

BIP Game Development with VR & AR (6 ECTS credits)

Teachers:

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- [Frida Gjermeni](mailto:fridagjermeni@uamd.edu.al) (fridagjermeni@uamd.edu.al) – Aleksandër Moisiu University in Durrës, Albania
- [Krzysztof Skabek](mailto:krzysztof.skabek@pk.edu.pl) (krzysztof.skabek@pk.edu.pl) - Cracow University of Technology
- [Volker Paelke](mailto:volker.paelke@hs-bremen.de) (volker.paelke@hs-bremen.de) - Hochschule Bremen City University of Applied Sciences

Partners:

1. Cracow University of Technology (Poland)
2. Université Marie et Louis Pasteur (France)
3. Aleksandër Moisiu University in Durrës, (Albania)
4. Hochschule Bremen City University of Applied Sciences (Germany)

Important Dates:

1. Online lectures and labs: 03.2026 – 06.2026
2. Physical week at Cracow University of Technology: 06.2026
3. Final evaluation (delivering all reports and required files): by June. 28, 2026

Curriculum (Syllabus):

Online lectures and labs: (3 teaching hours per week (3 x 45 min)- 10 weeks, combined theoretical and simple practical labs and demonstrations)

Week	Module	Topic	Lectura date	University	Lecturer
Week 1	Programming in C#	Introduction to the course, general information (<i>Adrian Widlak, CUT</i>) Lecture on C# programming basics: <i>tools (online and offline), operators, expressions, string formatting</i>	March 2026	Université Marie et Louis Pasteur	Adrian Widlak, Frédéric Lassabe
Week 2		Classes, objects, operator overloading: <i>defining a game's entities with properties and actions based on attributes and methods</i>	March 2026		Frédéric Lassabe
Week 3		Inheritance, interfaces; representing a	March 2026		Frédéric Lassabe

		game's state and moves <i>Identifying how to choose classes and interfaces hierarchy to model game board and pieces.</i>			
Week 4	3D models: assets, resource search, point cloud object creation, texture preparation	These modules learning how to import 3D models , effectively source assets from marketplaces, and correctly prepare textures (like Normal and Metallic maps) for realistic rendering and optimal performance. Additionally, students gain specialized skills in utilizing tools for point cloud creation to incorporate complex real-world scan data into their virtual environments.	April 2026	Aleksandër Moisiu University of Durrës	Frida Gjermeni
Week 5			April 2026		Frida Gjermeni
Week 6	Game Development in Unity	Game Design and Animation in Unity <i>An overview of game design principles in Unity, focusing on scene logic, animation systems, and how animations enhance interactivity and user experience.</i>	April 2026	Cracow University of Technology	Krzysztof Skabek
Week 7		Physics, Collisions, and Ray Tracing in Unity <i>Introduction to implementing physics in Unity, including collision detection, raycasting techniques, and the basics of ray tracing for realistic rendering.</i>	April 2026	Cracow University of Technology	Krzysztof Skabek
Week 8	Virtual Reality / Augmented Reality	Basic concepts of AR <i>terminology, tracking, rendering, interaction; Implementation options on mobile devices; Design process</i>	May 2026	Hochschule Bremen City University of Applied Sciences (Germany)	Volker Paelke
Week 9		Implementation aspects (prototyping, development, evaluation)	May 2026		Volker Paelke
Week 10		VR/AR Technologies and Engineering Applications <i>Exploration of VR/AR technologies with emphasis on motion tracking, indoor/outdoor navigation, geolocation methods, and their real-world applications in</i>	May 2026	Cracow University of Technology	Krzysztof Skabek

		engineering contexts. Exploration of VR/AR technologies with emphasis on motion tracking, indoor/outdoor navigation, geolocation methods, and their real-world applications in engineering contexts.			
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Physical week at Cracow University of Technology: A detailed agenda will be published in June 2026

The students will work individually or in small international teams (2-3 people). Challenges will be defined each morning to verify and improve their skills after the online lectures.

Learning Outcomes:

Students will develop interactive VR/AR applications using Unity, integrating AR frameworks and 3D assets, while applying key game development tools such as Unity, ARKit, ARCore, Oculus SDK, and C# scripting. They will also gain experience collaborating in international, cross-functional teams to create immersive VR/AR projects.

Assessment:

The final grades will be calculated based on evaluating the students' work at labs (online part) - N_1 , and the reports made by teams in the physical week N_2 . The following procedure is defined for calculating the final grades (F):

$$F = 0,3 * N_1 + 0,7 * N_2$$

Prerequisites:

Students from 3rd semester or higher. Knowledge of one object-oriented programming language. The teaching language is English.

Literature

1. I. Freeman, Pro C# 10 with .NET 6: Foundational Principles and Practices in Programming, Apress, 2022 – (for Module 1 – Programming in C#)
2. D. H. Eberly, 3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, CRC Press, 2006 – (for Module 2 – 3D models: assets, resource search, point cloud object creation, texture preparation)
3. A. Goldstone, Unity Game Development Cookbook: Essentials for Every Game, O'Reilly Media, 2021 – (for Module 3 – Game Development in Unity)
4. T. Parisi, Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, O'Reilly Media, 2015 – (for Module 4 – Virtual Reality / Augmented Reality)