COURSE DESCRIPTION CARD - SYLLABUS

Course name
Virtual design in biomedical engineering [S2IBio1>WPwIB]

Course

Field of study
Biomedical Engineering

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

prof. dr hab. inż. Filip Górski
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Lecturers

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. Skills in development of solid 3D model of an object and an assembly in a CAD 3D system. Social competences: student is open to implementation of modern computer technologies in science and technology. Can self-develop new skills and knowledge. Can work in a project team.

Course objective

Gaining knowledge about hardware and software used in interactive Virtual Reality (VR) applications, created for medicine and biomedical engineering. Gaining skills in use of Virtual Reality systems in design for biomedical engineering. Gaining skills of designing a simple VR application.

Course-related learning outcomes

Knowledge:
1. Student defines, distinguishes and classifies concepts of Virtual Reality, Augmented and Mixed Reality.
2. Student describes methods of geometrical modelling, transformation and object visualization for

presentation in VR systems.
3. Student has knowledge about Virtual Reality systems: projection, tracking, gesture recognition and haptics, as well as available software classes for VR application creation.
4. Student indicates possibilities and examples of application of Virtual Reality systems in product lifecycle for medicine and biomedical engineering.

Skills:
1. Student can develop 3D and 2D data for interactive VR applications.
2. Student can design an interactive VR application for presentation of properties of a specific product, activity or workplace.
3. Student can program interaction with objects in a VR system.
4. Student can analyze economical aspects of VR solutions in a specific application.

Social competences:
1. Student is aware of consequences of use of computer systems in public life.
2. Student is open to application of virtual design technology in engineering activities.
3. Student can work in a project team using VR systems for product development.
4. Student can appropriately present advantages and disadvantages of VR use in biomedical engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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 preparation of student for individual laboratory classes and evaluation of skills presented in particular exercises
- practical skill evaluation by tasks performed using a computer

Programme content

Lectures:
1. Basic concepts of Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). Types of interactive VR applications, VR applications in medicine and biomedical engineering.
2. Use of VR for design and prototyping of new products. Virtual prototypes, their types and methods of building. Application of virtual prototypes on different stages of product development.
3. VR systems – classes of hardware and software
4. Projection devices – passive and active stereoscopy devices, personal devices (goggles, helmets)
5. Interaction devices – tracking and gesture recognition systems, haptic devices with force feedback, application in design for biomedical engineering
6. Design and building VR applications. Preparation of data for virtual prototype creation.
Laboratory:
1. Methods of 3D data preparation for import into VR environment. Import and adjustment of visual model features, displayed in VR application (materials, textures, lighting). Methods of navigation in VR environment.
2. Programming of interaction between objects: translation, rotation, dynamic shape change and visual feature change.
3. Creation of user interface: elements of graphical user interface, communication using pointing devices.
4. Application of VR equipment: preparation of applications for large screen stereoscopic projection

and head-mounted device projection, use of motion tracking controllers and other VR devices.

Course topics

none

Teaching methods

- informative lecture
- multimedia presentation
- case study
- laboratory method

Bibliography

Basic
1. F. Górski, Metodyka budowy otwartych systemów rzeczywistości wirtualnej: zastosowanie w inżynierii mechanicznej, Wyd. Politechniki Poznańskiej, 2019
2. B. Arnaldi, P. Guitton, G. Moreau,Virtual Reality and Augmented Reality: Myths and Realities, Wiley, 2018
Additional
1. R. Riener, M. Harders, Virtual Reality in Medicine, Springer, 2012

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00