Engineering 3213: Digital Systems & Microprocessors

Department of Engineering, ANU

Semester 1, 2002

You should read this document as soon as possible carefully and retain it for the duration of the course. It contains important information about the content and structure of the course, the assessment methods and timetable, as well as a number of things that are expected of you.

1 Staff

Lecturer Dr Matt James (`Matthew.James@anu.edu.au`), (6125-3378)
Office: Main Engineering Office or Ian Ross R217
Office Hours: I will be available in R217 on Fridays for drop-in questions (except for when I am teaching or in a meeting). If you can't see me on a Friday, please make an appointment via the main ENGN office. Thank you.

Tutors Chanop Silpa-Anan
Ben Sheard
Grant Grubb

2 Web Page

There is a web page for ENGN3213. The URL is:

http://spigot.anu.edu.au/courses/engn3213/

Please *regularly* consult this page for additional information, announcements, software, and copies of handouts. This page will be updated regularly.

3 Introduction

Digital Systems & Microprocessors is a 6 credit point unit offered by the Department of Engineering. Features of the course:

- Two lectures per week (up to 16 hours).

- Seven computer labs/tutorials over the semester (14 hours).

- Nine hardware labs over the semester (33 hours).

- Lecture notes and lab/tut notes in printed and electronic form.

The course will cover the design of sequential digital systems using FPGA (programmable logic devices) and microprocessors. The languages VHDL, assembler and C will be used. Students will have the opportunity to execise their creativity in some of the lab design assignments.

Digital systems are widely used, and their use is ever-increasing. Witness the explosion in the uses of computers, and the development of digital communications systems, etc.

Modern digital design involves the use of a range of devices, from discrete logic chips (NAND, NOR, etc), to more complex logic chips (adders, counters, flip-flops, etc), to hardware programmable logic devices and memory arrays (PLD, ROM, etc), and ultimately to software programmable microprocessors and microcontrollers. This course will teach you the basics of how digital hardware and microprocessors work and how to design digital systems to solve engineering problems. You will learn to use CAD software, and to implement a design in hardware and software. The course will teach you about microprocessors, how to write software for them, and their applications. After completing course, you will be in a position to decide on the best way to solve a problem, using hardware and/or software.

This course is considerably more design-oriented than most of the other Engineering courses you will have taken to date. In particular, the course involves hands-on design lab assignments. You will find it lots of fun!

4   Schedule

A schedule for the course is shown in Table 1

Week	Tests	Computer Labs/Tuts	Hardware Labs	Hlab Hours
1	-	-	-	
2	-	CLAB1	-	
3	-	CLAB2	HLAB1	3
4	-	CLAB3	HLAB2	2
5	-	CLAB4	HLAB3	3
6	-	CLAB5	HLAB4	2
7	-	CLAB6	HLAB5	3
8	Test	CLAB7	HLAB5 (continued)	2
9	-	-	HLAB6	3
10	-	-	HLAB7	3
11	-	-	HLAB8	2
12	-	-	HLAB9	3
13	-	-	HLAB9 (continued)	2

Table 1: Schedule for ENGN3213.

Notes:

- Students are welcome to work *ahead* of schedule if they want, provided all work is done thoroughly and completely, and a *limited* amount of catch-up will be permitted - this will be limited to a *small* amount of finishing up from the previous lab, *up to at most 15 mins* (so as not to cause further delays). In general, students should at least keep up to the schedule.

5   Textbooks

The nominated texts are:

- J.F. Wakerly, Digital Design: Principles and Practices, 2000, Prentice-Hall, ISBN 0-13-769191-2

- A. Clements, Microprocessor Systems Design, 3rd Ed., 1997, PWS Pub. Co., ISBN 0-534-94822-7

You should purchase a copy of the following brick set from the Engineering Office:

6 Assessment

The assessment for this course is shown in the Table 2.

Item	Description	Marks
CLABs	satisfactory participation/completion	10
HLABs	satisfactory preparation/participation/completion	30
Test	1 hour written test	15
Exam	comprehensive 2 hour written	45
Total		100%

Table 2: Assessment for ENGN3213.

Notes.

- The 1 hours test will be held in scheduled lecture times to be announced.

- All tests/exams are closed book, except *students may bring in one (1) size A4 two (2) sided summary sheet, handwritten.*

- Students may work in *pairs*, but will be assessed *individually.*

- Each CLAB will be marked out of 10, as described in the Labs and Tutorial Notes. The total marks will be scaled in accordance with Table 2.

- HLABs 1, 2, 3, 4, 6, 7 and 8 will be marked out of 10, and HLABs 5 and 9 will be marked out of 20 as described in the Labs and Tutorial Notes. The total marks will be scaled in accordance with Table 2.

- Some variation will be permitted to accommodate students working ahead, or to take into account the small amount of permitted catch-up.

- Marks will be based on what is documented in your notebooks and on your answers to any questions the tutor may ask. It is expected that all hardware/software designs work correctly.

- It is the students responsibility to ensure that their marks are correctly recorded. The tutor will maintain a roll.

7 Course Organisation

7.1 Lectures

The lectures will present an overview of the main material for the course and offer you the opportunity for asking questions and keeping up to date with what is happening in the course.

Initially lectures will be held twice a week, and then later drop to one per week.

7.2 Computer Labs/Tutorials

The tutorials will be held in one of the Copland PC labs and each two hour session will have a sequence of exercises for you to complete. A tutor will be available to help you. You will often have to complete the exercises in your own time. Additional exercises from the textbooks will also be given.

7.3 Hardware Labs

A sequence of hardware lab sessions will be held in the Digital Systems & Microprocessors Lab. Each three hour session will have a sequence of exercises for you to complete. A tutor will be available to help you. Each lab session has some mandatory **preparation** which *must be done before coming to the lab.*

7.4 Lab/Tut Operation

The labs and tuts are the main parts of the course. You are expected to attend, and perform the exercises as indicated. You must do the PREPARATION as indicated in your own time before coming to the lab/tut session. Also, in your own time you are expected to read the lecture notes and sections from the textbooks, and other materials, do prescribed textbook/tut exercises, and study for tests/exams.

You are encouraged to ask questions.

The best way to pass this course is to DO IT! **You learn by doing.**

There are nearly 60 contact hours for this course. This means you are expected to do 120 hours on this course as a minimum requirement.

You should plan your time during the semester to at least keep up the the lab schedule.

8 Notebooks

All students *must* keep a notebook for this subject (the notebook must be for this course only, and not shared with other courses). This notebook should be a bound pad into which you enter *all* your rough working and preparation for the experiments as well as laboratory notes (your record of testing your designs and performing set experiments) and computer printouts and sourcecode where appropriate. *Loose sheets of paper are not acceptable.*

Your notebook does not have to be neat, but should be of a professional standard in the level of detail and quality. Detailed calculations, measurements, graphs and sourcecode should be included. If you get something wrong, that's OK, don't tear out the pages - simply cross it out and do it again elsewhere in your notebook.

Your notebooks should be a complete and detailed account of everything you do in this course. The tutor may request to see this book at any time.

You should record such information as notes on how to use pieces of equipment and software in here also. You should date each page of the notebook.

Note that it is standard engineering practice to keep such workbooks. Such a book can serve as a record of intellectual property for commercial reasons.

9 Software

This course will make use of software for digital design and microprocessor programming. Details will be discussed in class and information will be available on the ENGN3213 web page. Most of the software will be available for you to install at home; it will be on a CDROM available for overnight loan.