ENGG141

Digital Fundamentals and Numerical Techniques

S2 Day 2014

Dept of Engineering

Contents

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General Information

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Credit points
3

Prerequisites

Corequisites

Co-badged status

Unit description
This unit aims to provide an understanding of digital fundamentals to form a foundation for study programs in science, technology, computing and engineering. The unit is also suitable for programs in commerce, finance, economics, law, and arts as an introduction to the technology of computer systems. Topics in this unit, including associated laboratory work, cover: basic theory; digital devices; and procedures for the analysis and synthesis of digital circuits and systems. The unit aims to give an appreciation of hardware aspects of design, and provides the foundations for more advanced units on Programmable Logic Design, Computer Hardware and Digital Systems Design. The unit includes six presentations providing overviews of key areas of digital technology.

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:

Ability to synthesise "combinational circuits" given "truth tables", and synthesise

"sequential circuits" given "state transition diagrams"
Ability to analyse Boolean equations and to derive equivalent circuit diagrams
Ability to apply Boolean identities and Karnaugh maps to the minimisation of digital circuits
Understand what flip-flops are and be able to use them to construct a range of circuits requiring memory capability such as counters, registers and state machines.
Basic understanding of the functionality of medium-scale integrated circuits, arithmetic-logic-units of computers, memory systems, analogue-digital converters
Able to connect digital logic circuits together in a laboratory setting, ensure that the circuits operate correctly, apply test inputs and understand and evaluate the circuits outputs and operation
Ability to evaluate alternative digital systems based on criteria such as "propagation delay", "clock frequency", "number of components", "integration level"

Assessment Tasks

Name	Weighting	Due
Final examination	60%	Examination period
Practicals	25%	Throughout semester
Assignments	15%	Roughly every two weeks

Final examination

Due: **Examination period**
Weighting: **60%**

3-hour

On successful completion you will be able to:

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Practicals

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Weighting: **25%**

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Assignments

Due: **Roughly every two weeks**
Weighting: **15%**

Four short assignments (total weight 7.5%) and two longer assignments (total weight 7.5%).

On successful completion you will be able to:
- Ability to synthesise "combinational circuits" given "truth tables", and synthesise "sequential circuits" given "state transition diagrams"
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Delivery and Resources

Required unit materials:

- Text book
- Tutorial and laboratory notes
- Laboratory log book

Textbook

Floyd, T. L. "Digital Fundamentals", 10th ed, (Pearson Prentice-Hall, 2009)

Reference books

Another book that follows the treatment of ELEC141 closely is:

Tocci, Widmer and Moss, "Digital systems: principles and applications", 10th ed (Pearson Prentice-Hall)

Notes

Tutorial and laboratory notes for practical tutorial session are available on iLearn. Each student is required to print out the lab notes before each Practical.

Recommended readings

- Floyd, Chapters 1-9 (covered in detail)
- Floyd, Chapters 10, 11, 13 (overview lectures)

Technology used and required

Logic trainers for digital fundamentals and small/medium-scale integrated circuits. Access to a computer device to access iLearn, view video modules, and do online quizzes.

Assumed knowledge

None

Assignments

There will be 6 assignments. The assignments will be available on iLearn. The due dates for the assignments are:

- Assignment 1 – Due: Week 3
- Assignment 2 – Due: Week 5
- Assignment 3 – Due: Week 7
- Assignment 4 – Due: Week 9
- Assignment 5 – Due: Week 11
- Assignment 6 – Due: Week 13

See iLearn for precise dates and times.

You must sign each assignment as being substantially your own work. This does not mean that you may not consult staff or other students, but it does preclude work that is blindly copied from others.

Extension Requests

Must be supported by evidence of medical conditions or misadventure.

Satisfactory completion

A pass mark in each of the assessment components (practicals, assignments, examinations) is required to pass the unit.

Online lectures

Except for the first lecture in Week 1, all lecture material will be delivered as as online video modules (similar to youtube) through iLearn . Each module is approximately from 5 min to 15 min in duration with a number of modules comprising a topic. Students will be required to view the video modules that are identified for that week and then answer a short online quiz for each module. Lectures slides are also available for viewing.

Video modules and practical attendance

To be able to attend a particular practical session and do the work there the video modules identified for that practical in iLearn must have been viewed and the quizes for each of the modules passed.

Tutorial/practical sessions

There are eleven practical sessions (each of three hours duration) starting in Week 3. Students will work in groups of two, and will attend one practical session in each week. Most practical sessions will contain both tutorial work and laboratory work. Students are advised to attempt the tutorial work before attending each practical session.

On the completion of each session, each group must complete and submit a “check-list” that itemizes each section of tutorial and laboratory work. Each item is to be initialed by the group members on completion of the work. The check-list will also have (on its reverse side) one problem for which the group must solve. Your ability to solve this problem is considered an important “outcome” of the practical. Your performance as recorded in your copies of the practical notes and summarized by your check-list will be used in the assessment of your practical work.

Food and drink are not permitted in the laboratory. Students will not be permitted to enter the laboratory without appropriate footwear. Thongs and sandals are not acceptable.

Laboratory log book

Each student must have a bound exercise book to be used as a tutorial/laboratory note book. This book is to be used for any preliminary work for the laboratory sessions and for any designs or results recorded during these sessions. On the completion of each session note book entries must be signed and dated by a tutor.

Tutor consultation

Although no face-to-face lectures will be given (except week 1), the lecture time will be devoted to tutor consultations. During that 2 hour period tutor swill be available at a given location (TBD) to give assistance to students.

Tutor consultation periods will begin in week 2.

Changes from previous years' offerings

All the assignments will be online.

Unit Schedule

Week	Topics	Practicals	Lecturer
1	Introductory digital concepts Number systems	No practical	GF
2	Code conversion, binary arithmetic, Logic functions and IC logic gates	No practical	GF
3	Boolean algebra and logic identities	Practical 1 Number systems & logic gates	GF
4	K-maps and logic simplification using K-maps	Practical 2 Boolean algebra & logic gates	GF
5	Combinational logic Adders, subtractors	Practical 3 K-maps, logic minimisation and circuit implementation	GF
6	Comparators Multiplexers/demultiplexers	Practical 4 Combinational circuit implementation using integrated circuits	GF

7	Latches	Practical 5 XOR gate applications	RV
8	Edge-triggered flip-flops	**No Prac: Labour Day Long Weekend**	RV
9	Asynchronous counters	Practical 6 Encoder/decoder circuit	RV
10	Synchronous binary counters	Practical 7 Flip-flops	RV
11	Synchronous counter analysis and design	Practical 8 Binary counters & multiplexer/demultiplexer circuit	RV
12	Shift registers	Practical 9 Synchronous counter design	RV
13	Revision	Practical 10 Finite state machines and shift registers	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

- Able to connect digital logic circuits together in a laboratory setting, ensure that the circuits operate correctly, apply test inputs and understand and evaluate the circuits outputs and operation
- Ability to evaluate alternative digital systems based on criteria such as "propagation delay", "clock frequency", "number of components", "integration level"

Assessment task

- Practicals

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

- Able to connect digital logic circuits together in a laboratory setting, ensure that the circuits operate correctly, apply test inputs and understand and evaluate the circuits outputs and operation
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Assessment task

- Practicals

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

- Ability to synthesise "combinational circuits" given "truth tables", and synthesise

"sequential circuits" given "state transition diagrams"
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Assessment tasks

- Final examination
- Assignments

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

- Ability to synthesise "combinational circuits" given "truth tables", and synthesise "sequential circuits" given "state transition diagrams"
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Assessment tasks

- Final examination
- Assignments

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

- Ability to synthesise "combinational circuits" given "truth tables", and synthesise "sequential circuits" given "state transition diagrams"
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Assessment tasks

- Final examination
- Practicals
- Assignments

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

- Ability to synthesise "combinational circuits" given "truth tables", and synthesise "sequential circuits" given "state transition diagrams"
- Understand what flip-flops are and be able to use them to construct a range of circuits requiring memory capability such as counters, registers and state machines.
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Assessment tasks

- Final examination
- Practicals
- Assignments

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

- Able to connect digital logic circuits together in a laboratory setting, ensure that the circuits operate correctly, apply test inputs and understand and evaluate the circuits outputs and operation
- Ability to evaluate alternative digital systems based on criteria such as "propagation delay", "clock frequency", "number of components", "integration level"

Assessment task

- Practicals

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:

Assessment task

- Practicals