City University of Hong Kong
Course Syllabus

offered by School of Creative Media
with effect from Semester A 2024/25

Part I   Course Overview

Course Title:	**Making Things Blip, Blink & Move: Introduction to Physical Computing**
Course Code:	**SM5332**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**P5**
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**

This graduate studio is aimed at introducing students to the fundamentals of physical computing, embodied system programming and electronics. Through the use of microcontrollers, circuit emulation, circuit hacking and reverse engineering, students will acquire foundational knowledge in the theory and practice of electronics. Students will also learn to build physical artifacts that can exhibit reactive and intelligent behaviours.

This unit serves as a foundation for students to proceed with pervasive computing, robotics, and other more advance interactive applications. This class also serves as an introduction to the Arduino microprocessor platform.

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.	Recognise, identify and describe: • Key electronic components • Common circuits				✓
2.	Approach an understanding of the technical complexity of pre-existing electronic artworks				✓
3.	Build physical artifacts that exhibit reactive and intelligent behaviour			✓	
4.	Demonstrate the principles of interaction design			✓	
5.	Apply: • Knowledge and skills in electronics and physical computing to creative projects • Understanding of human motion and reaction in creative projects			✓	
6.	Integrate tactile technology and electronics into students' own art practice through additional self-initiated tasks.			✓	
		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, synthesising 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
		1	2	3	4	5	6	(if applicable)
Lecture, research and discussion	- Lectures with audio-visual illustration - Field-trip / hacker space visits - Summary / notes of assigned reading / viewing - In-class presentation and critique - In-class exercises	✓	✓	✓	✓			
Presentation, critique and discussion	- Creation of interactive art work / product - In-class presentation and critique				✓	✓	✓	

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%								
- Summary / notes of assigned reading - In-class presentation on the interactive artworks / devices	✓	✓					20%	
- In-class circuit-building, Arduino-coding and other technical exercises - Class assignments	✓	✓	✓				25%	
- Design, implement and present an end-of-semester creative work - Maintenance of a learning log book / blog				✓	✓	✓	45%	
- Participation in in-class discussion - Contribution to classmates' critique sessions	✓	✓	✓	✓	✓	✓	10%	
Examination: 0% (duration: , if applicable)								
							100%	

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. Summary / Notes of Assigned Reading	This assessment will grade on rationality, clarity and fluency of argument and comment.	− Rich content, excellent ability to interpret and integrate various resources − Rigorous organisation, coherent structure, systematic composition − Precision in argument, well defined and reasoned points of view grounded in insightful interpretation of existing literature − Readiness to respond to peer opinion and other views initiated in class discussion − Discussion shed light on new dimensions of the issue	− Adequate content, sufficient ability to integrate various resources based on demand − Reasonable organisation with balanced structure and composition − Clear elaboration of ideas that sticks to the point, with clearly differentiated issues, ability to interpret opinions independently − Sufficient responses to peer comments to sustain a discussion	− Adequate content, fair ability to integrate various resources based on demand − Fair organisation with adequate structure and composition − Relevant points made to the subject matter in question − Ability to respond to other statements and engage in class discussion	− Weak content, limited use of resources − Poor organisation, structure and composition − Relevant points to the subject matter, marginal ability to interpret opinions − Ability to respond to other comments in simple terms	− Inadequate content, no/ irrelevant use of resources − No organisation, structure or/and composition − Irrelevant points to the subject matter, no ability to interpret opinions − Fail to respond to other comments
2. Creative Work / Product Design	Students should demonstrate ability to utilise primary and secondary sources, execute creative ideas and	− Work has strong affective quality and the articulation of personal styles and signature − Excellent appreciation, exploration and/or application of the aesthetic and	− Strong appreciation, exploration and/or application of the aesthetic and expressive qualities of the medium − Ability to create project/ work that demonstrate the processes of thinking	− Basic appreciation and/or application of the aesthetic and expressive qualities of the medium − Limited ability to create project/ work that demonstrate the processes of thinking and creative exploration	− Marginal appreciation of the aesthetic and expressive qualities of the medium − Marginal ability to create project/ work that demonstrate the processes of thinking and creative exploration	− No appreciation of the aesthetics and expressive qualities of the medium − Fail to create project/ work that demonstrate the processes of thinking and creative exploration − Minimal adjustment of plans and strategies

projects.		expressive qualities of the medium – Work raises questions and instill insights about the process of conception, creative stratification and production – Innovative exploration by combining knowledge from different disciplines (e.g. mathematics, psychology, physics, anthropology, etc.) to create an inter-disciplinary project – Efficient adjustment of plans and strategies in response to resources (time, space, equipment, etc) available with constructive adjustment	and creative exploration – Proper adjustment of plans and strategies in response to resources (time, space, equipment, etc) available and constructive feedback/ suggestions	– Adjustment of plans and strategies in response to resources (time, space, equipment, etc) available	– Limited adjustment of plans and strategies in response to resources (time, space, equipment, etc) available	in response to resources (time, space, equipment, etc) available
3. In-Class Presentation	This assessment will grade on content and fluency of presentation. Students should show their co-operation to conduct a well-organized presentation with their	– Rich, informative content, excellent grasp of the material with in-depth and extensive knowledge of the subject matter – Rigorous organisation, coherent structure, and systematic exposition with a strong sense of narrative – Superior presentation skills: distinct pronunciation, fluent expression and appropriate diction,	– Adequate content with firm grasp of the material that informs the audience on a subject matter – Reasonable organisation, balanced structure and composition – Good verbal communication: comprehensible pronunciation, fluent expression and diction, fair time-management	– Adequate content with comprehensive grasp of the material demonstrating basic knowledge of the subject matter – Fair organisation, weak structure and composition – Fair presentation skills: acceptable pronunciation, expression and diction, fair time-management	– Weak content, loose grasp of the general ideas with some knowledge of the subject matter – Poor organisation, structure and composition – Poor presentation skills: marginal pronunciation, expression and diction, poor time-management	– Inadequate content, fail to identify the general ideas with knowledge of the subject matter – No organisation, structure or/and composition – Poor presentation skills: marginal pronunciation, expression and diction, minimal time-management

	own argument and evidence from readings and notes.	exact time-management − Critical analysis with insightful comments opening up new issues, or suggesting the ability to theorise				
4. Class Exercises, Discussion Participation and Contribution	Students' participation and performance in discussions, debates and other class activities and tutorials. Students have to show their pre-class preparation.	− Active in-class participation, positive listening, strong ability to stimulate class discussion and comment on other points − In-depth pre-class preparation and familiarity with peer reports and other materials − Interpret others' views with an open mind and ready to negotiate − Readiness to share personal insight via analysis and synthesis with informed views − Constructively critical, thus facilitating the discovery of new issues	− Active in-class participation, positive listening, ability to initiate class discussion and comment on other points − Adequate pre-class preparation and familiarity with peer reports and other materials − Interpret opinions effectively	− Attentive in-class participation, listening with comprehension, but only infrequently contributing − Adequate pre-class preparation but little familiarity with peer reports and other materials − Fair ability in interpreting opinions	− Unmotivated to participate in class discussion or comment on other people's views − Little pre-class preparation and familiarity with peer reports and other materials − Poor ability in interpreting opinions	− Unwilling to participate in class discussion and comment on other points, even when requested by the teacher − No pre-class preparation and familiarity with peer reports and other materials − Minimal ability in interpreting opinions

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. Summary / Notes of Assigned Reading	This assessment will grade on rationality, clarity and fluency of argument and comment.	− Rich content, excellent ability to interpret and integrate various resources − Rigorous organisation, coherent structure, systematic composition − Precision in argument, well defined and reasoned points of view grounded in insightful interpretation of existing literature − Readiness to respond to peer opinion and other views initiated in class discussion − Discussion shed light on new dimensions of the issue	− Adequate content, sufficient ability to integrate various resources based on demand − Reasonable organisation with balanced structure and composition − Clear elaboration of ideas that sticks to the point, with clearly differentiated issues, ability to interpret opinions independently − Sufficient responses to peer comments to sustain a discussion	− Weak content, limited use of resources − Poor organisation, structure and composition − Relevant points to the subject matter, marginal ability to interpret opinions − Ability to respond to other comments in simple terms	− Inadequate content, no/ irrelevant use of resources − No organisation, structure or/and composition − Irrelevant points to the subject matter, no ability to interpret opinions − Fail to respond to other comments
2. Creative Work / Product Design	Students should demonstrate ability to utilise primary and secondary sources, execute creative ideas and projects.	− Work has strong affective quality and the articulation of personal styles and signature − Excellent appreciation, exploration and/or application of the aesthetic and expressive qualities of the medium − Work raises questions and instill insights	− Strong appreciation, exploration and/or application of the aesthetic and expressive qualities of the medium − Ability to create project/ work that demonstrate the processes of thinking and creative exploration − Proper adjustment of plans and strategies in	− Marginal appreciation of the aesthetic and expressive qualities of the medium − Marginal ability to create project/ work that demonstrate the processes of thinking and creative exploration − Limited adjustment of plans and strategies in response to resources (time, space,	− No appreciation of the aesthetics and expressive qualities of the medium − Fail to create project/ work that demonstrate the processes of thinking and creative exploration − Minimal adjustment of plans and strategies in response to resources (time, space,

		about the process of conception, creative stratification and production − Innovative exploration by combining knowledge from different disciplines (e.g. mathematics, psychology, physics, anthropology, etc.) to create an inter-disciplinary project − Efficient adjustment of plans and strategies in response to resources (time, space, equipment, etc) available with constructive adjustment	response to resources (time, space, equipment, etc) available and constructive feedback/ suggestions	equipment, etc) available	equipment, etc) available
3. In-Class Presentation	This assessment will grade on content and fluency of presentation. Students should show their co-operation to conduct a well-organized presentation with their own argument and evidence from readings and notes.	− Rich, informative content, excellent grasp of the material with in-depth and extensive knowledge of the subject matter − Rigorous organisation, coherent structure, and systematic exposition with a strong sense of narrative − Superior presentation skills: distinct pronunciation, fluent expression and appropriate diction, exact time-management − Critical analysis with insightful comments	− Adequate content with firm grasp of the material that informs the audience on a subject matter − Reasonable organisation, balanced structure and composition − Good verbal communication: comprehensible pronunciation, fluent expression and diction, fair time-management	− Weak content, loose grasp of the general ideas with some knowledge of the subject matter − Poor organisation, structure and composition − Poor presentation skills: marginal pronunciation, expression and diction, poor time-management	− Inadequate content, fail to identify the general ideas with knowledge of the subject matter − No organisation, structure or/and composition − Poor presentation skills: marginal pronunciation, expression and diction, minimal time-management

		opening up new issues, or suggesting the ability to theorise			
4. Class Exercises, Discussion Participation and Contribution	Students' participation and performance in discussions, debates and other class activities and tutorials. Students have to show their pre-class preparation.	− Active in-class participation, positive listening, strong ability to stimulate class discussion and comment on other points − In-depth pre-class preparation and familiarity with peer reports and other materials − Interpret others' views with an open mind and ready to negotiate − Readiness to share personal insight via analysis and synthesis with informed views − Constructively critical, thus facilitating the discovery of new issues	− Active in-class participation, positive listening, ability to initiate class discussion and comment on other points − Adequate pre-class preparation and familiarity with peer reports and other materials − Interpret opinions effectively	− Unmotivated to participate in class discussion or comment on other people's views − Little pre-class preparation and familiarity with peer reports and other materials − Poor ability in interpreting opinions	− Unwilling to participate in class discussion and comment on other points, even when requested by the teacher − No pre-class preparation and familiarity with peer reports and other materials − Minimal ability in interpreting opinions

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.)

     Physical Computing; Embedded System; Micro-controller; Electronics; Arduino; Processing; Human-Computer Interaction; Human-Computer Interface; Product Design; Prototyping; Interactive Environment; Interactive Installation; Sensors; Motion Tracking;   Robotic Mechanic

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.	• O'Sullivan, D and T. Igoe. 2004. Physical computing: Sensing and controlling the physical world with computers. Course Technology Press.
2.	• Culkin, Jo and E. Hagan. 2017. Learn Electronics with Arduino: An Illustrated Beginner's Guide to Physical Computing. Maker Media, Inc..
3.	• Igoe, T. 2017. Making Things Talk: Practical Methods in Connecting Physical Objects. 3rd Edition. Cambridge: O'Reilly Media.
4.	• https://www.arduino.cc/
5.	• https://www.processing.org/
6.	• https://www.tinkercad.com/
7.	• https://www.fritzing.org/
8.	• https://www.sensorwiki.org/
9.	• https://www.adafruit.com/
10.	• https://www.parallax.com/
11.	• https://www.sparkfun.com/
12.	• https://www.seeedstudio.com/
13.	• https://www.instructables.com/
14.	• https://hackaday.com/

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

1.	Margolis, M. 2011. *Arduino Cookbook*. Cambridge: O'Reilly Media.
2.	Massimo, B. 2008. *Getting Started with Arduino*. Cambridge: O'Reilly Media.
3.	Mims III, F. 2003. *Getting Started in Electronics*. Illinois: Master Publishing.
4.	Mims III, F. 2000. *Electronic Sensors and Projects*. Illinois: Master Publishing.
5.	Noble, J. 2009. *Programming Interactivity*. Cambridge: O'Reilly Media.
6.	Scherz, P. 2000. *Practical Electronics for Inventors*. Columbus: McGraw-Hill.