Course Outline

COMP2121
Microprocessors and Interfacing
Semester 1 2013

Contents

- Course Staff
- Course Details
- Course Summary
- Course Aims
- Student Learning Outcomes
- Assumed Knowledge
- Teaching Rationale
- Teaching Strategies
- Assessment
- Academic Honesty and Plagiarism
- Course Schedule
- Resources for Students
- Course Evaluation and Development

Course Staff

Contact Details

Staff Name	Role	Email	Phone
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Consultations

Staff Name	Day/Time	Location

Course Details

Course Code:	COMP2121
Course Title:	Microprocessors and Interfacing
Units of Credit:	6
Course WebSite:	http://www.cse.unsw.edu.au/~cs2121/
Handbook Entry:	http://www.handbook.unsw.edu.au/undergraduate/courses/2013/COMP2121.html

Course Summary

The aims of this course are to introduce students the basic concepts and major components of microprocessors and microcontrollers and to provide students with knowledge and skills for solving problems with microprocessors /microcontrollers.

Course Aims

This course aims to teach principles of the use of microprocessors and to show how microprocessors can be interfaced to the real world. ...

Student Learning Outcomes

After completing this course, students will:

- know the fundamentals of microprocessors and microcontrollers;
- understand how C programs are converted into AVR machine instructions;
- be proficient in AVR assembly language programming;
- understand typical interface designs between hardware and software; understand how serial communication works;
- understand how analog signals are converted into digital signals and vice versa;
- obtain basic development skills for microprocessor / microcontroller applications.

This course contributes to the development of the following graduate capabilities:

Graduate Capability	Acquired in
scholarship: understanding of their discipline in its interdisciplinary context	lectures
scholarship: capable of independent and collaborative enquiry	labs
scholarship: rigorous in their analysis, critique, and reflection	assignments
scholarship: able to apply their knowledge and skills to solving problems	labs
scholarship: capable of effective communication	assignments
scholarship: information literate	course work
scholarship: digitally literate	course work
leadership: enterprising, innovative and creative	labs
leadership: collaborative team workers	labs
professionalism: capable of independent, self-directed practice	labs
professionalism: capable of lifelong learning	assignments
professionalism: capable of operating within an agreed code of practice	labs

Assumed Knowledge

Before commencing this course, students should:

- be able to competently program in C;
- be able to represent integers in binary;
- be able to work independently; and
- be able to work in a group;

These are expected to have been taught in COMP1021 or COMP1091 or COMP1721 or COMP1921 or COMP1927

Teaching Rationale

This course teaches the theory and skills needed to design and implement systems utilising microprocessor systems. Passing this course involves keeping up with the theory and putting in the time to complete the lab exercises. The lab work brings the theory alive and clarifies deeper issues. Without the theory, the lab work is difficult to master. Each therefore complements the other. Both require time. If you allocate sufficient time each week, you won't have any problems passing, and it can be a very rewarding experience. It is our belief that certain activities make a world of difference to your learning experience at University. You should:

- actively participate in lectures - if something is unclear, ask for clarification - if you don't understand something, try to figure it out when you reflect upon the material during private study, and if you still don't get it, raise it during the next class
- don't imagine you are the only one having trouble with something; chances are somebody else is having trouble as well. However, lecturers aren't necessarily aware of your problems, so please let them know when something is troubling you
- be prepared to concentrate during classes - if you only pay them half your attention, you'll probably only get half as much out of the experience as you would had you focused on the task completely
- actively participate in tutorials - prepare beforehand - know which problems you have difficulty solving - be prepared to participate in deriving a solution during the tutorial
- prepare for labs by reading up what is expected well before your lab session - sometimes you will need to complete some preparatory exercise - lab time is too valuable to waste on preparations that could have been completed beforehand
- make use of the staff; pester your lecturer, your tutor, and your lab demonstrator when you don't understand something

Teaching Strategies

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- Lectures ... introduce concepts, show examples
- Tutorials ... reinforce concepts and provide additional examples
- Lab Work ... introduce technology required for the assignments
- Assignments .. allow students to solve significant problems

In this course a variety of teaching strategies will be used.

1. Teaching in class, where lectures are delivered and interaction encouraged.
2. Laboratory exercises are performed under supervision and assessed.
3. Two assignments are given which enable you will expand upon the concepts already learned, or will apply concepts learned to create an artifact.
4. Homework will be posted each week, which you can do in your own time.

You are expected to spend at least one hour on the course for every hour you spend in class (i.e., at least 5 hours per week). You should practice programming as much as possible.

Creativity in subjects such as this will only be possible when you are an expert. It is no different from being a pianist, artist, or a mathematician.

You should understand all introduced concepts clearly. If not, you are encouraged to stop and ask.

Assessment

Please note that some of these aspects this will be negotiated on the first day of class

To pass this course, you MUST get at least 50% of the full marks in lab, return the lab kits, and achieve at least 40/100 in the final exam and 50/100 in final result. Your final result is calculated based on:

- Lab exercises (20%)
- Assignment and project (20%)
- Final exam (60%)

There will be one assignment and one project for this course counting towards 20% of your final mark.

- Assignment (10%)
- Project (15%)

The final exam (3 hours, closed book) examines whether you:

- understand how numbers and characters are represented in computers
- understand basic components of microprocessors
- can apply general concepts of Instruction Set Architectures (ISAs)
- can interpret a number of ISAs including the AVR
- can independently write assembly programs

The assignment will examine your ability to interpret other ISAs. The project will examine your ability to build a small working embedded system.

The labs will examine whether you can:

- independently write assembly programs
- interface a microcontroller with typical low level I/O

The first lab starts in Week 2. Each week you are required to attend a compulsory two-hour laboratory.

You will work in the laboratory in a group of TWO students. So if you intend to work with a partner of your choice, let your partner select the same laboratory session as yours. Otherwise, you will be randomly paired with another student if you haven't chosen a partner by the time of first laboratory session.

There will be five experiments this session. Each lab exercise consists of a number of tasks. After you finish a task, ask the assessor to mark your work.

You will use the AVR Studio to develop, debug and simulate your AVR assembly programs and use the AVR lab board to run your program. The AVR board will be used in Lab 3 onwards. A lab demonstrator will assist you with lab work. However, you cannot ask the lab demonstrator for the solution to an exercise.

You are strongly recommended to download AVR Studio and install it on your PC or laptop. For each lab, you need to write programs at home. Otherwise, you will be unable to finish it on time.

Academic Honesty and Plagiarism

Plagiarism is defined as "using the words or ideas of others and presenting them as your own". UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Learning Centre: Plagiarism and Academic Integrity
- MyUNSW: Plagiarism and Academic Misconduct
- CSE: Addendum to UNSW Plagiarism Guidelines
- CSE: Yellow Form (whose terms you have agreed to)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism.

Course Schedule

Each week there are two lectures. The following topics will be covered:

- Instruction set architecture.
- Number systems

- AVR assembly programming and assembly process
- Interrupts
- Buses and I/O
- Serial communication
- Analog/digital and digital/analog conversions.

Resources for Students

Text Book:

- Fredrick M. Cady: Microcontrollers and Microcomputers-Principles of Software and Hardware Engineering.

Further References:

1. AVR Data Sheet (on line).
2. AVR Instruction Set (on-line).
3. AVR Assembler Tutorial (on-line).
4. LCD Manual (on-line).
5. Mano, M.M. & Kime, C.R.: Logic and Computer Design Fundamentals, 3rd Edition, Prentice-Hall (2003).
6. Brian Kernighan & Dennis Ritchie: The C Programming Language, 2nd Ed., Prentice Hall, 1988, ISBN: 0-13-110362-8.
7. David Patterson and John Hennessy: Computer Organization & Design: The HW/SW Interface," 2nd Ed Morgan Kaufmann, 1998, ISBN: 1 - 55860 - 491X.

Course Evaluation and Development

Student feedback on this course will be obtained via electronic survey at the end of session, and will be used to make continual improvements to the course. Students are also encouraged to provide informal feedback during the session, and to let the lecturer in charge know of any problems, as soon as they arise. Suggestions will be listened to very openly, positively, constructively and thankfully, and every reasonable effort will be made to address them.

The CATEI evaluation from the last time I taught this course showed that students were generally satsified with all aspects of the course. Thus we intend to maintain the same style and structure for the up-coming offering.