RTU Course "Computer Graphics and Computational Geometry Methods"

33000 Faculty of Computer Science, Information Technology and Energy

General data

Code	DAA444
Course title	Computer Graphics and Computational Geometry Methods
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Aleksandrs Sisojevs
Volume of the course: parts and credits points	1 part, 4.5 credits
Language of instruction	LV
Annotation	The area of computational geometry deals with the study of algorithms for problems concerning geometric objects like e.g. lines, polygons, circles, etc. in the plane and in higher-dimensional space. During the course, students are introduced to some of the techniques and data structures developed in computational geometry with emphasis on their use in computer graphics applications. During the course, students practically implement methods for creating and processing graphical objects, as well as methods of analysis of graphical objects and methods of geometric transformation.
Goals and objectives of the course in terms of competences and skills	The course aims to teach the theoretical bases of computer graphics and computing geometry, as well as the principles of creating and transforming graphical objects. Students are able to use theoretical knowledge to formulate and address specific tasks.
Structure and tasks of independent studies	Assignments are integrated with the acquisition of theoretical material and practical works. Students independently create graphic objects in the 2D and 3D spaces, as well as an analysis of geometrical objects in a 2D plane.
Recommended literature	Sumanta Guha. Computer Graphics Through OpenGL®: From Theory to Experiments Chapman and Hall/CRC (2019) Zhigang Xiang. Computer Graphics: Theory and Practice with OpenGL CreateSpace Independent Publishing Platform (March 17, 2018) Steve Marschner, Peter Shirley. Fundamentals of Computer Graphics A K Peters/CRC Press (2015) Mark de Berg, Otfried Cheong. Computational Geometry: Algorithms and Applications (3rd Edition) Springer; 3rd edition (April 16, 2008)
Course prerequisites	Understanding of computer graphics techniques.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction to computer graphics. Classification of computer graphics. Basic computer graphics tasks.	2	3	0	0
Mathematical spaces and coordinate systems.	2	3	0	0
The tasks of curve approximation and their implementation in computer graphics.	6	9	0	0
The tasks of curve interpolation and their implementation in computer graphics.	6	9	0	0
The concept of spline functions. Spline curves and their application in computer graphics.	4	6	0	0
The concept of rational spline functions. Rational spline curves and their application in computer graphics.	4	6	0	0
Introduction to 3D graphics. Projection tasks. Projection transformations.	4	6	0	0
Geometrical transformations in 2D plane and 3D space.	2	3	0	0
Introduction to computing geometry. Basic tasks of computing geometry.	2	3	0	0
The concept of a vector multiplication in computing geometry.	4	6	0	0
The purpose of determining the crossing of two lines.	4	6	0	0
Minimum curved shell.	4	6	0	0
Geometric triangulation.	4	6	0	0
Total:	48	72	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students are able to discuss the principles, benefits and limitations of computer graphics and image processing, manage different screening graphics algorithms.	Written exams that include both theoretical questions and practical tasks.
Students are capable of independently creating a computer program that implements the formation of 2D and 3D objects.	Independently performed laboratory works.
Students are capable of independently creating a computer program that implements the transformation of 2D and 3D objects.	Independently performed laboratory works.

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	4.5	1.0	0.0	2.0		*	