COURSE DESCRIPTION CARD - SYLLABUS

Course name
Engineering design tools [N1ZiIP2>NPI]

Course

Field of study
Management and Production Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
0

Laboratory classes
8

Other
0

Tutorials
0

Projects/seminars
8

Number of credit points

2,00

Coordinators

Lecturers

Prerequisites

Knowledge: the student should have a synthetic knowledge of the various branches of physics necessary for the physical interpretation of technical issues. They should have basic knowledge including types of materials used in engineering, engineering calculations from the areas of technical mechanics and strength of materials and detailed knowledge of engineering graphics. Skills: the student should be able to apply mathematical apparatus to describe and calculate parameters of elements of mechanical structures, assess the selection of properties of a construction material, perform strength analysis of basic parts of machines and devices (beams, shafts, axles), making necessary strength calculations. Social competence: the student should understand the technical and non-technical aspects related to the design of structures and show responsibility for decisions taken.

Course objective

Practical familiarisation of students with the use of current tools in the design process, such as 3D CAD (Computer Aided Design) and CAS (Computer Algebra System) systems for obtaining functional solutions and CAS and FEM software for optimising solutions, as well as the role and application of RP (Rapid Prototyping) techniques during this process.

Course-related learning outcomes

Knowledge:

The student knows the basic techniques for creating parts and assemblies and technical documentation in 3D CAD.
The student knows the range of possibilities and ways of automating the 3D modelling process.
The student knows the purpose and field of application of CAS systems.
The student has knowledge of the functioning and use of FEM in the design process.
The student has knowledge of RP techniques and their use in the design process.

Skills:
The student is able to use the CAS system to determine the structural features of the designed component based on mathematical apparatus.
The student is able to create models of parts and assemblies in 3D CAD, using appropriate techniques and operations that automate the process of their creation, and associate technical documentation.
The student is able to use FEM to optimise designed technical objects.
The student is able to prepare a model for the application of RP techniques.

Social competences:
The student is aware of the role of the individual in the design process. They are able to interact and work in a group and tries to transfer, in an understandable way, their knowledge and skills in order to improve and thus shorten the execution of specific tasks.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratories: knowledge and skills verified through ongoing assessment of completed assignments. A maximum of 100 points can be obtained for an assignment. Threshold 50%.
Design: knowledge and skills verified through ongoing assessment of completed stages of the design task. A maximum of 100 points can be obtained for each stage. Threshold 50%.
Assignment of grades to percentage ranges of results: <90-100> very good; <80-90) good plus; <70-80) good; <60-70) satisfactory plus; <50-60) satisfactory; <0-50) unsatisfactory.

Programme content

Basic issues of the design process. Characteristics and selection of selected types of connections. Determination of design features of selected machine drive components. Characteristics and use of 3D CAD and CAS systems in design. Fundamentals of optimisation using FEM. RP techniques in the design process.

Course topics

Laboratory:
1. Use of CAS systems to determine design features.
2. Use of 3D CAD systems in design.
3. Use and creation of library operations in 3D CAD.
4. Techniques for creating assembly models.
5. Use of CAS in the selection of standardised parts.
6. FEM in structural optimisation and RP methods in design.

Design
1 Preliminary assessment of theoretical geometric features of the designed component using CAS.
2. Determination of actual geometrical features, selection of standardised and catalogue parts using CAS system.
3. Modelling the geometric form of the designed component using library operations.
4. Generation or acquisition of the required standardised and catalogue parts - creation of a 3D model of the assembly.
5. Creation of assembly and assembly drawing.
6. Creating the detailed drawing of the designed component.

Teaching methods

Laboratory: presentation including theoretical background and a practical example of the topic pursued. Laboratory tasks.
Design: presentation including a practical example of the design stage being carried out. Design tasks.

Bibliography

Basic:
1. Białoń T.: Mathcad. Zbiór zadań dla inżynierów, Wydawnictwo Helion 2021
2. Domański J.: SolidWorks 2022 Projektowanie maszyn i konstrukcji, Wydawnictwo Helion 2022
3. Skoć A., Spałek J.: Podstawy konstrukcji maszyn 1, WNT, 2006, 2012
4. Branowski B. (red.), Głowala S, Mostowski R., Pohl P., Sydor M., Torzyński D., Wieloch G., Zabłocki M.: Podstawy konstrukcji napędów maszyn, Wyd. Politechniki Poznańskiej, Poznań 2007

Additional:
1. Decker K-H.: Meschinenelemente Fuktion, Gestaltung und Berechnung, Carl Hanser Verlag, München 2009
2. Wichniarek R., Górski F., Kuczko W.: Szybkie prototypowanie w procesie projektowania, Projektowanie i Konstrukcje Inżynierskie, 6 (81), czerwiec 2014, s. 26-29

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	16	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	34	1,50