Course title	Code	semester	T+U	credit	ECTS
Virtual Reality		7	3+0	3	4

Prerequisite Courses	None
Language of the Course	English
Course Level	Undergraduate
Type of Course	Optional
Course Coordinator	
Instructors	
Course Assistants	
The aim of lesson	Within the scope of this course, different topics related to virtual reality are discussed, with an emphasis on haptic systems. The course aims to develop tactile-assisted virtual reality simulations and applications for students. Theoretical topics covered will include 3D virtual environments, haptic and visual rendering, haptic interfaces, tactile interaction with bendable and rigid bodies, and the psychophysics of touch. During the course, students will have the opportunity to practice with different graphic and tactile interaction libraries, as well as gaining basic information about virtual reality applications.
Course Content	Fundamentals of virtual reality systems, geometric modeling, transformations, graphic and haptic rendering, spatial representations and transformations, evaluation of virtual reality systems.
Course Learning Outcomes	Students who successfully complete this course; 1. Knowledge of basic virtual reality concepts. 2. Application development in 3D virtual world with Unity3D 3. Experience in developing a virtual reality application with Google Cardboard, haptic devices or depth sensors 4. Ability to evaluate the system developed with user studies 5. Informing through discussion about the latest technologies and the ethical and social impacts of virtual reality 6. group work skills

Weeks	Topics
one	Introduction: Course requirements and topics. Definition and history of virtual reality
2	Virtual reality technologies: Sensors, display devices, alternative-world generator, human senses, perception, virtual reality applications
3	3D concept
4	Spatial definitions and transformations: Angle-axis representation; quaternions; 3D transformations
5	Homogeneous transformations; screen conversions
6	Perspective transformations; gaze coordinate transformations
7	Graphic rendering; ray tracing; shading;
8	Directional reflection distribution functions (BRDF); scanning; baricentric coordinates
9	tactile rendering
10	Interaction with rigid body dynamics, collisions and haptic systems
11th	3D user interfaces
12	Evaluation of virtual reality systems
13	Project presentations
14	Project presentations

General Competencies

It enables them to grasp and experience the virtual reality world.

resources

LaValle, Steven M. Virtual Reality. To be published by Cambridge University Press. [http://vr.cs.uiuc.edu/vrbookbig.pdf]
Hearn, Donald, M. Pauline Baker, and Bjarne Stroustrup. Computer Graphics with OpenGL, 3/E. Prentice-Hall, 2003.
APA

Evaluation System
The dates, days and hours of the Midterm Exam, Quiz, Final Exam and Evaluations will be announced later, according to the decision of the Faculty Administrative Board.

	WITH PROGRAM LEARNING OUTCOMES COURSE LEARNING OUTCOMES RELATIONSHIP TABLE										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
LO1	3	3	3	3	3	3	3	3	5	3	4
INCREASE 2	3	3	3	3	3	3	3	3	5	3	4
INCREASE 3	3	3	3	3	3	3	3	3	5	3	4
INCREASE 4	3	3	3	3	3	3	3	3	5	3	4
LO 5	3	3	3	3	3	3	3	3	5	3	4
LO 6	3	3	3	3	3	3	3	3	5	3	4
LO: Learning Outcomes OP: Program Outcomes											
Contribution Level	**1 Very Low**		**2 Low**		**3 Medium**		**4 High**		**5 Very High**		

Relation of Program Outcomes and Related Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
Virtual Reality	3	3	3	3	3	3	3	3	5	3	4