COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer aided machine design

Course

Field of study
Engineering Management
Area of study (specialization)

Level of study
First-cycle studies
Form of study
full-time

Year/Semester
2/3
Profile of study
general academic
Course offered in
Polish
Requirements
compulsory

Number of hours

Lecture
30
Tutorials
15
Laboratory classes

Projects/seminars

Other (e.g. online)

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
Ph.D., Eng., Dominik Wilczyński

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Phone: 61 224-4512

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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Phone: 61 224-4512, 61 665 2244

Faculty of Mechanical Engineering

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Prerequisites

Knowledge of physics (mechanics in the field of: statics, kinematics and dynamics), mathematics, after passing as part of the study program.

Ability to solve problems with the basics of machine design based on knowledge and the ability to obtain information from specified sources.

Awareness of the need to expand their competences, readiness to cooperate within a 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

The student describes the basic principles of the design process and elements of the construction mechanism. [P6S_WG_16]

The student defines types of loads and formulates appropriate strength conditions. [P6S_WG_16]

The student names different types of connections, such as soldered, welded, brazed, glued, riveted, keyed, pinned, and threaded, and explains their applications and structural calculations. [P6S_WG_16]

The student characterizes compliant elements, such as springs and rubber compliant elements, and explains their role in constructions. [P6S_WG_16]

The student recognizes the structure of a machine's drive system, functions of transmissions, couplings, and basic drive parameters. [P6S_WG_14]

The student names various types of gearings, such as spur gears, bevel gears, worm gears, planetary gears, and others, and explains their operating principles, parameters, and applications. [P6S_WG_14]

Skills

The student plans and conducts experiments, including measurements and computer simulations, interpreting the results and drawing conclusions in the context of structural design. [P6S_UW_09]

The student uses analytical, simulation, and experimental methods to formulate and solve engineering tasks related to constructions. [P6S_UW_10]

Social competences

The student seeks and selects educational and training centers to supplement and improve knowledge and skills in the field of structural design. [P6S_KK_01]

The student is aware that creating products that satisfy user needs requires a systemic approach considering technical, economic, marketing, legal, organizational, and financial issues. [P6S_KO_02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam from lecture, test from classes.

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

Informative lecture, problem lecture.

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

Bibliography

Basic

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Additional

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3. Bahl G., Beitz W., Nauka konstruowania, WNT, Warszawa 1984.

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

10. 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	100	4,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests, project preparation) [1]	55	2,0

[1] delete or add other activities as appropriate