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:	Computer Organization
Course Code:	CS2115
Course Duration:	1 semester
Credit Units:	3 credits
Level:	B2
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)*	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

(A 150-word description about the course)

This course aims to introduce digital logic, Boolean algebra and also principles behind the organization of the functional parts of CPU and fundamental components. The course demonstrates computer architecture and programming CISC and RISC microprocessors. It also introduces the basics of assembly language programming.

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.	Describe functions of the basic building blocks of a digital system.				
2.	Identify various architectures and explain the design concepts of computer systems.			✓	
3.	Create the designs of simple digital logic circuits.		✓		
4.	Apply techniques of assembly language to write simple programs.		✓		
5.	Explain and critique the basic operations of cache and main memory, I/O operations and interrupt, as well as analyzing the performance of different designs.		✓	✓	
** 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 hrs. lecture; 1 hr. tutorial.

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	Explain key concepts, such as theories related to computer organization and architecture.	✓	✓	✓	✓	✓	2 hrs/wk
Tutorial	Tutorial sessions will be used for Q&A. If there is no question from students, the tutor will discuss practical questions and exercises with students. In the middle of semester, hands-on will be included in tutorial sessions to let students to do experiment with circuit simulator and/or cross assembler. This activity helps support course ILO, especially #3 and #4.	✓	✓	✓	✓	✓	1 hr/wk
Assignments	Assignments will be given out during the semester. Assignments will be focusing on practical questions and at least one of them will be allocated for low level programming in assembly language. Students are required to solve simple programming problem in group or individual basis. Students may also be required to write report to present the design rationale. This activity helps support course ILO #1, #3, #4 and #5. Assignments will be graded according to the correctness, as well as the robustness of design and prototype.	✓	✓	✓	✓	✓	3 hrs/wk for 4 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	5		
Continuous Assessment: 30%							
Coursework	✓	✓	✓	✓	✓	20%	4 assignments
Midterm Exam	✓	✓	✓	✓	✓	10%	
Examination^: 70% (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. Coursework	Assignment may include short factual questions and design exercises regarding the various building blocks of computer. Assignment may include simple circuit design project / exercises. There would be hands-on and case study on circuit design during tutorial. Assignment may include mini programming project in assembly language. There would also be hands-on exercises during tutorial.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Midterm Exam	The mid-term quiz will include questions assessing the students' understanding on architectural aspect of computer such as single bus organization.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Final Exam	The final exam and mid-term quiz will include questions assessing the students' understanding on architectural aspect of computer such as single bus organization, I/O, bus, interrupt and peripheral operations.	High	Significant	Moderate	Basic	Not 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.)

Number Systems. Floating Point. Logic Gates. Combinational Circuit Design. Classical Combinational Circuits. Basic Computer Architecture Model. Classification of Processors. Stages of Instruction Execution. Memory Systems. Memory Mapped I/O, Programmed I/O, Interrupt I/O, DMA. Assembly Programming. Addressing Mode. Stack Operation.

Syllabus

1. Number systems
   Number representation. Binary arithmetic. Conversion between number systems. Floating point numbers and calculations, IEEE floating point.

2. Digital logic fundamentals
   Logic gates and pricinples. Boolean Algebra. Basic combinational circuits. Karnaugh-Map logic simplication. Examples with applications.

3. Basic computer organization
   Functional subsystems: CPU, memory, input/output systems.

4. CPU organization and operations
   CPU model, Fetch and execute cycle. Control unit and signal, Interrupt cycle, case study on a typical microprocessor.

5. Assembly instruction and assembly language programming
   Machine code instruction. Assembly instruction. Assembly language programming. Addressing modes and example of assembly program.

6. Processor design
   Instruction pipelining. Classification of Processors. CISC v.s. RISC

7. Memory system
   Memory bus, memory access. Cache.

8. I/O system, bus and interrupt and peripherals
   Basic model of an I/O system including programmed, Interrupt, DMA.

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.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian (2012). *Computer Organization and Embedded Systems.* McGraw-Hill Education, 6th edition.

2.2 Additional Readings

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

1.	Andrew S. Tanenbaum and Todd Austin (2012). *Structured Computer Organization.* Pearson, 6th edition.
2.	William Stallings (2015). *Computer Organization and Architecture*. Prentice-Hall, 10th edition.