**MACQUARIE**
University
SYDNEY·AUSTRALIA

# COMP247

## Data Communications

S1 Day 2018

*Dept of Computing*

# Contents

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# General Information

Unit convenor and teaching staff
Unit Convenor and Lecturer
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Lecturer
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Credit points
3

Prerequisites
COMP115 or ISYS114

Corequisites

Co-badged status

Unit description
This unit introduces basic data communication concepts, theory and practice within the context of the use of communication networks in organisations. Topics include: protocols and standards, including the OSI model; network switching and routing; LAN and WAN topologies; wireless networking; network hardware, such as routers, modems, repeaters, switches and hubs; public telecommunication-based data services; the effect of telecommunications on society; the role of telecommunications within organisations; introduction to security and network management; organisational management of telecommunications; introduction to network design; and regulatory frameworks. Practical work includes basic network hardware set up and protocol performance using Cisco routers and switches. This unit does not presume any knowledge of programming nor is there any programming work in the unit.

## 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:

Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.

Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.

Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.

Be aware of different major network technologies including wireless, backbone, wide area networks, and the Internet and, being aware of their properties, be able to evaluate different network designs.

Demonstrate technical networking proficiency including demonstrated ability to configure, construct, and document, and in simple cases design, networks, as well as the ability to perform traffic analysis on local area networks.

Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

# General Assessment Information

## Assignments

Assignment work must be written clearly, with good grammar, correct word usage, correct punctuation,and lack of spelling errors. Poor or bad expression will be penalized, Wherever required, all written work must be properly referenced and conform to standard stylistic conventions.

## Practicals

**Note** that while the practical material is structured against the lecture material, you need to keep in mind that there will not always be a one to one mapping between the practical exercises and the lecture topics. This is because you need some practical sessions to get acquainted to new tools and devices thereby limiting the number of practical time slots available to experiment with technologies discussed in some lectures.

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
|------|-----------|--------|-----|
| Practical work | 10% | Yes | Every week |
| Assignment 1 | 15% | No | Week 6 |
| Assignment 2 | 15% | No | Week 11 |
| Tutorial Submissions | 10% | No | Weekly |
| Final Examination | 50% | Yes | End of semester exam period |

# Practical work

Due: **Every week**

Weighting: **10%**

**This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)**

The practical work in this unit makes up 10% of your mark. The practical work is divided up into ten sections. You are expected to complete all ten. Practical classes are a hurdle requirement, and, as such you will be required to perform to a satisfactory standard in at least six of the practical classes to pass the unit. Each practical contributes 1% of your total mark for the unit.

To receive your marks you must attend the practical section and demonstrate your completion of the section to your practical supervisor. Earning the marks will require not only successful completion of the exercises, but presentation of appropriate documentation, as outlined in the question sheets. You must complete the practical session in the week it is allocated.

Practical classess will commence during week 2 of the semester. Students must be enrolled in two practical classes: Practical_1 and Practical_2.

Practical_1 will utilise specialised networking equipment located in an Engineering Laboratory whereas Practical_2 will be conducted in a regular Computing Laboratory.

The student cohort has been divided into two streams, an even stream and an odd stream.

Studens in the even stream will attend thier Practical_1 in weeks 2, 4, 8, 10, 12 and Practical_2 in weeks 3, 5, 7, 9, 11.

Students in the odd stream will attend thier Practical_1 in weeks 3,5,7,9,11 and Practical_2 in weeks 2,4,8,10,12.

Note that due to the Good Friday public holiday students who are enrolled in a Friday practical session will complete thier week 5 practical class the following week in week 6. There are no other scheduled practical classes in week 6.

On successful completion you will be able to:

• Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.

• Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.

• Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.

• Be aware of different major network technologies including wireless, backbone, wide area networks, and the Internet and, being aware of their properties, be able to evaluate different network designs.

- Demonstrate technical networking proficiency including demonstrated ability to configure, construct, and document, and in simple cases design, networks, as well as the ability to perform traffic analysis on local area networks.

# Assignment 1

Due: **Week 6**
Weighting: **15%**

The first assignment tests your understanding of selected networking technologies.

Late submission of the assignment will be accepted, but penalised at the rate of 15% per day late. If you cannot submit assignments on time because of illness or other circumstances, please apply for disruption of studies as soon as possible.

 For all assignment work you are encouraged to:

- set your personal deadline earlier than the actual one;
- keep backup of all important files;
- make sure that no one else has access to any of your work.

On successful completion you will be able to:
- Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.
- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.
- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.

# Assignment 2

Due: **Week 11**
Weighting: **15%**

The second assignment tests your understanding of local area networks, routing, and IP addressing.

Late submission of the assignment will be accepted, but penalised at the rate of 15% per day late. If you cannot submit assignments on time because of illness or other circumstances, please apply for disruption of studies.

On successful completion you will be able to:
- Be aware of different major network technologies including wireless, backbone, wide area networks, and the Internet and, being aware of their properties, be able to evaluate

different network designs.

- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

# Tutorial Submissions

Due: **Weekly**
Weighting: **10%**

Each week tutorial problems will be posted in iLearn related to the lecture content for that week.

By the end of each week you are required to submit your responses in the manner specified in the questions for that week. Your answers will need to demonstrate appropriate depth of understanding.

All submission are done via turnitin.

**General notes on tutorial submissions:**

The tutorial submissions are important for your learning.   We set a number of questions that you should think carefully about. Don't be late with submission -- iLearn is an automated system with a strict cutoff time. Always try your hardest with these questions -- you only get the learning benefit if you think carefully. But don't worry if you're not completely sure about your answer.  The important thing is to have a go and submit the best answer you have.

We'll try to ensure that the tutorial questions don't involve too much writing.   So you should expect that you can answer them in half a page or so.

The tutorial submissions are essential, but will only be "sample" marked in detail (a small sample of student submissions will be fully marked). General feedback about the questions will be given in lectures, and if you'd like individual feedback or if you'd like to discuss a question in more detail you should raise it with your practical teacher.  The questions are meant to help your learning, so we will usually award you the full marks available if you have completed a reasonable attempt at the specified questions.

On successful completion you will be able to:

- Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.
- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.
- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.
- Be aware of different major network technologies including wireless, backbone, wide area networks, and the Internet and, being aware of their properties, be able to evaluate

different network designs.

# Final Examination

Due: **End of semester exam period**
Weighting: **50%**
**This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)**

The final examination allows us to individually and securely assess each student's mastery of the coursework material.  The examination will be closed book and three (3) hours in length.

Regarding the examination process, note that

- you must be available to attend the examination at the time set by the University which may be any time during the official University Examination period for First Half Year

- you are expected to present yourself for examination at the time and place designated in the University Examination Timetable

- no early examinations for individuals or groups of students will be set. All students are expected to ensure that they are available until the end of the teaching semester, that is until the final day of the official examination period

- if illness or unavoidable disruption prevents you from sitting the examination at the designated time, you should contact the University in accordance with the Disruption to Studies policy. You will need to provide documentary evidence of the circumstances.

**Supplementary Exams**

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session.  By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments.  Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the same supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit.

On successful completion you will be able to:
- Enunciate the importance and the role of network protocols including why they are

organised into protocol stacks and how protocol stacks function.

- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.

- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.

- Be aware of different major network technologies including wireless, backbone, wide area networks, and the Internet and, being aware of their properties, be able to evaluate different network designs.

- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

# Delivery and Resources

## Classes

Each week you should attend three hours of lectures, and a two hour practical. For details of days, times and rooms consult the timetables webpage.

**Note** that practicals (lab sessions) commence in **week 2**. The week-by-week details of the practical (lab) classes will be available from iLearn.

You should have selected a practical at enrolment. **You should attend the practicals that you are enrolled in**.

## Textbook and Reading Materials

The textbook for this semester is:

- Fitzgerald, J. & Dennis, A, Business Data Communications and Networking, Twelfth Edition, Wiley, 2015. ISBN 978-1-118-89168-1

Additional reading that you may find useful for this unit:

- White, C., Data Communications and Computer Networks, 8th ed., Cengage Learning, Inc, 2016. ISBN 978-1-305-11663-4.
- Kurose, J. & Ross, K. Computer Networking: A Top-Down Approach Featuring the Internet 7th edn, ISBN 978-0-134-31095-4.

## Web Resources

**Unit Websites**

Comp247 is administered via iLearn (http://ilearn.mq.edu.au).

This unit outline can be found on units.mq.edu.au.

**Live Streaming**

Digital recordings of lectures may be available. They will be linked from iLearn.

# Technologies Used and Required

In this unit you will will be exposed to the following technology and tools:

- HP networking equipment and the Comware network operating system.
- Wireshark Packet Analyzer software.

# General Notes

In this unit, you should do the following:

- Attend lectures, take notes, ask questions.
- Attend your weekly Practical session
- Prepare for and strive to do well in the tutorial submissions
- Read appropriate sections of the text, add to your notes and prepare questions for your lecturer/tutor.
- Prepare answers to tutorial questions.
- Work on any assignments that have been released.

Lecture notes will be made available each week but these notes are intended as an outline of the lecture only and are not a substitute for your own notes or the recommended reading list.

# Unit Schedule

**Tentative teaching schedule, subject to change.**

| Week | Lecture | Reading | Workshop Even Stream | Workshop Odd Stream |
|------|---------|---------|----------------------|---------------------|
| **1** | Intro | Chapter 1 | No Pracs | No Pracs |
| **2** | Local Area Networks | Chapter 7 | Intro to Comware | Intro to Wireshark |
| **3** | Network Layer | Chapter 5 | Intro to Wireshark | Intro to Comware |
| **4** | Data Link Layer | Chapter 4 | Switches, MAC, ARP | IP Headers |
| **5** | Physical Layer | Chapter 3 | IP Headers | Switches, MAC, ARP |
| | | | Easter: no friday class week 5 | Easter: no friday class week 5 |

| 6 | Transport and Application Layers | Chapters 5 and 2 | IP Headers (Friday only) | Switches, MAC, ARP (Friday only) |
|---|---|---|---|---|
| 7 | Backbone Networks | Chapter 8 | Subnetting | Static Routing |
| Mid-semester break | | | | |
| 8 | Metropolitan and Wide Area Networks | Chapter 9 | Static Routing | Subnetting |
| 9 | Wireless Local Area Networks | Chapter 7 | TCP and Application Layer | Dynamic Routing |
| 10 | The Internet | Chapter 10 | Dynamic Routing | TCP and Application Layer |
| 11 | Network Security | Chapter 11 | Security | Virtual LANs |
| 12 | Network Security | Chapter 11 | Virtual LANs | Security |
| 13 | Tying it all together | | TBD | TBD |

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

# 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://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

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

# Graduate Capabilities

# 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 outcome

- Demonstrate technical networking proficiency including demonstrated ability to configure, construct, and document, and in simple cases design, networks, as well as the ability to perform traffic analysis on local area networks.

## Assessment tasks

- Assignment 1
- Assignment 2
- Final Examination

# 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

- Demonstrate technical networking proficiency including demonstrated ability to configure, construct, and document, and in simple cases design, networks, as well as the ability to perform traffic analysis on local area networks.

- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

# 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 outcome

- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

## Assessment tasks

- Assignment 1
- Assignment 2
- Final Examination

# 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

- Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.
- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.
- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.
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- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

## Assessment tasks

- Practical work
- Assignment 1
- Assignment 2
- Tutorial Submissions

- Final Examination

# 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

- Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.
- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.
- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.
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- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

## Assessment tasks

- Practical work
- Assignment 1
- Assignment 2
- Tutorial Submissions
- Final Examination

# 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

- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.

- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.

- Be aware of different major network technologies including wireless, backbone, wide area networks, and the Internet and, being aware of their properties, be able to evaluate different network designs.

- Demonstrate technical networking proficiency including demonstrated ability to configure, construct, and document, and in simple cases design, networks, as well as the ability to perform traffic analysis on local area networks.

- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

## Assessment tasks

- Practical work
- Assignment 1
- Assignment 2
- Tutorial Submissions
- Final Examination

# 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

- Enunciate the importance and the role of network protocols including why they are organised into protocol stacks and how protocol stacks function.

- Demonstrate an understanding of IP addressing, routing and subnetting by for example computing routing outcomes and determining effective and actual IP addresses.

- Differentiate among LAN components, and describe and, in particular instances calculate, how MAC addresses, address resolution (as implemented by protocols such as ARP) and the ethernet protocol interact.
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## Assessment tasks

- Practical work
- Assignment 1
- Assignment 2
- Tutorial Submissions
- Final Examination

# 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 outcome

- Be acutely aware of issues in, and have an ability to develop plans for dealing with, network security and management.

# Changes from Previous Offering

During previous offerings all practical classes were completed in a specialist networking laboratory.   This year we have reconstructed the practical work to include new material that also uses resources available in standard laboratories, and students will from week to week alternate between the normal computing laboratories and the specialist networking lab.  Many modern networking tools are now designed to run on standard computing equipment.

Last year the unit was run, unusually, with no hurdle assessments.  This year the hurdles have

been reinstated.

# Grading

Grading

At the end of the semester, you will receive a grade that reflects your achievement in the unit

- **Fail (F)**: does not provide evidence of attainment of all learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; and incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.

- **Pass (P)**: provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the field of study; and communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.

- **Credit (Cr)**: provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; plus communication of ideas fluently and clearly in terms of the conventions of the discipline.

- **Distinction (D)**: provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.

- **High Distinction (HD)**: provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application.

In this unit, the final mark will be calculated by combining the marks for all assessment tasks according to the percentage weightings shown in the assessment summary. The final examination in this unit is a hurdle requirement; you must get a mark of at least 40% in the examination to pass the unit. If you get a mark between 30% and 40% in your first attempt at the final examination, you will be given a second and final attempt. The practical classes are also a hurdle assessment, you will be required to perform to a satisfactory standard in at least six of the practical classes to pass the unit.

Concretely, **in order to pass the unit**, you must obtain an overall total mark of 50% or higher, a mark of 40% or higher in the final examination, and satisfactorily complete at least 6 out of the 10 practical exercises.

Students obtaining a higher grade than a pass in this unit will (in addition to the above)

- ◦ have a total mark of 85% or higher to obtain High Distinction;
  ◦ have a total mark of 75% or higher to obtain Distinction;
  ◦ have a total mark of 65% or higher  to obtain Credit.

# Changes since First Published

| Date | Description |
|------|-------------|
| 14/02/2018 | A custom "Grading" section was added. |