

## Course

# VER - Virtual and Augmented Reality

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### ^ General information

<b>Long name</b>	Virtual and Augmented Reality
<b>Approving CModule</b>	<a href="#">VER MaMT</a> , <a href="#">VER MaTIN</a>
<b>Responsible</b>	Prof. Dr.-Ing. Arnulph Fuhrmann Professor Fakultät: IME
<b>Level</b>	Master
<b>Semester in the year</b>	winter semester
<b>Duration</b>	Semester
<b>Hours in self-study</b>	60
<b>ECTS</b>	5
<b>Professors</b>	Prof. Dr.-Ing. Arnulph Fuhrmann Professor Fakultät: IME  Prof. Dr. Stefan Grünvogel Professor Fakultät: IME
<b>Requirements</b>	Computer Graphics Computer Animation
<b>Language</b>	German, English if necessary
<b>Separate final exam</b>	Yes

## Final exam

### Details

In an oral examination, students demonstrate the following competences:

- mastering the concepts of VR/AR (proven by answering questions on these concepts)
- Applying the mathematical basis of VR/AR (proven by computational tasks)
- Evaluation of VR/AR solutions (proven by answering questions on current solutions)

## Minimum standard

At least 50% of the questions are answered correctly.

## Exam Type

In an oral examination, students demonstrate the following competences:

- mastering the concepts of VR/AR (proven by answering questions on these concepts)
- Applying the mathematical basis of VR/AR (proven by computational tasks)
- Evaluation of VR/AR solutions (proven by answering questions on current solutions)

## ^ Lecture

## Learning goals

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### Knowledge

Explain terms from the field of virtual and augmented reality

Explain and compare data structures and algorithms for VR/AR applications

3D data formats

Spatial data structures

Describing Multimodal User Interfaces

Selection of 3D objects

Manipulation of 3D objects

Navigation in virtual scenes

system control

Describe input and output devices and specific virtual and augmented reality hardware

display technologies

Stereo Displays

Autostereoscopic Displays

projection solutions

Wearable Displays

Head Mounted Displays

Handheld Displays

See-through Displays

Workbench

Cave

Tiled Displays

3D-Audio

Force Feedback Devices

Haptic feedback

input devices

controller

data gloves

locomotion devices

Explain algorithmic and mathematical basics

stereoscopy

tracking

capture of position and orientation: Degrees of freedom

tracking technologies

Mechanical

Optical

Electromagnetic  
ultrasound  
inertial  
eye tracking  
head tracking  
object tracking  
Markerless Tracking  
Marker-Based Tracking  
rendering  
management of large 3D scenes  
haptic rendering  
stereo rendering  
real-time rendering  
collision detection  
intersections between primitives  
Discrete and continuous collision detection  
acceleration data structures  
collision response

## Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Tutorial (voluntary)	0

## Separate exam

none

## ^ Practical training

### Learning goals

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#### Skills

- Design, build and evaluate virtual environments and augmented reality applications
- Creating Interaction and Navigation Procedures
- Further develop fundamental technologies of virtual and augmented reality
- Use tools and methods to implement VR/AR applications
- Apply algorithmic and mathematical principles of VR/AR
- understand and grasp textual tasks
- Testing and debugging your own application

## Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	2
Tutorial (voluntary)	0

## Separate exam

### Exam Type

working on practical scenarion (e.g. in a lab)

### Details

Development of different VR/AR applications with tasks to the topics of the lecture. During the laboratory the students work on the tasks with the help of the lecturer. Afterwards the independent completion takes place in self-study.

### Minimum standard

More than 80% of all exercises submitted. A task is deemed to have been completed if it has been solved predominantly and independently.

## ^ Seminar

## Learning goals

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### Skills

- Apply Algorithmic and Mathematical fundamentals
- Check interaction and navigation procedures
- Independently obtaining and summarizing scientific literature
- Present and discuss new concepts of virtual and augmented reality

## Expenditure classroom teaching

Type	Attendance (h/Wk.)
Seminar	1
Tutorial (voluntary)	0

## Separate exam

