COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basic of Machin Design [S1IMat1>PKM]

Course

Field of study
Materials 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
0

Other
0

Tutorials
15

Projects/seminars
15

Number of credit points

4,00

Coordinators

Lecturers

Prerequisites

Basics of mechanics and strength of materials as well as material science and heat treatment. Basics of engineering calculations. Engineering graphics - the ability to make sketches and technical drawings. Individual and team work. Creativity and regularity.

Course objective

Transfer of theoretical and practical knowledge in the field of machine construction. Understanding the construction and operation and methodology of designing simple technical devices and their elements. Acquiring the skills of analyzing construction solutions. Development of a simple device design documentation.

Course-related learning outcomes

Knowledge:
1. The student has knowledge from the basics of machine construction in the scope enabling the design of simple technical devices and their elements (K_W05).
2. The student has knowledge of technical mechanics and material strength that allows determining the state of load and stress of calculated machine elements and selecting permissible stresses (K_W09).
3. The student has knowledge in the field of construction, operation and structural features of connections as well as machines teams to analyze and develop simple design documentation (K_W05).

4. The student has knowledge from engineering graphics enabling analysis and presentation of variants of construction solutions (K_W05).
5. The student has knowledge about engineering materials that allows to select the appropriate structural materials and shape their features (K_W10, K_W14).

Skills:
1. The student can use the available sources of knowledge during the implementation of design work and has the ability to self -education (K_U01, KU_05).
2. The student can determine and check the strength criteria for calculated machine elements (K_U15).
3. The student has the ability to design simple technical devices using the principles of engineering graphics (K_U17).
4. The student can choose engineering materials and shape their properties in the design process of machine parts (K_U21).
5. The student can work individually and as a team using computer support techniques in design (K_U02).

Social competences:
1. The student sees the need to constantly acquire and update technical knowledge (K_K01).
2. The student is aware of the engineer's responsibility for technical decisions and their impact on the environment (K_K02).
3. The student sees the role of an engineer in shaping technical awareness in society (K_K05).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: credit based on the colloquium in general and detailed knowledge presented in lectures. Evaluation criteria: for each question there is a certain number of points to be scored. On this basis, the percentage score of the colloquium is calculated. Grading scale: up to 49% - 2.0, from 50% - 3.0, from 60% - 3.5, from 70% - 4.0, from 80% - 4.5, from 90% - 5.0.
Assessment criteria: knowledge of construction, operation and structural features of connections and machine elements. Principles of construction and selection of engineering materials.
Exercises: Passing based on a written test with solving simple computing tasks of machines in the field of machines processed in class. Assessment criteria: correctness of determining the state of load and stress, proper selection of strength criteria, correctness of calculations.
Project: credit based on an individual design task of a simple device. Assessment criteria: Review of the construction and justification of the adopted solution, design methodology, document development.

Programme content

1. Design methodology
2. Identification of load and stress state in machine elements
3. Analysis of operation and kinematics of basic machine parts. Forming the structural design.
4. Analysis of design variants. Strength calculations.
5. Design of basic structural nodes. Selection of structural materials. Standardised elements.
6. Connections and assemblies in machine construction
7. Creating design documentation

Course topics

Lecture programme covers the following topics:
1. Modern approach to design – design thinking. Engineering design.
2. Stages of project task implementation.
3. Principles of construction. Requirements for constructions.
4. Analysis of structural stability.
5. Computer-aided design. Heuristics and bionics.
6. Connections in engineering structures – permanent and separable connections. Characteristics. Principles of design and calculation. Joining techniques. Technological aspects of connections.
7. Screw connections and mechanisms. Threads – parameters and properties. Stress distributions. Calculation algorithm.
8. Bearing assemblies in machine construction. Design and selection of bearings.
9. Machine assemblies – shaping structural features, properties, and design.

Exercise programme covers the following topics:
1. Methodology for solving calculation tasks in connections and machine assemblies.
2. Practising design and verification calculations for machine parts.
3. Analysis of load and stress state, selection of strength criteria using practical examples of machine elements.
4. Calculation of actual stresses and selection of permissible stresses.
5. Graphical representation of load state and creating graphs in calculation tasks.
6. Selection of standardised elements.
7. Identifying causes of calculation errors.

Project programme covers the following topics:
1. Analysis of kinematic schemes, geometry, and load state of screw-nut drive systems.
2. Determining forces in structural elements.
3. Selection of structural materials.
4. Strength calculations of structural assemblies.
5. Selection of standardised dimensions.
6. Selection of standardised elements, working with standards.
7. Determining the safety margin of the screw-nut system.
8. Analysis of shaped connections.
9. Creating design documentation for the designed device: calculations, assembly drawings, and detailed drawings.

Teaching methods

Lecture: multimedia presentation, discussion of the presented issues.
Exercises: solving sample calculation tasks by the lecturer (presentation and/or board). Methodological commentary. Independent calculations made by students. Discussion and interpretation of the results.
Project: Student's own work (individual and team) in class. Presenting construction progress. Discussion. Project correctness control.

Bibliography

Basic
1. Osiński Z., Podstawy konstrukcji maszyn. PWN Warszawa 2024
2. Praca zbiorowa pod red. E. Mazanka: Przykłady obliczeń z podstaw konstrukcji maszyn, t. 1-2. WNT Warszawa 2008, 2009.
3. Chomczyk W., Podstawy konstrukcji maszyn. Wydawnictwo Naukowe PWN, Warszawa 2017.
4. Juchnikowski W., Żółtowski J.: Podstawy konstrukcji maszyn. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004.
4
5. Korytkowski B.: Podstawy konstrukcji maszyn. Projektowanie I. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2009.
6. Skrzyszowski Z.: Podnośniki i prasy śrubowe. PKM projektowanie. Wyd. Politechniki Krakowskiej. Kraków 2005.
7. Child P.R.C.: Mechanical Design. Theory and Applications. Elsevier 2021.
8. Mott R.: Machine Elements in Mechanical Design. Pearson 2017.
9. Raeymaekers B.: Design of Mechanical Elements. John Wiley and Sons Ltd 2022.
Additional
1. Szopa T.: Podstawy konstrukcji maszyn. Zasady projektowania i obliczeń inżynierskich, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012.
2. Kurmaz L W., Kurmaz O. L.: Projektowanie węzłów i części maszyn. Wyd. Politechniki Świętokrzyskiej. Kielce 2011.
3. Potrykus J.: Poradnik mechanika. Wyd. Rea 2020.
4. Śledziński M.: Kształtowanie cech konstrukcyjnych tłumika drgań ubijaka pneumatycznego. Rozprawa doktorska. Politechnika Poznańska. Poznań 2006.

Breakdown of average student's workload

	Hours	ECTS
Total workload	110	4,00
Classes requiring direct contact with the teacher	65	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00