

**City University of Hong Kong
Course Syllabus**

**offered by School of Creative Media
with effect from Semester A 2018 /19**

Part I Course Overview

Course Title: Image Processing and Augmented Reality

Course Code: SM3123

Course Duration: One semester (13 weeks)

Credit Units: 3

Level: B3

Proposed Area: Arts and Humanities
(for GE courses only) Study of Societies, Social and Business Organisations
 Science and Technology

Medium of Instruction: English

Medium of Assessment: English

Prerequisites: SM2715 Creative Coding
(Course Code and Title)

Precursors: Nil
(Course Code and Title)

Equivalent Courses: Nil
(Course Code and Title)

Exclusive Courses: Nil
(Course Code and Title)

Part II Course Details

1. Abstract

(A 150-word description about the course)

The course aims to provide fundamental knowledge in digital image processing and its applications in pixel based computer graphics. The classes introduce the theory and practical tools to create, manipulate and display digital images with the use of simple computer programming. Students will master the basic mathematical background necessary to work creatively on image processing within the application framework of mixed reality applications, which spans from virtual reality and augmented reality systems. Additional topics will introduce the simple mechanism of computer vision and motion detection and tracking techniques in which students can apply to work on their interactive projects.

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 key concepts in pixel based computer graphics and simple image processing techniques.		✓		
2.	Apply the image processing techniques to generate creative computer graphics.			✓	
3.	Describe simple computer vision mechanisms and motion tracking applications.		✓		
4.	Relate computer vision techniques in human computer interaction application areas.			✓	
5. [^]	Associate, combine and integrate knowledge from different disciplines (e.g. mathematics, sciences, literature etc.) into course assignments			✓	
6. [^]	Transform basic technical competence into a unique style or personal signature				✓
		100%			

* If weighting is assigned to CILOs, they should add up to 100%.

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

[^] Negotiated Learning Outcome (NLO) explicitly articulating the elements of Discovery oriented learning.

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.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	6	
Lecture	Introductory mini-lectures on image processing and computer visions.	✓		✓				
Workshop	Practical workshops on image processing, <u>augmented reality</u> and computer vision with computer programming in the Flash Action Script language.		✓		✓	✓	✓	
Presentation	Individual project presentation on creative ideas and final deliverables.		✓		✓	✓	✓	

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	5	6		
Continuous Assessment: 100%								
In-class programming exercises on image processing , computer vision and augmented reality.	✓		✓				20%	
Assignment on pixel based computer graphics, which can be interactive.		✓			✓		40%	
Assignment on computer vision, augmented reality application and human computer interaction.				✓	✓	✓	40%	
Examination: 0% (duration: _____, if applicable)								
* The weightings should add up to 100%.							100%	

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. In-Class Exercises	Students should demonstrate ability to utilize primary and secondary sources, build up argument and analysis. The threshold of 'discovery' lied in a student's self initiatives to conduct additional research and to personalize theories for her/his personal daily experience.	<ul style="list-style-type: none"> - Excellent grasp of research material, able to explain key concepts, assumptions and debates - Rigorous organization, coherent structure, distinct thesis, properly argued with strong narrative - Insightful interpretation of the subject matter with distinct themes and thesis - Critical analysis with insightful 	<ul style="list-style-type: none"> - Firm grasp of materials, able to explain key concepts and assumptions - Reasonable organization, balanced structure, adequate content, sufficient ability to integrate various resources based on demand - Clear ideas which keep to the point, clear-cut subject, ability to interpret 	<ul style="list-style-type: none"> - Comprehensive grasp of materials, able to explain key concepts - Fair organization, weak structure, adequate content, fair ability to integrate various resources based on demand - Relevant points to the subject matter, fair ability to interpret opinions - Unorganized bibliography which can be utilized in accordance with the topic 	<ul style="list-style-type: none"> - Loose grasp of materials, cannot explain key concepts - Poor organization and structure, weak content, limited use of resources - Relevant points to the subject matter, marginal ability to interpret opinions - Insufficient and/or unorganized bibliography 	<ul style="list-style-type: none"> - Poor grasp of materials - No organization and structure, inadequate content, no/irrelevant use of resources - Irrelevant points to the subject matter, minimal ability to interpret opinions - Irrelevant bibliography

		<p>comments opening up new issues, or suggesting the ability to theorize</p> <ul style="list-style-type: none"> – Ability to approach a text or a theme using a variety of theories and analytical tools – Strong bibliography suggesting breadth and depth of coverage and informed insights 	<p>opinions independently</p> <ul style="list-style-type: none"> – Organized bibliography which can be utilized in accordance with the topic 			
2. Computer Graphic Project, Human-Computer Interaction Project	Students should demonstrate ability to utilize primary and secondary sources, execute creative ideas and projects. The threshold of 'discovery'	<ul style="list-style-type: none"> – Work has strong affective quality and the articulation of personal styles and signature 	<ul style="list-style-type: none"> – Strong appreciation, exploration and/or application of the aesthetic and expressive 	<ul style="list-style-type: none"> – Basic appreciation and/or application of the aesthetic and expressive qualities of the medium 	<ul style="list-style-type: none"> – Marginal appreciation of the aesthetic and expressive qualities of the medium – Marginal ability to create project/ work 	<ul style="list-style-type: none"> – No appreciation of the aesthetics and expressive qualities of the medium – Fail to create project/ work that demonstrate the

	<p>lies in a student's proactively turning theory into praxis, to transform course material into self-owned authorship.</p>	<ul style="list-style-type: none"> - Excellent appreciation, exploration and/or application of the aesthetic and expressive qualities of the medium - Work raises questions and instill insights about the process of conception, creative strategization and production - Innovative exploration by combining knowledge from different disciplines (e.g. mathematics, psychology, physics, 	<p>qualities of the medium</p> <ul style="list-style-type: none"> - Ability to create project/ work that demonstrate the processes of thinking and creative exploration - Proper adjustment of plans and strategies in response to resources (time, space, equipment, etc) available and constructive feedback/ suggestions 	<ul style="list-style-type: none"> - Limited ability to create project/ work that demonstrate the processes of thinking and creative exploration - Adjustment of plans and strategies in response to resources (time, space, equipment, etc) available 	<p>that demonstrate the processes of thinking and creative exploration</p> <ul style="list-style-type: none"> - Limited adjustment of plans and strategies in response to resources (time, space, equipment, etc) available 	<p>processes of thinking and creative exploration</p> <ul style="list-style-type: none"> - Minimal adjustment of plans and strategies in response to resources (time, space, equipment, etc) available
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		<p>anthropology, etc.) to create an inter- disciplinary project</p> <p>– Efficient adjustment of plans and strategies in response to resources (time, space, equipment, etc) available with constructive adjustment</p>				
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Note: All A+/A/A- grade assignment should comply with the highest performance of Discovery-oriented learning.

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.)

- Digital colour model
- Pixels
- Image transformation
- Image filter
- Convolution matrix
- Computer vision
- Image capture
- Motion analysis
- Motion tracking
- Virtual reality
- Augmented reality
- Interaction design

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.)

1.	Richard Szeliski (Author) (2010) Computer Vision: Algorithms and Applications
2.	Lawrence O’Gorman (Author), Michael J. Sammon (Author), Michael Seul (Author) (2008) Practical Algorithms for Image Analysis
3.	Borko Furht (Editor) (2011) Handbook of Augmented Reality
4.	Tony Mullen (Author) (2011) Prototyping Augmented Reality

2.2 Additional Readings

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

1.	Jens Grubert (Author), Dr. Raphael Grasset(Author) (2013) Augmented Reality for Android Application Development
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