City University of Hong Kong
Course Syllabus

offered by Department of Computer Science
with effect from Semester A 2018 /19

Part I Course Overview

Course Title:	Virtual Reality
Course Code:	CS4188
Course Duration:	1 semester
Credit Units:	3 credits
Level:	B4
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	CS2303 Data Structures for Media or CS3334 Data Structures or EE3206 Java Programming and Applications
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

(A 150-word description about the course)

Virtual reality emphasizes on the construction of interactive 3D virtual/mixed environments, and how to interact within such environments through different sensory channels, such as audio, vision and gesture. Virtual Reality has many applications. The most popular ones include 3D computer games and virtual walkthrough, which have attracted a lot of attention. This course aims at introducing virtual reality techniques and their applications.

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 and critique different types of virtual reality hardware systems.			✓	
3.	Evaluate and critique different types of virtual reality applications.			✓	
4.	Apply virtual reality techniques to develop an application.			✓	
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

 # Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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. Teaching and Learning Activities (TLAs)

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

Teaching pattern:
Suggested lecture/tutorial/laboratory mix: 2 hours lecture; 1 hour tutorial.

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	The lecture will focus on the introduction and evaluation of virtual reality technologies and their applications.	✓	✓	✓		2 hours/week
Tutorial	Students are required to work on different exercises and case studies that are relevant to virtual reality technologies and applications. Some of the tutorial exercises will involve evaluation and design of virtual reality technologies.	✓		✓		1 hour/week
Project	Students apply suitable virtual reality techniques to develop applications.		✓	✓	✓	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: 50%						
Quiz	✓	✓			20%	
Course Project		✓	✓	✓	30%	
Examination^: 50% (duration: 2 hours)						
** The weightings should add up to 100%.*					100%	

^ 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.)

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 techniques	High	Significant	Moderate	Basic	Note even reaching marginal levels
2. Course Project	Ability to apply virtual reality techniques to develop an application	High	Significant	Moderate	Basic	Note even reaching marginal levels
3. Examination	Ability to evaluate virtual reality techniques and to apply them to some applications	High	Significant	Moderate	Basic	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.)

Immersive VR. Non-immersive VR. Augmented VR. Telepresence. Interaction Techniques. Real-time rendering Techniques. Physically Based Modeling. Motion Capture. Tracking Techniques. Display Systems. Virtual Reality Applications. Graphics Systems.

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

  Real-time rendering techniques, visibility determination, motion prediction, motion synchronization.

- Software Platforms

  Scene graph, Unity3D, Unreal Engine, jMonkey Engine.

- Applications of Virtual Reality

  Applications of VR in different areas such as training, simulation and information visualization.

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.	*G. Burdea and P. Coiffet, "Virtual Reality Technology," Second Edition, Wiley-Interscience, 2003.*
2.	*Mel Slater, Anthony Steed, and Yiorgos Chrysanthou, "Computer Graphics and Virtual Environments," Addison Wesley, 2002.*
3.	*Jason Jerald, "The VR Book: Human-Centred Design for Virtual Reality," ACM, 2015.*
4.	*Jeff W. Murray, "Building Virtual Reality with Unity and Stream VR," CRC Press, 2017.*
5.	*Mitch McCaffrey, "Unreal Engine VR Cookbook: Developing Virtual Reality with UE5,"Addison-Wesley Professional, 2017.*