COURSE DESCRIPTION CARD - SYLLABUS

Course name

Grafika komputerowa - Computer Graphics

Course

Field of study
Teleinformatics

Year/Semester
3/6

Area of study (specialization)

Profile of study
general academic

Level of study
first-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)

Tutorials
0

Projects/seminars
0/0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Olgierd Stankiewicz, ITM, 61 665 3840
olgierd.stankiewicz@put.poznan.pl

Responsible for the course/lecturer:

mgr. Hubert Żabiński, ITM, 61 665 3846
hubert.m.zabinski@doctorate.put.poznan.pl
dr Adrian Dziembowski, ITM, 61 665 3896
adrian.dziembowski@put.poznan.pl
dr Sławomir Maćkowiak, ITM, 61 665 3890
slawomir.mackowiak@put.poznan.pl

Prerequisites

A student starting this course should have basic knowledge of computer science, object-oriented programming and multimedia. Should have the ability to perform calculations using mathematical apparatus from the scope of algebra and obtain information from indicated sources. Should also understand the need to broaden their competences.
In addition, in terms of social competence the student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1 To provide students with basic knowledge of: computer graphics including three-dimensional graphics.
2 To develop students' ability to solve basic computer graphics problems.
3. Shaping students' skills of acquiring knowledge about currently implemented solutions in computer graphics.

Course-related learning outcomes

Knowledge

1. Has basic knowledge of issues related to geometric transformations in three-dimensional space used in computer graphics programming
2. Knows the basics of GPU (graphics processing unit) programming.
3. Knows principles of operation and construction of modern graphic systems. Knows construction and operation of data communications systems used to provide multimedia services, including processing, compression and transmission of images.

Skills

1. Is able to use basic computational algorithms, data structures and high-level programming languages to solve technical problems related to computer graphics.
2. Is able to use programming mechanisms and programming environments of object-oriented languages and available library software to program graphics processors.
3. Is able to determine the basic requirements for ICT systems that provide multimedia services, implement the most commonly used three-dimensional graphics effects in multimedia systems and design image transmission systems

Social competences

1. The student knows the limits of his knowledge and understands the necessity of its updating. Is open to possibilities of continuous education and improvement of professional, personal and social competences.
2. Understands the influence of own work on the team's results and the necessity of obeying rules of teamwork and taking responsibility for tasks performed together.
3. Understands the importance of the formation of an information society for national development.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative Assessment:
(a) For laboratory exercises:
• Based on evaluation of current progress on assignments and exercises.

Summative Assessment:
a) in the scope of lectures verification of the assumed educational results is realized by:
• An evaluation of the knowledge demonstrated on the exam.
b) in the field of laboratory, verification of the assumed educational results is realized by:
• Substantive evaluation of the performance of individual problems to be solved.
• Continuous evaluation, every class (verbal answers).
• The grade for the final project.
• Obtaining additional points for activity during laboratory classes.

Programme content

Lectures:
1. Basic mathematical operations in three-dimensional graphics.
Geometric transformation in 2- and 3-dimensional space. Mathematical description of 3D models. Matrix description of geometric transformations (translation, scaling, rotation, projection). Different projection techniques.
2. Basic concepts and techniques in three-dimensional graphics.
Light models, directional light, diffuse light. Rendering color models, texturing models. Texture filtering. Texture compression, anti-aliasing. Z-Buffer, Stencil buffer.
3. Classical fixed processing pipeline in computer graphics.
Processing of vertices and primitives. Rasterization process. Interpolation of attributes.
4. Programmable processing pipeline in computer graphics - a high-level shader language.
Programs and attributes in OpenGL HLSL.
5. Shading and special effects rendering algorithms.
Shadow volume and shadow-maps techniques. Rendering mirror portals. Bump-mapping.
6. Advanced animation techniques.
Skeletal animations. Particle systems.
7. Applications of computer graphics to mobile devices and the internet
OpenGL ES, WebGL.

Laboratory Exercises:
1. The first program to use the OpenGL/WebGL library. Rendering of simple geometric figures.
2. Efficient navigation in three-dimensional space.
3. Interaction with three-dimensional space.
Working with 3D models, loading and displaying 3D models. Getting familiar with Blender program.
5. Model texturing.
6. Shadows in a three-dimensional scene. Designing a program to cast shadows on three-dimensional objects.
7. Software for graphical effects using the shader language.
8. Character animations in MD5 format.

Teaching methods

Lecture: multimedia presentation, supplemented with current examples and additional explanations on the blackboard.
Laboratory exercises: solving tasks, programming.

Bibliography

Basic

1. S. Wright, B Lipchak: OpenGL ksiega eksperga, Helion, 2011.
2. Introduction to Computer Graphics, WNT, Warsaw 1995.

Additional

1 Angel E., Interactive Computer Graphics: A top-down approach using OpenGL. Addison-Wesley. 2011.
2. Foley et al, Introduction to Computer Graphics. Addison-Wesley, 1994.
3. Angel E., OpenGL Primer. Addison-Wesley, 2007.
4 Woo et al, OpenGL Programming Guide (Fourth Edition). Addison-Wesley, 2013.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3.0
Classes requiring direct contact with the teacher	49	2.0
Student's own work (preparation for tests, preparation for laboratory classes, preparation for exam, literature studies)	41	1.0