UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
META-514	Extended Reality	10
Prerequisites	**Department**	**Semester**
None	Digital Innovation	Fall/Spring
Type of Course	**Field**	**Language of Instruction**
Required	Metaverse	English
Level of Course	**Lecturer**	**Year of Study**
2nd Cycle	Dr. Chris Christou	1st
Mode of Delivery	**Work Placement**	**Corequisites**
Face to face	N/A	N/A

Course Objectives:

The main objectives of the course are to:

1. Explain and analyse Virtual Reality and Augmented Reality.
2. Discuss the historical foundations of AR and VR.
3. Explore at a principal level how the XR technologies work.

Learning Outcomes:

After completion of the course students are expected to be able to:

1. Identify the technologies which contribute to XR.
2. Appreciate the XR application development process.
3. Identify the application areas of AR and VR
4. Discuss the future trends of XR

Course Content:

Session 1: Introduction to Extended Reality (XR)

- Defining Augmented Reality (AR) and Virtual Reality (VR)
- Defining XR
- A look at other types of XR with examples
  - Mixed Reality
  - Augmented Virtuality

- Extended Reality and the Metaverse
  - Independent Worlds
  - Layered Worlds
  - Spatial computing

Session 2: Fooling the senses

- Visual perception
  - The eye
  - The brain
- Auditory perception
- Touch perception
- Computer Graphics
- Realism and Virtual Reality
- Presence and Immersion
- Spatial Audio
- Haptic devices – The Phantom Haptic Interface

Session 3: XR evolution

- Trompe-L'œil
- Robert Mitchell's Panorama
- Stereographs and Stereoscopes
- Analogue Simulators
- Sensorama
- Sword of Damocles
- Tom Caudell - AR
- CAVE
- Google Glass
- Oculus Rift

Session 4: Current state of VR

- Form Factor Convergence
- A generic HMD
- Desktop and Standalone
- Google Cardboard
- Meta Quest and HTC Vive
- Roomscale v Stationary VR experience
- Inside-Out tracking
- Haptic feedback
- Audio
- Controllers
  - Head Tracking
  - Body tracking
  - Hand tracking – LEAP

- Hand tracking (Quest)

Session 5: Current state of AR

- Spatial Computing
- Available form factors
  - Video pass-through
  - Optical pass-through
  - Spatial computing glasses (SCGs)
- Controllers and Interaction
  - Head tracking
  - Hand Tracking
- Cost and availability
- Tracking
- Field of view

Session 6: XR - Human Factors

- Motion sickness
- Cyber sickness
- Vergence-Accommodation Conflict
  - VR
  - Head-mounted AR
- Latency
- Screen-door effect
- The Immersive Society
  - Cyber bully and XR
  - The interpersonal distance experiments

Session 7: Creating Content for XR

- Computer Graphics Modelling
  - 3DS Max
  - Blender
  - Google Sketchup
- Cinematic VR
- Snapchat
- Unity3D and Unreal Engine
- 360° cameras
- 180° and 360° video on youtube

Session 8: Creating XR

- A typical developer team
- The Unity 3D environment
- The Unreal Engine environment
- Cloud computing

- XR Software development libraries
  - OpenXR
  - ARKit
  - ARCore
  - ARFoundation

Session 9: Exploring VR use cases

- Art
  - (Meta) Reality Labs
  - Cinematic VR
  - Tilt Brush
- Education
- Entertainment and Gaming
- Healthcare and Rehabilitation

Session 10: Exploring AR use cases

- Art
- Education
- Industry & Commerce
- Entertainment

Session 11: Design, Development and Validation of AR software

- Design principles and best practices for AR app development

Session 12: Future of XR

- Discuss the future of VR
- Discuss the future of AR
- Discuss developments of an open Metaverse and the role of XR.
- Discuss new XR influencing technologies e.g. multi focal displays, photogrammetry, and light fields.

Learning Activities and Teaching Methods:

- Faculty Lectures
- Guest-Lectures Seminars
- Directed and Background Reading
- Case Study Analysis
- Academic Paper Discussion
- Simulations
- Student-led Presentations
- In-Class Exercises

Assessment Methods:

- Interactive activities and classroom participation
- Assignments
- Final exams

Assessment Methods in alignment with Intended Learning Outcomes:

		Intended Learning Outcomes to be assessed			
Assessment Method	**Weighting**	LO1	LO2	LO3	LO4
Interactive activities	30%	✓	✓	✓	✓
Assignments	10%	✓	✓	✓	✓
Exams	60%	✓	✓	✓	✓

Student Study Effort Expected:

Student Study Effort Expected	Hours
Lectures	12h
Assignments	30h
Interactive activities and forum participation	65h
Reading and research	140h
Exam	3h
Total	250h

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
The Metaverse: A Professional Guide: An expert's guide to virtual reality (VR), augmented reality (AR), and immersive technologies.	Fiske Tom	Independent publication	2022	979-8403364522.

Recommended Textbooks / Readings:

- Christou C.G. and Parker A.J. (1995). Visual realism and virtual reality: a psychological perspective. In K. Carr & R. England (Eds.), Simulated and Virtual Realities: Elements of Perception. London: Taylor & Francis.

- Glover, J., & Linowes, J. (2019). Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications. Packt Publishing Ltd.
- Greengard, S. (2019). Virtual reality. Cambridge, MA: MIT Press.
- Pangilinan, E., Lukas, S., & Mohan, V. (2019). Creating augmented and virtual realities: theory and practice for next-generation spatial computing. Sebastopol, CA: O'Reilly Media, Inc.
- Rauschnabel, P. A., Felix, R., Hinsch, C., Shahab, H., & Alt, F. (2022). What is XR? Towards a framework for Augmented and Virtual Reality. Computers in Human Behavior, 130, 107289.
- Schmalstieg, D., & Hollerer, T. (2016). Augmented reality: principles and practice. Upper Saddle River, NJ: Addison-Wesley Professional.
- Timothy Jung, M. Claudia tom Dieck. (2018). Augmented Reality and Virtual Reality Empowering Human, Place and Business. Springer.