ELEC342

Computer Hardware

S1 Day 2014

Dept of Engineering

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General Information

Unit convenor and teaching staff
Unit Convenor
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E6A 242

Credit points
3

Prerequisites
39cp including ELEC241(P)

Corequisites

Co-badged status

Unit description
This unit is a sequence of lectures and practical work on digital circuits and systems, and their application throughout digital computers, from the central processing unit to remote peripherals. Students gain experience in using a range of techniques, including programmable logic devices for constructing various computer sub-systems and a PC-based development system for a small microcontroller (8-bit processor, digital and analogue I/O).

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Understand the architecture of a computer

Understand the functionality of major sections of a computer

Ability to design sections of a computer

Understand characteristics of microcontrollers

Ability to program microcontrollers in assembly language

Ability to interface microcontrollers to I/O devices

To be aware of advances in the technology of computer hardware

Assessment Tasks

Name	Weighting	Due
Practicals	28%	Week 2 to Week 11
Report 1	6%	07:00PM 9/5/2014
Report 2	6%	07:00PM 13/6/2014
Final Exam	60%	Exam Timetable

Practicals

Due: **Week 2 to Week 11**
Weighting: **28%**

Practicals 1~3 (3 practicals @ 3%): 9%

Practicals 4~6 attendance (3 practicals @ 1%): 3%

Demo (work of Practicals 4~6) : 4%

Practicals 7~10 (4 practicals @ 3%): 12

On successful completion you will be able to:

- Understand the architecture of a computer
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- Ability to design sections of a computer
- Understand characteristics of microcontrollers
- Ability to program microcontrollers in assembly language
- Ability to interface microcontrollers to I/O devices

Report 1

Due: **07:00PM 9/5/2014**
Weighting: **6%**

Report 1(based on work of Practicals 4~6)

On successful completion you will be able to:

- Understand the architecture of a computer
- To be aware of advances in the technology of computer hardware

Report 2

Due: **07:00PM 13/6/2014**
Weighting: **6%**

Report2(based on Practical 7~10)

On successful completion you will be able to:

- Understand the architecture of a computer
- To be aware of advances in the technology of computer hardware

Final Exam

Due: **Exam Timetable**
Weighting: **60%**

The final exam will cover all the lectures and Pracs.

On successful completion you will be able to:

- Understand the architecture of a computer
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- Ability to design sections of a computer
- Understand characteristics of microcontrollers
- Ability to program microcontrollers in assembly language
- Ability to interface microcontrollers to I/O devices
- To be aware of advances in the technology of computer hardware

Delivery and Resources

Access information on this unit on iLearn at https://ilearn.mq.edu.au/login/MQ/

Useful books:

Text book: Spasov, Peter, “Microcontroller Technology: The 68HC11and 68HC12”, 5th edition, Prentice-Hall, 2004

Reference book: Dirkman, R. J. & Leonard, J., “68HC11 Microcontroller – Laboratory Workbook”, Prentice-Hall, 1996

Lab notes will be available on iLearn.

Changes since last offering:

More time will be put on how to program the interfaces.

Unit Schedule

Week ABC	Lectures	Practical
1A GF	ELEC342 Outline + Computer Hardware Computer hardware architecture 68HC11 microcontroller Memory and addressing Computer Hardware Instruction set Instruction execution Instruction cycles Evaluation Board Introduction	No practical
2A GF 2B GF	**Microcontroller Programming** Assembly Language Instructions Addressing **Microcontroller Programming** Basic Operations Arithmetic Registers Condition Code Registers Flow Control Cross Assembler process	**Practical 1: Microcontroller programming** 68HC11 microprocessor Evaluation board Simple machine-language programs (Dirkman – Experiment 1 – Straight-line programs and using the accumulator Dirkman – Session 1 – Connecting to the EVB and some BUFFALO commands Dirkman – Session 2 – Entering and executing machine-language code)

3A **GF** **3B** **GF**	**68HC11 Memory Addressing Modes** Inherent, immediate, direct, extended, indexed, relative Stack, subroutines and practice Stack introduction and instructions Subroutines introduction programming using subroutines	**Practical 2: Microcontroller program development** (Dirkman – Experiment 2 – Condition codes, branching and applications Dirkman – Session 3 – Using the BUFFALO line assembler: breakpoints Dirkman – Session 6 – Introduction to the Motorola HC11 cross-assembler)
4A **GF** **4B** **GF**	Operation Modes and bus Concept of operation modes Bus and address decoding Memory expansion **Timing circuits** Timing diagrams Bus timing Machine instruction cycles	**Practical 3: Stack, Subroutines, Using the HC11 Cross Assembler** Dirkman – Experiment 4

5A **GF**	**Memory Technology and Expansion** ROM, RAM, RPROM and Flash memory **Memory Technology and Expansion** Bus cycles and timing Memory expansion and its interface to 68HC11	Practical 4: Alarm Project 1/3
5B **GF**	Alarm Project: Requirements Information	
6A **GF**	Concept of Interrupts	**Practical 5: Alarm Project 2/3**
6B **GF**	Interrupt Programming and practices	
7A **GF**	Timer and Programming 68HC11 timers and principles Registers to programme timers	Practical 6:Alarm Project 3/3
7B **GF**	Input/output compare functions	

8A **GF** **8B** **GF**	Interfacing concepts Interfacing standards 68HC11 registers I/O addressing Polling and interrupts Interrupt masking **Parallel interfacing** Data direction Flags Configuration	Alarm Project Report: **Due: 9/05/2014**
9A **GF** **9B** **GF**	**Parallel interfacing** Displays Switch debouncing Switch matrices Multiplexed displays **(Review)**	**Practical 7: Interrupts** (Dirkman – Experiment 7 – Interrupts)
10A **GF** **10B** **GF**	**Analogue Digital Converters** 68HC11 system Accuracy Procedures for using A/D converter Examples routines of A/D	**Practical 8: Parallel interfacing** 68HC11 parallel interfacing hardware (Dirkman – Session 6 – Introduction to the Motorola HC11 Cross-Assembler Experiment 6 – Interfacing parallel I/O ports)

11A **GF**	**Serial Interfacing** Concept of serial data communications EIA232 specification	**Practical 9: Analogue-digital converters** 68HC11 A/D and D/A converters (Dirkman - Experiment 8 – A/D converters)
11B **GF**	68HC11 SCI subsystem Subroutines to control SCI	
12A **GF**	**SPI** Concept of Serial Peripheral Interface EIA232 specification 68HC11 SCI subsystem	**Practical 10: Serial Communication and Serial Peripheral Interfaces – D/A Converters** (Dirkman – Experiment 10 – The serial interfaces and D/A converters)
12B **GF**	Subroutines to control SCI	

13A **GF**	**Computer Hardware Technology** Integrated-circuit technology Interconnection technology Fabrication and packaging Architecture Memory technology Disc systems Examples of advanced microprocessors Array processor Processor arrays **Supercomputers** Computer systems Examination & unit review Typical examination questions Unit review	No practical Lab report based on Practicals 7 ~ 10 Due: 13/06/2014
13B **GF**		

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of

Conduct: https://students.mq.edu.au/support/student_conduct/

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Ability to design sections of a computer
- Ability to interface microcontrollers to I/O devices
- To be aware of advances in the technology of computer hardware

Assessment tasks

- Practicals
- Report 2
- Final Exam

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- Ability to interface microcontrollers to I/O devices
- To be aware of advances in the technology of computer hardware

Assessment tasks

- Practicals
- Report 1
- Final Exam

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Understand the architecture of a computer
- Ability to design sections of a computer

Assessment tasks

- Practicals
- Report 1
- Report 2

- Final Exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Understand the architecture of a computer
- Understand the functionality of major sections of a computer

Assessment tasks

- Practicals
- Report 1
- Report 2
- Final Exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Understand the architecture of a computer
- Ability to program microcontrollers in assembly language

Assessment tasks

- Practicals
- Report 1
- Report 2
- Final Exam

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be

imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Understand the functionality of major sections of a computer
- Understand characteristics of microcontrollers
- Ability to program microcontrollers in assembly language

Assessment tasks

- Practicals
- Final Exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Understand the functionality of major sections of a computer
- Understand characteristics of microcontrollers
- Ability to program microcontrollers in assembly language
- To be aware of advances in the technology of computer hardware

Assessment task

- Practicals

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Ability to design sections of a computer

- Understand characteristics of microcontrollers
- To be aware of advances in the technology of computer hardware

Assessment task

- Final Exam

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Ability to design sections of a computer
- Understand characteristics of microcontrollers
- Ability to interface microcontrollers to I/O devices
- To be aware of advances in the technology of computer hardware

Assessment tasks

- Practicals
- Final Exam