the field of study. 2. Developing students' skills: - calculating and constructing machine elements and assemblies, - 3D modeling of machine elements and assemblies, using 3D modeling aids - generators of assemblies and elements, using libraries and databases of standardized elements and "finished" products - documenting and reading technical documentation based on knowledge gained from the subject of engineering machine graphics, - practical use of knowledge gained from subjects including: mechanics, strength of materials, machine science, materials science. 3. Shaping students' teamwork skills

## Course-related learning outcomes

Knowledge:
1. Has general knowledge of engineering design and engineering graphics. It includes a holistic and systemic approach to the design process (construction, technology), including elements of the theory of mechanisms, basic construction units and their elements, methods and evaluation of the selection of a construction variant, and multi-criteria optimization of the construction.
2. Knows engineering databases and computer-aided design programs (CAD - Computer Aided Design).
3. Has detailed knowledge of basic and auxiliary processes in machine construction. Knows computer-aided process design systems.

Skills:
1. Is able to design machines and mechanical devices, taking into account the technology and methods of manufacturing and connecting individual mechanical elements.
2. Is able to 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. Is able to plan and organize individual and team work

Social competences:
1. Understands the need for lifelong learning; is able to inspire and organize the learning process of others.
2. Is able to determine the importance of knowledge in solving cognitive and practical problems and to seek expert opinions in the event of difficulties in solving a problem independently.
3. Is able to think and act in a creative and enterprising manner.
4. Is aware of the social role of a technical university graduate, understands the need to formulate and communicate information and opinions about technological achievements to society.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam from the lecture, final colloquium from the exercises, project credit. Grades: <90-100> very good; <80-90) good plus; <70-80) good; <60-70) satisfactory plus; <50-60) satisfactory; <0-50) unsatisfactory.

## Programme content

Basic principles of the design process, general and detailed design principles, design methodology, design issues, design features and their assignment to elements and assemblies, mechanism elements, characteristics of load types, defining loads and formulating appropriate strength conditions. Detachable and inseparable connections and their characteristics. Construction of screw mechanisms: examples and application. Flexible elements: springs, rubber flexible elements. Design of machine structural nodes using CAD. Structure of drive systems and their characteristics. CAD and its role.

## Course topics

Lecture: Basic principles of the design process, general and detailed design principles, design methodology, design issues, design features and their assignment to elements and assemblies, mechanism elements, characteristics of load types, defining loads and formulating appropriate strength conditions. Detachable and inseparable connections and their characteristics. Construction of screw mechanisms: examples and application. Flexible elements: springs, rubber flexible elements. Design of machine structural nodes using CAD. Structure of drive systems and their characteristics. CAD and its

role.
Exercises: Process of designing machine nodes. Design of welded connections. Design of riveted connections. Design of hub-shaft connections (keyed, splined and pin). Design of pin connections. Design of threaded connections and screw mechanisms. Design of axles and shafts, selection of bearings, design of tension gears: belt, chain, design of friction gears.
Project:
Design using the CAD system of an element/assembly in accordance with the adopted guidelines/criteria/principles of design. It is planned to use databases, libraries and CAD program modules supporting the modeling/generation of elements and assemblies.

## Teaching methods

Informative lecture, blackboard exercises using the case method (case study), project classes - project method.

## 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. 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.
7. 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.
8. Grafika komputerowa dla mechaników pod red. Piotra Krawca, Wydawnictwo Politechniki Poznańskiej, 2020.

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 Szkoła zawodowa w Pile, 2006.
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 | 62 | 2,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 63 | 2,50 |