CS2115: COMPUTER ORGANIZATION

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Computer Organization

Subject Code
CS - Computer Science
Course Number
2115

Academic Unit
Computer Science (CS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-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.			x	
3	Create the designs of simple digital logic circuits.		x		
4	Apply techniques of assembly language to write simple programs.		x		
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.		x	x	

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 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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will explain key concepts, such as theories related to computer organization and architecture. Discuss practical questions and exercises with students.	1, 2, 3, 4	3 hours/week

2	Tutorial	Students will demonstrate the usage of useful supporting software tools and do exercise and case studies. The students will apply the computer organization concepts and use the supporting software tools to implement to design and analysis problems.	2, 3, 4, 5	8 hours/semester
3	Group project	Students will work as a group to apply computer organization concepts to design, implement and validate a CPU and its associated instruction set. The design will be done using circuit simulation software.	1, 2, 3, 4	After class
4	Assignment	Students will apply computer organization concepts to solve different programming, analysis and calculation problems that are common in modern operating system design.	1, 2, 3, 4, 5	After class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Coursework	1, 2, 3, 4, 5	20	4 assignments	Yes
2	Midterm Exam	1, 2, 3, 4, 5	10	-	No

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

Coursework

Criterion

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.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Midterm Exam

Criterion

The mid-term quiz will include questions assessing the students' understanding on architectural aspect of computer such as single bus organization.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Final Exam

Criterion

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.

Excellent (A+, A, A-)

High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

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

- Number systems
  Number representation. Binary arithmetic. Conversion between number systems. Floating point numbers and calculations, IEEE floating point.
- Digital logic fundamentals
  Logic gates and pricinples. Boolean Algebra. Basic combinational circuits. Karnaugh-Map logic simplication. Examples with applications.
- Basic computer organization
  Functional subsystems: CPU, memory, input/output systems.
- CPU organization and operations
  CPU model, Fetch and execute cycle. Control unit and signal, Interrupt cycle, case study on a typical microprocessor.
- Assembly instruction and assembly language programming
  Machine code instruction. Assembly instruction. Assembly language programming. Addressing modes and example of assembly program.
- Processor design
  Instruction pipelining. Classification of Processors. CISC v.s. RISC
- Memory system
  Memory bus, memory access. Cache.
- I/O system, bus and interrupt and peripherals
  Basic model of an I/O system including programmed, Interrupt, DMA.

Reading List

Compulsory Readings

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

Additional Readings

	Title
1	Andrew S. Tanenbaum and Todd Austin (2012). Structured Computer Organization. Pearson, 6th edition.
2	William Stallings. Computer Organization and Architecture. William Stallings. Computer Organization and Architecture. Pearson, 11th edition.