# COURSE DESCRIPTION CARD - SYLLABUS

Course name

Basics of Machine Design and CAD

## Course

Field of study

Logistics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/4

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

## Number of hours

Lecture

30

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

## Number of credit points

3

## Lecturers

Responsible for the course/lecturer:

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Faculty of Mechanical Engineering

ul.Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Ph.D., D.Sc., Eng. Krzysztof Talaśka, University Professor

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## Prerequisites

The student starting this course should have basic knowledge of technical drawing, strength of materials and technical mechanics. He should also have the ability to obtain information from the indicated sources and be ready to cooperate as part of the team.

## Course objective

1. Providing students with knowledge of the basics of machine design, to the extent specified by the curriculum content appropriate to the field of study.

2. Developing students' skills:

- calculating and designing machine components and assemblies,

- documenting and reading technical documentation based on acquired knowledge

  in the field of machine engineering graphics,

- practical use of knowledge gained in the subjects of mechanics,

  strength of materials, machine science, material science.

3. Developing teamwork skills in students

## Course-related learning outcomes

### Knowledge

1. Student knows the basic issues of construction, technology and techniques related to design and production [P6S_WG_01].

2. Student knows the basic issues of mechanics, design and operation of machines [P6S_WG_02].

### Skills

1. The student is able to apply appropriate experimental and measurement techniques, including computer simulation as part of logistics and its specific issues, and supply chain management to solve the problem covered by the studied subject [P6S_UW_03].

2. The student is able to choose the right tools and methods to solve the problem within logistics and supply chain management, and to use them effectively.[P6S_UO_02].

3. The student is able to identify changes in requirements, standards, regulations, technical progress and the reality of the labor market, and on their basis determine the need for supplementing knowledge [P6S_UU_01].

### Social competences

1. The student is aware of initiating activities related to the formulation and transfer of information and cooperation in the society in the field of logistics [P6S_KO_02].

2. The student is aware of the cooperation and work in a group on solving problems within the scope of logistics and supply chain management [P6S_KR_02].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: The knowledge acquired during the lecture is verified by one 60-minute test carried out during the 15th lecture. The test consists of 5 open-ended questions with different scores. Passing threshold: 50% of points.

Tutorials: Final test: open questions. Passing threshold: 50% of points.

## Programme content

Lecture:

Basic principles of the design process, elements of the mechanism, characteristics of load types, definition of loads and formulation of appropriate strength conditions. Connections and their calculation: soldered, welded, pressure welded, glued, riveted connections, shaped connections: key, spline, pin, spigot and threaded connections. Screw mechanisms: examples and applications, structural calculations. Flexible components: springs, flexible rubber components.

The structure of the machine's propulsion system, gears and clutches functions, basic parameters of the drive, types of drives, kinematic diagrams. Clutch breakdown, design and application overview. System start with clutch. Clutches: permanent, controlled, flexible, overload. Calculation of couplings and selection rules from catalogs. General distribution of gears, kinematic diagrams, structure review, basic parameters. Gear selection rules, calculation of gear ratios and moments Toothed gears: classification, meshing principle, tooth outline. Helical gears: meshing geometry, kinematics, geom parameters. wheels, inter-tooth force, base of structure. Bevel gears, systems, teeth variations, wheel geometrical parameters, inter-tooth force. Stress condition in gear teeth of gears. Design calculations of front gears. Worm gears, geometry, kinematics. Planetary gears, construction examples. General characteristics of belt transmissions, forces and stresses in belt tendons, transmitted power and transmission efficiency. Calculation and selection of design features of belt transmissions. Chain gears. Friction gears, selection of materials for wheels, slips, efficiency. Helical-ball gears, types, load capacity, efficiency, examples of structures, selection of structural features.

Tutorials:

Basics of the strength of materials, determining the allowable stress. Example of design process of the machine assembly. Elaboration of technical documentation. Designing of welded joints. Designing of riveted joints. Designing of pin and spigot connections. Designing of key and splined connections. Designing of threaded joints and screw mechanisms. Designing of the drive shafts along with its bearing and selection of the clutch.

## Teaching methods

Information lecture, problem lecture, talk.

Practical method - subject exercises.Exercise method (subject exercises, exercises) - in the form of auditorium exercises.

## Bibliography

Basic

1. Osiński Z., Podstawy konstrukcji maszyn, Wydawnictwo PWN, Warszawa, 1999.

2. Dietrich M., Podstawy konstrukcji maszyn, tom 3, Wydawnictwo Naukowo-Techniczne, Warszawa, 1999.

3. Osiński Z., Sprzęgła, Wydawnictwo PWN, Warszawa, 1998.

4. Dziama A., Michniewicz M., Niedźwiedzki A., Przekładnie zębate, Wydawnictwo PWN, Warszawa, 1989.

5. Ochęduszko K., Koła zębate, Wydawnictwo Naukowo-Techniczne, 1985.

6. Dudziak M., Przekładnie cięgnowe, Wydawnictwo PWN, Warszawa, 1997.

7. Żółtowski J., Podstawy Konstrukcji Maszyn, Oficyna Wydawnicza Politechniki Warszawskiej, 2002.

8. Knosala R., Gwiazda A., Baier A., Gendarz P, Podstawy Konstrukcji Maszyn, Wydawnictwo Naukowo-Techniczne, Warszawa 2000.

9. Dziurski A., Kania L., Kasprzycki A., Mazanek E, Przykłady obliczeń z Podstawy Konstrukcji Maszyn, Tom 1 i 2, Wydawnictwo Naukowo-Techniczne, Warszawa 2005.

Additional

1. Müller L., Przekładnie obiegowe, Wydawnictwo PWN, Warszawa, 1983.

2. Bahl G., Beitz W., Nauka konstruowania, Wydawnictwo Naukowo-Techniczne, Warszawa 1984.

3. Dietrich M., Podstawy konstrukcji maszyn, Wydawnictwo Naukowo Techniczne, 1995.

4. Niezgodziński M. E., Niezgodziński T., Wzory, wykresy i tablice wytrzymałościowe, Wydawnictwo Naukowo Techniczne, 1996.

5. Sempruch J., Piątkowski T., Podstawy konstrukcji maszyn z CAD, Piła, Państwowa Wyższa Szkoła zawodowa w Pile, 2006.

6. Bhandari V. B., Design of Machine Elements, 3rd Edition 2010, published by TATA McGraw-Hill Publishing Company Limited.

7. Bhandari V. B., Introduction to Machine Design, 2nd Edition 2013, published by TATA McGraw-Hill Publishing Company Limited.

8. Budynas R. G., Keith J Nisbett K. J., Shigley's Mechanical Engineering Design, McGraw-Hill Higher Education; 9 edition, 2011.

9. Collins J. A., Busby H. R., Staab G. H., Mechanical Design of Machine Elements and Machines, John Wiley & Sons; 2nd Edition, 2009

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 75 | 3,0 |
| Classes requiring direct contact with the teacher | 45 | 2,0 |
| Student's own work (literature studies, preparation for tutorials, preparation for tests) [1] | 30 | 1,0 |

[1] delete or add other activities as appropriate