COMP3221: Microprocessors and Embedded Systems

Lecture 1: Introduction
http://www.cse.unsw.edu.au/~cs3221
Lecturer: Hui Wu
Session 2, 2005

COMP 3221 Administration (1/2)

Lecturer:
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Consultation: Wed: 3:00–5:00pm

Lecturer In Charge of the Lab:
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For all issues regarding the lab contact Samir

COMP 3221 Administration (2/2)

Course Homepage:
http://www.cse.unsw.edu.au/~cs3221

Course homepage contains:
• All Lecture slides presented in the class.
• All material related to the Laboratory Exercises.
• Pointers to supplementary material.
• Announcements.

Check it out frequently!

Syllabus (1/2)

Main Topics:
• Instruction Set Architecture (ISA).
• Number representation, computer arithmetic.
• Assembly and machine language Programming.
• Interrupts and I/O interfacing.
• Serial communication.
• Analog Input and output.
• Buses and memory system.
**Syllabus (2/2)**

**Laboratory exercises:**
- AVR assembly programming and I/O interfacing. Tools include AVR Studio, AVR board designed by David Johnson.

**Assignments:**
- A survey of ARM microprocessor.
- A lift controller using AVR.

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**Pre-Requisite (1/2)**

**Digital Circuits (ELEC 1041, COMP 2021)**
- Number representation, coding, registers, state machines.
- Realisation of simple logic circuits.
- Integrated circuit technologies.
- Designing with MSI components.
- Flip-Flops & state machines.
- Counters and sequential MSI components.
- Register transfer logic.
- Bus systems.

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**Pre-requisite (2/2)**

**Computers and Computing (COMP1011 & COMP1021)**
- The von Neumann model: memory/I-O/processing.
- The instruction set and execution cycle.
- Registers and address spaces.
- An instruction set: operations and addressing modes.
- An expanded model of a computer: mass storage and I/O.
- The layered model of a computer: from gate- to user-level.
- C- Language Programming.

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**Textbooks**

- **Main references for lecture material**
  - Fredrick M. Cady: Microcontrollers and Microcomputers — Principles of Software and Hardware Engineering.

- **Additional references**
Laboratory Schedule

- Monday: 2:00 – 4:00 pm EE233
- 5:00 – 7:00 pm EE233
- Wednesday: 1:00 – 3:00 pm EE233
- Thursday: 12:00 – 2:00 pm EE233

You will be only allowed to attend the lab session that you are enrolled in. No exception allowed.

- Starts in Week 3.

Special Open Access labs
- TBA
- Not assessed.
- It is only for those who need a bit of extra time.

Enrolment System in Lab Session

- Run “sirius” booking system form any CSE lab machine.
- Read http://www.cse.unsw.edu.au/%7Ehelpdesk/documentation/SiriusGuideNew.ps as how to run “sirius”.
- Any problem with “sirius”, contact Mei-Cheng Whale (meicheng@cse).
- If you want to work with a partner please make sure that both of you enrol for the same lab session.
- You will be paired with a partner randomly if you don’t have one.

Students who DO NOT select their Lab sessions will be not be allowed into the lab.

Lab Format

- In group of two partners.
- You choose your partner in Sign Up Session (Week 3).
  It CANNOT be changed later.
- You will get a group account.
- No formal report to hand in.
- You are assessed based on a system of checkpoints.
- An assessors marks your check points.
- Lab Demonstrators help you with the lab.

Laboratory Preparation & Catch Up

- You CAN finish the laboratory exercises in the allocated time only if you do the preparation before hand.
- You need to prepare for the laboratory outside the laboratory by:
  - Carefully reading the lab related documentation
  - Writing your programs and simulating them at home
- Leaving things to the last minute or walking into the laboratory without preparation may make you fail in this course.
- Go to one of the OPEN ACCESS Sessions if you think you are falling behind.
Laboratory Structure & Specifications

- 5 experiments.
  - Each experiment consists of several checkpoints.
  - The full mark of each checkpoint is 5.
  - Optional checkpoints give you extra marks.
- Each experiment lasts two weeks except Experiment 2 which takes 3 weeks.
- Lab specifications are available in the course homepage one week before each experiment starts.

Assignments

- Two assignments.
- The first assignment: A Survey of ARM Microprocessor.
- The second assignment: An AVR-Based Lift Controller.
- Details to be announced.

Course Grading Scheme

- Laboratory mark = 25%
- Assignment mark = 25%
  - Assignment 1: 10%
  - Assignment 2: 15 %
- Final exam mark = 50%
  - Postgraduate students have a different exam paper (not harder, but slightly different scopes).

Why Take This Course?

- Embedded Systems is a big, fast growing industry (US$ 40 billions in 2000).
- Microprocessors/Microcontrollers are the core of embedded systems.
What is an Embedded System?

- A combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a dedicated function. In some cases, embedded systems are part of a larger system or product, as is the case of an anti-lock braking system in a car. Contrast with general-purpose computer.
- Examples range from washing machines, cellular phones to missiles and space shuttles.

Why AVR?

- RISC architecture with load-store memory access.
- Two-stage instruction pipelining.
- Internal program and data memory
- Wide variety of on-chip peripherals (digital I/O, ADC, EEPROM, UART, pulse width modulator (PWM) etc).

Microcontrollers vs Microprocessors

- A microprocessor is a CPU on a single chip.
- If a microprocessor, its associated support circuitry, memory and peripheral I/O components are implemented on a single chip, it is a microcontroller.