



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Basics of machine design [S1ETI2>PKM]

### Course

Field of study

Education in Technology and Informatics

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

dr hab. inż. Michał Śledziński

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### Lecturers

### Prerequisites

Basic knowledge in the field of engineering. Engineering graphics - the ability to create sketches and technical drawings in orthogonal projection, executive and assembly drawings of simple machine assemblies. Fundamental knowledge of materials science, as well as technical mechanics and strength of materials - analysis of load conditions, material selection, and elementary strength calculations.

### Course objective

Provide knowledge in the general principles and methodology of machine design. Acquiring skills in designing simple machine components and assemblies, as well as preparing technical documentation. Developing practical application skills based on existing knowledge in areas such as mechanics, material strength, and materials science. Cultivating the ability to independently analyze the technical aspects of the construction, operation, and structural solutions of simple machine components and mechanical devices.

### Course-related learning outcomes

Knowledge:

1. Student has basic knowledge in the general principles of engineering design. 2. Student is familiar with fundamental standards applied in the design of selected mechanical devices. 3. Student

understands the principles of engineering graphics and applies them in design. 4. Student understands the structure and operation of basic assemblies in selected mechanical designs. 5. Student knows the principles of developing technical documentation for the designed structures.

Skills:

1. Student can analyze the load condition of simple machine parts, select permissible stresses, and determine the geometry of components. 2. Student is capable of presenting individual conceptual design solutions within a team, designing connections, bearings, and drive components. 3. Student can effectively apply acquired knowledge, including materials science, technical mechanics, and material strength, in the design process. 4. Student is able to perform design calculations for simple machine elements, select standardized components, create conceptual sketches, and develop technical documentation. 5. Student pursues creative, environmentally friendly, and cost-effective solutions.

Social competences:

1. Student understands the need for continuous learning and expanding competencies. 2. Student can work independently on assigned tasks as well as collaboratively within a team. 3. Student respects the principles of professional ethics.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Examination covering theoretical and practical aspects (computational tasks). Exercises: Quiz on simple computational tasks. Project: Evaluation of an individual project related to the design of a simple mechanical device. Grading principles: Passing based on knowledge of the construction, operation, and calculation of simple machine elements.

Grading scale: below 60% unsatisfactory; 60-67% satisfactory, 68-75% satisfactory plus; 76-83% good; 84- 91% good plus; 92 -100% very good.

### 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, solving sample problems on the board. Exercises: Problem-solving, discussion. Project: Analysis of project components, discussion.

### Bibliography

Basic:

1. Osiński Z.: Podstawy konstrukcji maszyn. PWN Warszawa 2020.
2. Praca zbiorowa pod red. E. Mazanka: Przykłady obliczeń z podstaw konstrukcji maszyn, t. 1-2. WNT Warszawa 2008, 2009.
3. Knosala R., Gwiazda A., Baier A., Gendarz P.: Podstawy Konstrukcji Maszyn: ćwiczenia, WNT, Warszawa 2018.
4. Juchnikowski W., Żółtowski J.: Podstawy konstrukcji maszyn. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004.
5. Korytkowski B.: Podstawy konstrukcji maszyn. Projektowanie I. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2009.

Additional:

1. Szopa T.: Podstawy konstrukcji maszyn. Zasady projektowania i obliczeń inżynierskich, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50