1.	Course Title	Virtual reality
2.	Code	F18L3S083
3.	Study program	Software engineering and information systems
4.	Study Program Organizer	Faculty of Computer Science and Engineering
5.	Degree (first, second, third cycle)	first cycle
6.	Academic year / semester 4 / summer / optional	7. ECTS credits 6
8.	Teacher	full professor Suzana Loshkovska
9.	Course enrollment prerequisites	Дизајн на интеракцијата човек-компјутер
10.	Course program goals (competencies): The course should introduce students with the concept of virtual reality, the different types of virtual environments, input-output devices, as well as basic programming techniques for designing and development of virtual environments. Upon completion of the course, the student is expected to understand the concept of virtual reality, to be able to describe the characteristics of different types of virtual environments and have basic knowledge about designing and developing virtual worlds.	
11.	Course program content: Introduction. Terminology. Examples. Input devices, types of input devices (head tracking devices, hand tracking devices, platforms, world tracking devices). Evaluation criteria for tracking devices. Output devices and types. Video output devices, spatial viewing, techniques for producing 3D view and types of devices. Audio devices and spatial sound, stationary and non-stationary audio devices. Input-output devices, haptic devices, forms of tactile perception, tactile devices. Output devices for other senses (scent, taste). Representation of the virtual world, types of representation, using symbols, realism and degrees of realism. Techniques for representation of video, audio and tactile signals. Rendering of virtual worlds, surface and volume rendering , rendering complex scenes and optimizing resources, scene graph, rendering audio and tactile signals. Interaction with the user. Manipulating objects in the virtual world. Techniques for selecting objects. Commands in the virtual worlds. Navigation in a virtual world. Path finding and assistance in path finding. Traveling in the virtual world. Achieving a sense of presence.	
12.	Learning methods: Lectures using presentations, interactive lectures, exercises (using equipment and software packages), teamwork, case studies, invited guest lecturers, independent preparation and defense of a project assignment and seminar work.	
13.	Total available time	6 ECTS x 30 hours = 180 hours

14.	Distribution of the available time		30 + 45 + 15 + 15 + 75 = 180 hours	
15.	Teaching activity forms	15.1.	Lectures – theoretical teaching	30 hours
		15.2.	Exercises (laboratory, auditory), seminar papers, teamwork	45 hours
16.	Other activity forms	16.1.	Project Tasks	15 hours
		16.2.	Independent Learning Tasks	15 hours
		16.3.	Home learning	75 hours

17.	Assessment methodology		
	17.1.	Tests	0 points
	17.2.	Seminar paper/project (presentation: written and oral)	40 points
	17.3.	Activity and learning	10 points
	17.4.	Final exam	50 points

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		51 to 60 points	6 (six) (E)
		61 to 70 points	7 (seven) (D)
		71 to 80 points	8 (eight) (C)
		81 to 90 points	9 (nine) (B)
		91 to 100 points	10 (ten) (A)
19.	Course completion and final exam requirements	Realized activities 15.1 and 15.2	
20.	Teaching Language	Macedonian and English	
21.	Teaching quality evaluation method	Internal evaluation mechanisms and questionnaires	
22.	Course Material		
	22.1.	Mandatory course material	

	No.	Author	Title	Publisher	Year
	1	William R. Sherman & Alan B. Craig	Understanding Virtual Reality: Interface, Application, and Design	Morgan Kaufmann	2003
	2	Jason Jerald	The VR Book: Human-Centered Design for Virtual Reality	Association for Computing Machinery and Morgan & Claypool Publishers	2016
	3	Steve Aukstakalnis	Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)	Addison-Wesley Professional	2016

22.2. Additional course material

No.	Author	Title	Publisher	Year