

**City University of Hong Kong  
Course Syllabus**

**offered by Department of Computer Science  
with effect from Semester A 2024/25**

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**Part I Course Overview**

**Course Title:** Virtual Reality and Game-Engine Technologies

**Course Code:** CS6175

**Course Duration:** One semester

**Credit Units:** 3 credits

**Level:** P6

**Medium of Instruction:** English

**Medium of Assessment:** English

**Prerequisites:**  
*(Course Code and Title)* Nil

**Precursors:**  
*(Course Code and Title)* Nil

**Equivalent Courses:**  
*(Course Code and Title)* Nil

**Exclusive Courses:**  
*(Course Code and Title)* Nil

## Part II Course Details

### 1. Abstract

Virtual reality emphasizes on the construction of interactive 3D virtual environments, and how to interact with such environments through different sensory channels, such as audio, vision and gesture. Virtual Reality has many applications. The most popular one is 3D computer gaming, which is attracting a lot of attention in recent years. This course aims at introducing advanced virtual reality techniques and their applications. In particular, it investigates the 3D computer gaming application and the game engine architectures.

### 2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Identify the important characteristics of different virtual reality techniques.		✓		
2.	Evaluate different types of virtual reality systems.			✓	
3.	Explain and discuss different game engine architectures.			✓	
4.	Design and apply virtual reality techniques to address real-world problems.			✓	✓
		100%			

**A1: Attitude**

*Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.*

**A2: Ability**

*Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.*

**A3: Accomplishments**

*Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.*

### 3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Student will engage in formal lectures to gain knowledge about virtual reality technologies and their applications, including a very popular application of virtual reality – game engines.	✓	✓	✓	✓	2 hours/week
Tutorial	Students will participate in different class exercises that are relevant to virtual reality technologies and applications. Some of the tutorial exercises will involve the evaluation and design of virtual reality technologies.	✓	✓	✓		1 hour/week
Project	Students will participate in groups to consolidate their learning as they produce a program/report, integrating virtual reality techniques in an application under a game engine framework.		✓	✓	✓	3 hours/week for 7 weeks

### 4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting	Remarks
	1	2	3	4		
Continuous Assessment: <u>40%</u>						
Quiz	✓	✓	✓		20%	
Course Project		✓	✓	✓	20%	
Examination <sup>^</sup> : <u>60%</u> (duration: 2 hours)						
					100%	

<sup>^</sup> For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

## 5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Quiz	Capacity in understanding the key concerns of virtual reality and game-engine techniques	High	Significant	Moderate	Basic	Note even reaching marginal levels
2. Course Project	Ability to apply virtual reality and game-engine techniques to develop an application	High	Significant	Moderate	Basic	Note even reaching marginal levels
3. Examination	Ability to evaluate virtual reality and game software and to apply virtual reality and game-engine techniques on applications	High	Significant	Moderate	Basic	Note even reaching marginal levels

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Quiz	Capacity in understanding the key concerns of virtual reality and game-engine techniques	High	Significant	Moderate	Note even reaching marginal levels
2. Course Project	Ability to apply virtual reality and game-engine techniques to develop an application	High	Significant	Moderate	Note even reaching marginal levels
3. Examination	Ability to evaluate virtual reality and game software and to apply virtual reality and game-engine techniques on applications	High	Significant	Moderate	Note even reaching marginal levels

### Part III Other Information (more details can be provided separately in the teaching plan)

#### 1. Keyword Syllabus

(An indication of the key topics of the course.)

Real-time Rendering Techniques. Animation Techniques. Obstacle Avoidance. Emotion and Expressions. Physically Based Modeling. Motion Capture. Tracking Techniques. Display Systems. Game Engine Architecture. Virtual Reality Applications. Graphics Systems. Audio Rendering.

#### Syllabus

- Virtual Reality Technologies  
Overview of input and output devices for VR: head-mounted display, data gloves, 3D video capture, 3D displays, CAVE, haptic devices, motion tracking.
- Interaction Techniques in Virtual Reality  
3D selection and manipulation techniques, 3D user interface design and evaluation, gesture recognition and tangible interfaces.
- Virtual Environments and Distributed Virtual Environments  
Real-time rendering techniques, visibility determination, motion prediction, motion synchronization.
- Applications of Virtual Reality  
Applications of VR in different areas such as training, simulation and information visualization.
- Game Engine Technologies  
Game Engine Architecture, Single- and Multi-Player techniques.

#### 2. Reading List

##### 2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

##### 2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	<i>G. Burdea and P. Coiffet, "Virtual Reality Technology," Second Edition, Wiley-Interscience, 2003.</i>
2.	<i>Mel Slater, Anthony Steed, and Yiorgos Chrysanthou, "Computer Graphics and Virtual Environments," Addison Wesley, 2002.</i>
3.	<i>Jobe Maker, "ActionScript for Multiplayer Games and Virtual Worlds," New Riders, 2010.</i>
4.	<i>Jason Busby, Zak Parrish, and Jeff Wilson, "Mastering Unreal Technology, Volume I: Introduction to Level Design with Unreal Engine 3," Sams Publishing, 2010.</i>
5.	<i>Jason Busby, Zak Parrish, and Jeff Wilson, "Mastering Unreal Technology, Volume II: Advanced Level Design Concepts with Unreal Engine 3," Sams Publishing, 2010.</i>