The Hong Kong University of Science and Technology
UG Course Syllabus

[Course Title] Computer Organization
[Course Code] COMP2611
[No. of Credits] 3 credits
[Any pre-/co-requisites] COMP2011 or COMP2011H

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Course Description
Inner workings of modern digital computer systems and tradeoffs at the hardware-software interface. Topics include: digital logic, data and instruction representation, instruction set architecture, assembly language programming, computer arithmetic, processor, pipelining, and memory systems. Prerequisite(s): COMP 2011 OR COMP 2012H. Exclusion(s): ELEC 2300, ELEC 2350

List of Topics
Introduction of digital logic
Data representation
MIPS ISA and assembly
Computer Arithmetic
Processor: Datapath and Control
Pipelined Processor
Memory System

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:
1. Understand the basic concepts of digital logic and build the small circuits involved in computer systems

2. Describe the interaction between software and hardware and instruction set architecture

3. Write and execute small programs of a few hundred lines in assembly language

4. Define the basic concepts of modern computer hardware, including datapath, control, memory and input/output

5. Describe the organizational paradigms that determine the capability and performance of computer systems

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

[List specific assessed tasks, exams, quizzes, their weightage]

Assessment Task	Contribution to Overall Course grade (%)	Due Date
Mid-Term	30%	week 7 or 8
Final Exam	40%	Final examination period
4 Homework	15%	Released on week 3, 5, 7, 11 and due in 1.5-2 weeks
1 Programming Project	15%	Released on week 9 and due in one month

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Midterm and Final Exam	ILO1, ILO2, ILO3. ILO4, ILO5	These exams assess students' understanding of digital logic, instruction set architecture, and computer hardware principles, as well as their ability to apply these concepts in problem-solving scenarios.
Homework 3 and Programming Project	ILO3	These tasks require students to write and execute assembly language programs, demonstrating their ability to apply programming skills in practical contexts.
Homework 1	ILO1	This homework focuses on the fundamental concepts of digital logic and circuit design, allowing students to practice building small circuits.
Homework 2 and 4	ILO2, ILO4	These assignments emphasize the relationship between software and hardware, as well as the organization of computer systems, including memory and control structures.

Grading Rubric

Assessed Task		
Homework 1 Digital Circuit and Logic Design	**Excellent**	Demonstrates an in-depth understanding of digital logic concepts. Designs circuits with exceptional precision and effectiveness. Presents work in a clear and professional manner.
	Good	Shows a solid understanding of digital logic with minor errors. Designs circuits that are mostly accurate with minor flaws. Presentation is mostly clear with minor organizational issues.
	Satisfactory	Shows a basic understanding of digital logic with noticeable errors. Some designs are accurate, but several mistakes are evident.

		Presentation lacks clarity or organization.
	Needs Improvement	Displays limited or no comprehension of digital logic concepts. Significant errors in circuit design are present. Work is poorly presented or unclear.
Homework 2 Data Representation	**Excellent**	Thorough understanding of data representation concepts, including 2's complement, range, and IEEE 754. All calculations related to representable ranges, maximum and minimum values, and conversions are accurate and well-explained.
	Good	Solid grasp of data representation concepts with minor inaccuracies. Most calculations are accurate, with only a few minor errors.
	Satisfactory	Basic understanding of data representation concepts, but with noticeable gaps. Some calculations are correct, but there are several errors or omissions.
	Needs Improvement	Limited or no understanding of data representation concepts. Major errors in calculations; most are incorrect or missing.
Homework 3 MIPS Programming	**Excellent**	Code executes correctly with all specified test cases. Code is highly efficient with clear logic. Documentation is thorough and includes clear comments.
	Good	Minor issues; most test cases are successful. Code is mostly efficient with minor inefficiencies. Documentation is generally clear with small gaps.
	Satisfactory	Several issues; some test cases fail. Some inefficiencies are present in the code. Documentation is present but lacks clarity.
	Needs Improvement	Major issues; code does not execute correctly. Code is inefficient or poorly structured. Lacks documentation or has insufficient comments.
Homework 4 Computer Architecture	**Excellent**	Accurately analyzes and explains the functioning of various processor components and their interactions.
	Good	Most analyses and explanations are accurate, with only a few minor errors.
	Satisfactory	Some analyses are correct, but there are several errors or omissions in explanations.
	Needs Improvement	Major errors in analyses; most explanations are incorrect or missing.
MIPS Programming Assignment	**Excellent**	Program functions correctly with all features. Code is clean, efficient, and well-organized. Documentation is thorough and includes clear comments.

	Good	Minor issues; most features operate correctly. Code is generally clean with minor inefficiencies. Documentation is mostly clear with small gaps.
	Satisfactory	Several issues; some features do not work. Quality issues are present; organization is lacking. Documentation is present but lacks clarity.
	Needs Improvement	Major issues; program does not run as intended. Code is poorly structured or inefficient. Lacks documentation or has insufficient comments.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	• Exhibits a comprehensive understanding of digital logic design principles, demonstrating exceptional accuracy in designing small circuits. • Displays an in-depth knowledge of instruction set architecture design principles. • The program accurately processes all specified test cases, showcasing high efficiency with clear, logical, and easily understandable code. • Shows extensive theoretical knowledge of computer hardware and design principles, with a strong ability to accurately describe the datapath, control of given machine instructions, and memory structure. • Capably analyzes and compares computer performance across all specified scenarios.
B	Good Performance	• Shows a solid understanding of digital logic design principles, with minor errors in designing small circuits. • Demonstrates good knowledge of instruction set architecture design principles. • The program handles most specified test cases correctly, with efficient code that is mostly clear and understandable. • Displays a good theoretical understanding of computer hardware and design principles, accurately describing most aspects of datapath, control of machine instructions, and memory structure. • Effectively analyzes and compares computer performance in most given scenarios.
C	Satisfactory Performance	• Demonstrates a basic understanding of digital logic design principles, with some errors in circuit design. • Shows a basic grasp of instruction set architecture design principles.

		• The program correctly handles some specified test cases, but may have inefficiencies and lacks clarity in parts of the code. • Displays a basic theoretical understanding of computer hardware and design principles, with some inaccuracies in describing datapath, control of machine instructions, and memory structure. • Provides a general analysis of computer performance, but may miss key aspects in some scenarios.
D	Marginal Pass	• Shows limited understanding of digital logic design principles, with frequent errors in circuit design. • Demonstrates minimal knowledge of instruction set architecture design principles. • The program fails to handle several specified test cases correctly, with unclear and inefficient code. • Displays limited theoretical understanding of computer hardware and design principles, with significant inaccuracies in describing datapath, control of machine instructions, and memory structure. • Provides a superficial analysis of computer performance, lacking depth in most scenarios.
F	Fail	• Fails to demonstrate understanding of digital logic design principles, with major errors in circuit design. • Lacks knowledge of instruction set architecture design principles. • The program does not handle specified test cases correctly, with unclear, inefficient, or non-functional code. • Shows no theoretical understanding of computer hardware and design principles, with incorrect descriptions of datapath, control of machine instructions, and memory structure. • Fails to analyze or compare computer performance, providing little to no relevant information.

Course AI Policy
No use of generative artificial intelligence tools to complete assessment tasks.

Communication and Feedback
Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students who have further questions about the marks should consult the instructor within five working days after the feedback is received. Appealing sessions will be arranged for both midterm and final exam.

Resubmission Policy

No resubmission is allowed

Required Texts and Materials

Computer Organization and Design: The Hardware/Software Interface
6th Edition

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.