COURSE DESCRIPTION CARD - SYLLABUS

Course name

Augmented Reality in Mechanical Engineering

Course

Field of study

Mechanical Engineering

Year/Semester

2/1

Area of study (specialization)

Mechanical Engineering

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Faculty of Mechanical Engineering

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Responsible for the course/lecturer:

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Faculty of Mechanical Engineering

Prerequisites

Knowledge in scope of information technologies, computer graphics and engineering drawing, CAD systems. Knows basics of product lifecycle, understands notion of design and prototyping, can plan manufacturing processes.

Skills in development of solid 3D model of an object and an assembly in a CAD 3D system. Skills in planning a manufacturing and assembly process.

Social competences: student is open to implementation of modern computer technologies in science and technology. Can self-develop new skills and knowledge. Can cooperate in a project team.

Course objective

Gaining knowledge about hardware and software used in interactive Augmented Reality (AR) and Mixed Reality (MR) applications in mechanical engineering. Getting familiarized with rules of using AR systems in aiding design, manufacturing and operation processes. Gaining skills of designing simple industrial AR application.

Course-related learning outcomes

Knowledge

1. Student defines, distinguishes and classifies concepts of Augmented and Mixed Reality.

2. Student describes methods of geometrical modelling, transformation and object visualization for presentation in AR systems.

3. Student has knowledge about AR systems: projection and interaction, as well as available software classes for AR application creation.

4. Student indicates possibilities and examples of application of AR and MR systems in product lifecycle for design, manufacturing and operation of machines.

Skills

1. Student can develop 3D and 2D data for interactive AR applications.

2. Student can design a simple interactive AR application used in mechanical engineering.

3. Student can plan a process aided with AR/MR.

4. Student can analyze economical aspects of AR solutions in mechanical engineering.

Social competences

1. Student is aware of consequences of use of computer systems in public life.

2. Student is open to application of AR and MR technology in engineering activities.

3. Student can work in a project team using AR systems for processes.

4. Student can appropriately present advantages and disadvantages of AR use in mechanical engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Partial marks:

a) lectures:

- on the basis of answers to questions regarding material from previous lectures,

b) laboratories:

- on the basis of evaluation of current advancement in realization of given tasks,

Summary mark:

a) lectures:

- evaluation of knowledge by written final test with open and closed questions, the test is passed when a student obtains 51% or more score, test results are discussed. The test is performed at the end of the semester.

b) laboratories:

- evaluation of reports of realization of laboratory exercises or realization of own project of AR application in mechanical engineering

Programme content

Lectures:

1. Virtual technologies: Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) and their place in the concept of a smart factory - Industry 4.0.

2. AR and MR systems for industry - hardware and software

3. Methodology of aiding processes of design, manufacturing and operation of machines using AR and MR

4. Examples of industrial applications in scope of AR and MR in design, production and operation of machines

Laboratory:

1. Basics of virtual environment programming in building interactive XR applications in mechanical engineering (2-3 classes)

2. Build, operation and programming of modern AR/MR hardware: 4 workplaces with various AR/MR equipment; student rotation in 3-4 person groups, building and testing applications in virtual environment.

Teaching methods

- informative lecture

- multimedia presentation

- case study

- laboratory method

Bibliography

Basic

1. S. Aukstakalnis, Practical Augmented Reality, Addison-Wesley Professional, 2016

2. B. Arnaldi, P. Guitton, G. Moreau,Virtual Reality and Augmented Reality: Myths and Realities, Wiley, 2018

Additional

F. Górski, Metodyka budowy otwartych systemów rzeczywistości wirtualnej: zastosowanie w inżynierii mechanicznej, Wyd. Politechniki Poznańskiej, 2019

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	35	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	15	0,5

[1] delete or add other activities as appropriate