The Hong Kong University of Science and Technology

UG Course Syllabus

Introduction of Computer Organization and Design

ELEC 2350

4 Credits

Prerequisite(s): ELEC 1100

Exclusion(s): COMP 2611, ISDN 4000F

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Office Hours: By Appointment

Course Description

This is an introductory course to computer hardware and software organization. The topics covered include combinational and sequential logics, computer systems, computer programming, hardware-software collaboration, compute arithmetic, computer hardware organizations and operations, parallel processing, memory technologies and organization, and technology trends.

List of Topics

1. Computing System Overview
2. Software Development Process
3. Software Programming
4. Computer Hardware-Software Collaboration
5. Computer Arithmetic: representation systems
6. Computer Arithmetic: Addition, Subtraction, Multiplication, Division, Overflow and Underflow
7. Computer Performance, Power, Cost Metrics and Benchmarking
8. Review of Digital Logic Circuits
9. Computer Hardware Components
10. Computer Hardware Organizations and Operations
11. Hardware Pipelining
12. Parallel Processing and Domain Specific Computers
13. Memory technologies and organization

Intended Learning Outcomes (ILOs)

On successful completion of this course, the students will be able to:

1. ILO1 – Understand the typical computer hardware and software components and computer technology trends.

2. ILO2 – Understand typical instruction set architecture and assembly programming method.
3. ILO3 - Use computer arithmetic techniques to represent and process data in computers.
4. ILO4 - Use typical methods to evaluate computer performance.
5. ILO5 - Use a typical computer system design flow to systematically develop single-cycle processor architectures including datapath and control for an instruction set.
6. ILO6 - Systematically develop basic multi-cycle pipelined processor architectures for an instruction set and handle hazards.
7. ILO7 – Understand memory hierarchies and use cache to handle temporal and spatial locality in programs.

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:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Homework	10%	Week 7 and Week 12
Midterm Exam	25%	Week 7-8
Lab experiment	20%	Week 4-13
Final Exam	45%	Finals week

* 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
Homework	ILO1, ILO2, ILO3, ILO4, ILO5, ILO6	These assessments evaluate students' ability to understand the concepts and knowledge of computer architecture.
Midterm Exam	ILO1, ILO2, ILO3, ILO4	These assessments evaluate students' ability to understand the concepts and knowledge of computer architecture.
Lab Experiment	ILO2, ILO3, ILO5, ILO6	These lab experiments assess students' ability to understand assembly programming to apply the concepts of computer architecture.
Final Exam	ILO1-ILO7	These assessments evaluate students' ability to understand computer architecture concepts and knowledge.

Grading Rubrics

Detailed rubrics for each assignment will be provided through Canvas. These rubrics clearly outline the evaluation criteria. Students can refer to these rubrics to understand how their work will be assessed.

Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Course AI Policy

The course encourages students to use generative artificial intelligence tools toward their studies. However, for homework assignments, generative artificial intelligence is prohibited.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include specific details. Students who have further questions about the feedback including marks should consult the instructor/teaching team within five working days after the feedback is received.

Resubmission Policy

The regrade request will be conducted via Canvas. Students will have the opportunity to request re-grading if they believe it is necessary.

Required Texts and Materials

D. Patterson & J. Hennessy, Computer Organization and Design: The Hardware/Software Interface (5th 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.