# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design oriented on 3D printing

## Course

Field of study
Mechanical Engineering
Area of study (specialization)
-
Level of study
First-cycle studies
Form of study
full-time
Year/Semester
3/6
Profile of study
general academic
Course offered in
English
Requirements
elective

## Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

## Number of credit points

3

## Lecturers

Responsible for the course/lecturer:
dr inż. Robert Roszak

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tel. 61-6652167

Faculty of Mechanical Engineering

Piotrowo 3 st, 60-965 Poznań

Responsible for the course/lecturer:
second person allowed

## Prerequisites

KNOWLEDGE: the student has basic general knowledge about the construction of the surrounding world and the laws that govern it

SKILLS: the student is able to integrate the obtained information, interpret it, draw conclusions, formulate and justify opinions

SOCIAL COMPETENCES: the student is aware of the importance of additive manufacturing techniques

## Course objective

Construction and modeling in CAx systems. Preparation of models for additive manufacturing techniques. 3D printing methods. Materials and applications of printing techniques in engineering design. Characteristics of printed materials. Computer simulation of construction using printed materials.

## Course-related learning outcomes

### Knowledge

Has an ordered, theoretically founded knowledge of the strength of materials in the field of: methods of determining external and internal forces and moments, basic tests to determine the mechanical properties of materials, including printed materials, determining stresses and displacements.

Has a basic knowledge of information technology and computer science in the field of the basics of computer hardware and software in the processes of processing, transmitting, presenting and securing information. He has knowledge of computer-aided engineering systems in mechanics, mechanical engineering and technology, in particular CAx engineering computer systems in product design and improvement and in preparing the product for production. Can design elements of machine parts using additive manufacturing techniques (3D modeling, finite element method, 3D printing).

### Skills

Can obtain information from literature, databases and other properly selected sources (also in English or another foreign language recognized as the language of international communication) in the field of mechanics and machine construction as well as other engineering and technical issues consistent with the field of study; is able to integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions.

Can develop documentation for the implementation of an engineering task in the field of mechanics and machine construction (construction, technology, organization) and prepare a text containing an overview of the results of this task.

Can select printed engineering materials for applications in mechanics and machine construction.

Can select and use AM manufacturing technologies in order to shape the form, structure and properties of products, design technological processes along with the selection of devices for printing with incremental methods.

Social competences

Is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made.

Able to interact and work in a group, assuming different roles in it.

Can properly define priorities for the implementation of a task set by himself or others.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

For discussion, ongoing preparation and activity in class. Written credit. Compulsory implementation of projects related to 3D printing. Final credit of laboratory classes.

## Programme content

Introduction to design principles using SolidWorks, NX systems. Preparation of gemetric models for FDM, FFF, SLA, LOM printing techniques. Manufacture of models with the methods of sintering metal powder (SLM). Optimization of printing processes to improve the quality and durability of manufactured components. The role of 3D techniques in the preparation of the product concept. Properties, testing and simulation of elements manufactured by incremental techniques.

## Teaching methods

1. Lecture with multimedia presentation

2. Laboratory - laboratory exercises in the field of 3D printing with FDM, SLA, FDM-metal methods

## Bibliography

Basic

1. McConnell Steve, Szybkie projektowanie. Zapanuj nad chaosem zadań i presją czasu, Helion 2017

2. Oczoś K.E.: Kształtowanie materiałów skoncentrowanymi strumieniami energii, Wyd. Pol. Rzeszowskiej, Rzeszów 1988.

3. Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000.

4. Olszewski H, LABORATORIUM SZYBKIEGO PROTOTYPOWANIA : Inżynieria odwrotna. Elbląg 2012

Additional

1. Kamrani K., Abouel E., Rapid Prototyping, Springer 2006.

2. Leong K., Lim Ch. Rapid Prototyping: Principles and Applications (3rd Edition), 2010.

3. D. Schob, I. Sagradov, R. Roszak, H. Sparr, R. Franke, M. Ziegenhorn et al., Experimental determination and numerical simulation of material and damage behaviour of 3D printed polyamide 12 under dynamic loading, submitted Engineering Fracture Mechanics 2019 (2019).

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 75 | 3,0 |
| Classes requiring direct contact with the teacher | 40 | 1,5 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 35 | 1,5 |

[1] delete or add other activities as appropriate