PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINERING
DEPARTAMENT OF COMPUTER SCIENCE
ABET COURSE SYLLABI

IIC2343 COMPUTER ARCHITECTURE

Credits and contact hours: 10 credits / 10 hours (3 hours in lectures and 7 individual work hours per week)

Instructor's name: Jose Honorato

Course coordinator's name None

Textbook: Patterson, D. and Hennessy, J. (2013) Computer Organization and Design (Fifth Edition). Elsevier.

Course Catalog Description: Computers are a fundamental part of our everyday life: We use them as work tools, for communication and entertainment, they control our cars and transportation vehicles, store our personal and financial information, among many others. In simple words, they make the world work.

The purpose of this course is make the student capable of understanding what is a computer and how it works, going over the main concepts in computing hardware, architecture and programming.

Prerequisite Courses: IIC1103 Introduction to Computer Programming

Co-requisite Courses: None

Status in the Curriculum: Required

Course Learning Outcomes:

1. Explain what is a computer from a hardware and software perspective, being able to sketch and propose a design of a simple computing machine.
2. Identify different data formats and their internal representation in memory, recognizing their limitations and consecuences in their everyday use.
3. Study the components of a digital circuit and how their connections enable a computer to perform numerical operations and control mechanisms.
4. Associate high-level programming techniques and paradigms with their low-level machine language representation, including concepts such as variables, operations, flow control, functions and subroutines and arrays.
5. Implement algorithms in machine language, using specific instructions,

registers, addressing modes and conventions.

6. Explain different patterns for communication between the CPU, Input/Output devices and memory, taking into account interruptions, DMA and cache memory.
7. Understanding different ways to achieve parallelism and concurrency in modern CPUs and how they are implemented.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
c. Design a system, component, or process
e. Identify, formulate, and solve engineering problems
h. Broad education necessary for global, economic, environmental and societal context
j. Knowledge of contemporary issues
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Unit 1: Design of a basic computer
   - 1.1 Data representation: binary numbers, hexadecimals and floating point.
   - 1.2 Arithmetic and logic operations: Boolean algebra, logic gates. Binary arithmetic and arithmetic circuits.
   - 1.3 Data storage: storage technologies, registers and memory.
   - 1.4 Analog-to-digital conversion: continuous and discrete signals, digital representation and quantization noise.
   - 1.5 Instructions and operation automation: sequences and machine language.
   - 1.6 Flow control: Condition codes and control unit.
   - 1.7 Arrays: Data memory and addressing modes.
   - 1.8 Functions and subroutines: Stack management, recursivity.

2. Unit 2: Design of a modern computer
   - 2.1 Computer architectures: x86 and MIPS architectures, conventions and instruction sets.
   - 2.2 Input-Output technologies.
   - 2.3 CPU and I/O connection.
   - 2.4 Caché and virtual memory.
   - 2.5 Instruction level parallelism: instruction pipeline and superscalar architectures.
   - 2.6 Hardware parallelism: multiprocessors and GPU.