GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2026-2027

Advanced Media Systems (E016210)

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0 **Study time 90 h**

Course offerings in academic year 2026-2027

A (semester 2)	Dutch, English	Gent

Lecturers in academic year 2026-2027

Van Wallendael, Glenn	TW06	lecturer-in-charge
Lambert, Peter	TW06	co-lecturer

Offered in the following programmes in 2026-2027	**crdts**	**offering**
Master of Science in Computer Science	3	A
Master of Science in Computer Science Engineering	3	A

Teaching languages

English, Dutch

Keywords

Computational imaging, generative visual AI, 3D & volumetric media representation, compression and streaming technologies, immersive display systems

Position of the course

The main goal of this course is to familiarize students with the key concepts in the advanced multimedia systems. Additionally, students are expected to gain practical experience of working with and creating advanced multimedia systems.

Contents

Video and Image Capture:
- Camera Calibration: Intrinsics, extrinsics, distortion models
- Stereo 360° Video: projections, stitching
- Light Field Cameras: Plenoptic function
- Holographic Capture: Interference pattern acquisition

Generative AI
- Visual Content Synthesis: diffusion and denoising process
- 3D-Aware Generative Models
- Detection: deepfake detection and provenance verification

Data Representation:
- Video: GOP structures
- Light Fields: LF parameterizations (2D-4D), refocusing
- Volumetric Video: implicit neural representations (e.g., NeRFs), sparse kernel-based representations (Gaussian Splatting)
- Audio: spatial/ambisonic audio (1st–8th order)

Compression Techniques:
- Image/Video Compression: H.265/HEVC, H.266/VVC
- AI Image/Video Compression: JPEG AI
- Audio Compression: spatial codecs (Higher Order Ambisonics (HOA), Dolby-Atmos)
- Rate-Distortion Theory & Metrics: PSNR, SSIM, MS-SSIM, VMAF

Media Storage and Streaming
- Container Formats: MP4, Matroska (mkv)
- Adaptive Streaming: DASH, MPEG OMAF (360/VR)

Display and Interaction Systems

- Standard Displays: HDR
- VR/AR Displays: HMDs (e.g., VR headsets), latency, tracking systems
- Light Field Displays: Integral imaging, multi-plane
- Holographic Displays: SLM-based systems, synthetic aperture, true 3D light wave reconstruction

Initial competences

- Programming in a high-level language
- Basic knowledge of communication networks
- Basic knowledge of multimedia coding (DCT and Fourier transform, quantization, entropy coding, JPEG compression, video compression)

Final competences

1 Gain in-depth understanding of the physical and computational principles behind multimodal data acquisition.
2 Formulate and analyze representation models for audiovisual data.
3 Understand and apply advanced compression theory to multimodal data.
4 Design and model efficient systems for media transmission and visualization.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, Practical, Independent work

Extra information on the teaching methods

Students are strongly encouraged to use their own laptops during lab sessions.

Study material

Type: Slides

Name: Slides of lectures
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No

References

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment

Examination methods in case of periodic assessment during the second examination period

Written assessment

Examination methods in case of permanent assessment

Skills test, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

- Periodic assessment: closed-book written exam
- Non-periodic assessment: evaluation of lab work and project reports; second exam chance: possible in modified form

Calculation of the examination mark

General rule: if the student does not participate in the evaluation of one or more components, they cannot pass the course. The final score will be reduced to the

highest non-deliberable score (7/20) if it would otherwise be higher.
First exam period: Final score = 40% non-periodic assessment + 60% periodic exam. A minimum of 9/20 must be obtained on both components. If not met, and the final score would otherwise be 10 or higher, it is reduced to 9/20.
Second exam period: Final score = 40% score from the non-periodic evaluation obtained in the first exam period + 60% exam. If the non-periodic score in the first exam period is less than 9/20, an additional (individual) assignment is required. In that case: final score = 40% additional assignment + 60% exam. A minimum of 9/20 must be obtained on both components. If not, the score is reduced to 9/20 even if it would otherwise be passing.