Department of Computer Science and Engineering
Faculty of Engineering, University of Moratuwa

CS 2052 Computer Architecture
2016 Batch Semester 2 (Aug - Nov 2017)

Class LMS	http://online.mrt.ac.lk/course/view.php?id=7374
Discussion Forum	https://www.yammer.com/uomcse.lk/#/threads/ inGroup?type=in_group&feedId=6264532 (request to join to Group)
Schedule	Lectures (14 sessions) – Wednesday 1:15pm - 3:15pm at CSE Seminar Room Labs (10 labs) – Thursdays 1:15pm - 4:15pm at 1st and 2nd Year Labs
Instructors	Dr. Dilum Bandara, dilumb@cse.mrt.ac.lk, 011 265 0152
Prerequisite(s)	CS1032

Text

- M. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education, Delhi, India.

Supplementary readings:

- John L. Hennessy and David Patterson, "Computer Organization and Design: The Hardware/Software Interface", 4th or 5th Edition, Morgan Kaufmann.
- Computer Organization and Architecture: Designing for Performance, 10th Edition, William Stallings, ISBN 978-93-325-7040-5
- Course notes

Assessment

Distribution of marks is as follows:

- Labs (10)   23% ($3 \times 5 + 8$)
- Field Visit and Report   7%
- Quizzes (2)   10%
- Final Exam (2 hour, closed book)   60%

Course Objectives

To provide a broader understanding of architectural elements of a computer, how they work together, and their impact on design and performance of programs. At the end of the module, you will be able to:

- develop a simple microprocessor with a limited instruction set
- list down the components of a computer and their functionalities
- describe how a program is executed in a computer
- sketch designs of various components in a computer system
- evaluate the performance enhancement techniques used in computer systems

Required readings, labs, discussions, and field visit will enhance both the analytical and soft skills.

Syllabus

We will start with a high-level design of a computer system and how various components work together. As we continue our exploration, we will gradually dig into specific sub-components of the system. The goal for the class is to be broad rather than deep.
Our plan is to touch upon the following areas:

Date(s)	Topic
Aug 16	Introduction to computer architecture • Design goals, high-level design, architectural differences,

	programming levels
Aug 23 & 30	ALU design • Logic gates, Boolean algebra, k-maps, half and full adders, encoders, multiplexers
Sep 6 & 13	Registers • Flip-flops, registers, counters, state diagrams, clocks
Sep 20 & 27	Instruction Set Architecture (ISA) • Micro operations, Assembly instructions, Harvard vs. Von Neumann architecture, RISC/CISC, addressing modes
Oct 11	Data Representation • Number systems, character representations
Oct 18	Busses
Oct 25 & Nov 1	Memory • Memory hierarchy, types of memory, addressing modes, stack
Nov 8	Input/Output • Devices, text representation, pooling vs. interrupts, DMA
Nov 15 & 22	Performance enhancements in modern computing systems • Caching, pipelining, Amdahl's law, hyper threading, multi-core, many-core

Labs

Lab 1   Introduction to Development Environment
Lab 2   Behavioral Simulation
Lab 3   Ripple Carry Adder
Lab 4   Combinational Circuits
Lab 5   7-Segment Display
Lab 6   Arithmetic Unit
Lab 7   Counter With External Input
Lab 8   Assembly Programming
Lab 9-10   Microprocessor Design Competition (3 students per group)

Workload Expectations

There is a normative workload expected of you while following this module. This is a 3-credit module. For the average student, this means 135 study hours over the semester. The following table provides a rough breakdown of how these hours might be spent over the whole semester – but this is only for guidance:

Classes	
14 weeks × 2-hour lectures	28
Independent work	
Labs 1 - 8 (8 Labs × 3-hour lab session)	24
Preparatory work – e.g., set reading, contributing to LMS discussions, and preparation for lectures. 15 weeks × 4 hours a week	60
Group work	
Lab 9-10 (3 labs × 3-hour lab session)	9
Field visit	12
Assessment	
Exams	2
TOTAL	**135**

Class policies

- Topics to be discussed in each class will be posted on Moodle, along with relevant readings for each topic. You are expected to keep up with the readings as we go, as they will help provide the foundation for the homework, quizzes, and exam. Impromptu quizzes will be based on these assigned readings.
- All students are expected to actively participate in class, Moodle, and Yammer activities. Poor participation and/or poor performance in assigned course work can be grounds for failure in the course.
- Discussing and exchanging ideas through study groups are encouraged, as this

usually leads to a better understanding. As part of the discussions, you may share ideas and thoughts, discuss the meaning of homework and lab questions, or possible ways of approaching a solution. However, you must write homework and lab solutions strictly. If one of your solutions is based on a key idea of someone else, you must acknowledge this in your homework, to avoid the perception of cheating. This form of collaboration is not an opportunity to copy answers from others.

- Group assignments are given to encourage teamwork and discussion/toleration of alternative ideas/views; hence, they need to be done as a group. A penalty will be enforced for doing group assignments individually.

- Plagiarism, copying another person's work, letting another person copy your work, giving or receiving aid during any test or examination is all strictly not allowed. Any student caught in any of these will receive a failing grade regardless of marks earned on other assessed work.

- Proper netiquette should be observed in using the Moodle and Yammer.

- Each assigned work will have either a deadline for submission or a specific date for performance. For each day delayed beyond a deadline, 10% of marks will be deducted. Not performing (e.g., not doing a presentation) on an assigned date will result in 0 marks unless there is a valid reason and another student/group is arranged as a replacement. Details of submission will be given with each assignment.

- The dictionary meaning of deadline is "the latest time or date by which something should be completed". Thus, as you may already experience during your internship, deadlines are supposed to be met.

- All quizzes and final exam will be closed book and closed note exams. The final exam will be comprehensive, covering material from the entire course including labs, homework, and filed visit.

- You may not use cell phones, mp3 players, etc., during class. All laptops and mobile phones must be closed and all computer screens of the computers in the classroom must be turned off unless you use it to take notes, take photos of slides, or search for additional contents relevant to the ongoing class discussion. The reason is to prevent distractions to other students, and to prevent the temptation to check e-mail, Facebook, etc.