1.	**Field of study**	**Computer Science**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2020/2021 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Real-time graphics

Module code: W4-INA-S2-20-F-GCR

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
M_001	The student knows and understands the principles of real-time graphics, in particular: programmable graphics pipeline, transform feedback transformation, computational shaders.	K_W02 K_W04	1 1
M_002	The student knows and understands mathematical notions used in real-time graphics, in particular: cross product, dot product, normal vector, partial derivative, linear interpolation, matrix computations.	K_W01	1
M_003	The student knows and understands the physical notions used in real-time graphics, in particular: Snell's law, the law of reflection, the fundamental equations of kinematics.	K_W01	1
M_004	The student can use tools that support shaders' writing process and tools for profiling graphical applications.	K_U09	1
M_005	The student can get information about real-time graphics from literature, databases and other sources.	K_U01 K_U07	1 1
M_006	The student can work individually and in a team.	K_U02	1
M_007	The student can prepare and present a presentation on the completion of the project's task.	K_U03 K_U04	1 1
M_008	The student can think and act creatively.	K_K01 K_K03	1 1

3. Module description

Description	The classes aim to introduce the graphics generated in real-time to the students using GPU (Graphics Processing Unit). For this aim, the students will use libraries such as OpenGL and Vulkan, and the GLSL programming language. They will also become acquainted with the basic mathematical and

	physical notions and algorithms that generate various effects, e.g., realistic lighting, environment mapping, bump mapping. During the course, the students will prepare projects in teams of maximum two and present their work results in front of the group.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
W_001	Project	The students prepare the project and present the chosen topic connected with real-time graphics.	M_001, M_002, M_003, M_004, M_005, M_006, M_007, M_008
W_002	Reports	The students solve sets of tasks.	M_001, M_002, M_003, M_004, M_006

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
Z_001	lecture	The lectures have a form of presentation with the use of audiovisual methods.	15	The students self-study the lecture topics and recommended literature.	15	W_001
Z_002	laboratory classes	The classes thoroughly prepare the students to (1) creating applications displaying complex computer graphics in real-time, (2) development of suitable algorithms. The students solve programming tasks.	30	The students get acquainted with the subject of the laboratory classes and the chosen project, prepare it in a team and present it in front of the group.	60	W_001, W_002